

ON *PSEUDOSTOMELLA* SWEDMARK 1956
WITH DESCRIPTIONS OF *P. PLUMOSA* NOV. SPEC.,
P. CATAPHRACTA NOV. SPEC.,
AND A FORM OF *P. ROSCOVITA* SWEDMARK 1956
FROM THE WEST ATLANTIC COAST ⁽¹⁾.

by

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Résumé

Sur *Pseudostomella* Swedmark 1956, avec des descriptions de *P. plumosa* nov. spec., *P. cataphracta* nov. spec. et d'une forme de *P. roscovita* Swedmark 1956, de la côte Ouest atlantique américaine.

L'auteur décrit deux espèces nouvelles du genre *Pseudostomella*. Un revêtement d'écaillés pédonculées, cas unique chez les Macrodasyoidea, caractérise *P. plumosa* nov. spec. Un revêtement de petits pentancres caractérise *P. cataphracta* nov. spec. Une forme de *P. roscovita* Swedmark 1956 est décrite de Caroline. L'auteur discute également la nécessité de descriptions très détaillées. Il présente des diagnoses de toutes les formes et de toutes les espèces connues du genre et donne une clef systématique. Tous les spécimens cités proviennent de la zone côtière de la Caroline du Nord.

Introduction

This paper is the second in a series of articles describing new genera and species of marine Gastrotricha, found along the coast of North Carolina. A general statement of these findings is given in an earlier paper (Schoepfer-Sterrer, 1969).

Two species and two forms of the genus *Pseudostomella* have already been described (Swedmark 1956, Forneris 1961, d'Hondt 1965, Renaud-Mornant et Jouin 1965, Ganapati and Rao 1967, Renaud-Mornant et Serène 1967, Renaud-Mornant 1967). I have found three along the North Carolina coast, of which two are new to science and the third appears to correspond, at least in its major features, to *Pseudostomella roscovita*, as described by Swedmark (1956).

If this is the case, the statement that *P. roscovita* is found along North America shores carries the responsibility to affect the image we have concerning the pattern of geographical distribution of Gastrotrichs. One must be careful in making such assertions. The problem is further complicated by the fact that species definitions, as a consequence of the growing faunistic knowledge, become more differentiated.

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Since Swedmark's classical description of the genus *Pseudostomella* (1956) in which the first species, *P. roscovita*, was well defined, further findings have shown more differences in minute characters correlated within the level of species diagnosis, as one was able to predict. Such observations necessarily lead to one of two alternatives. One can enlarge the former diagnoses by assembling new forms or narrow them by splitting further species. Regardless of the alternative chosen, one generally finds agreement in the opinion that character differences have to be defined as carefully as possible to avoid confusion of any sort. The final decision depends on the variability of characters within populations lined up in a geographical series and, at the same time, correlated at the level of species diagnosis. Consequently this variability should be studied in detail.

Faunistic knowledge concerning the genus and variability within species was still little known when the descriptions following *P. roscovita* appeared. It is only now that we can use the accumulated information and begin to look critically at variability and determine the correlations. Consequently, additional responsibility is placed on future workers for the thoroughness of their descriptions.

I wish to thank Prof. Rupert Riedl, my teacher and friend without whose help this paper would not have been possible, and Christiane Schoepfer-Sterrer for critically reading my final manuscript.

GENERAL DATA

Locality.

P. plumosa and *P. cataphracta* were taken on « Eastward » cruise no. E50L-68-69, station number 11575 at 34°18'0" N and 76°13'10" W at a depth of 40 m. The Carolina form of *P. roscovita* was taken below the ground water level at mean low tide on the outer banks at Morehead City, N.C.

Types.

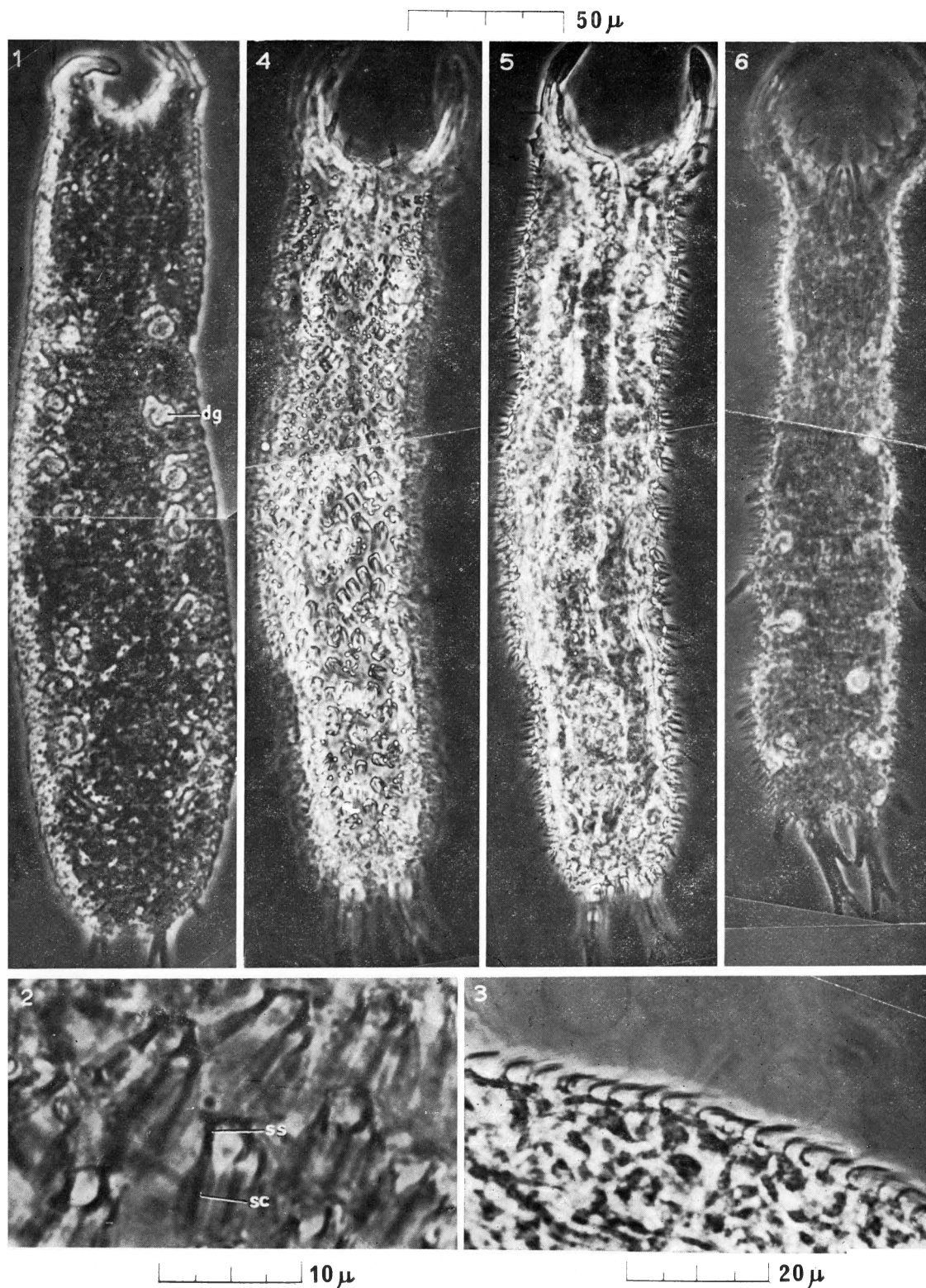
Holotype AMNH. No. 82 (*P. plumosa*) and holotype AMNH. No. 81 (*P. cataphracta*) deposited in the Department of Living Invertebrates of the American Museum of Natural History in New York.

Names.

The name of the species, *P. plumosa*, is derived from the Latin "*plumosa*" meaning "*feathered*" in reference to the scaled trianctres. The species name *P. cataphracta* is taken from the Latin "*cataphractus*" corresponding to "*mail-clad*" and referring to the cuticular armament.

Material and methods.

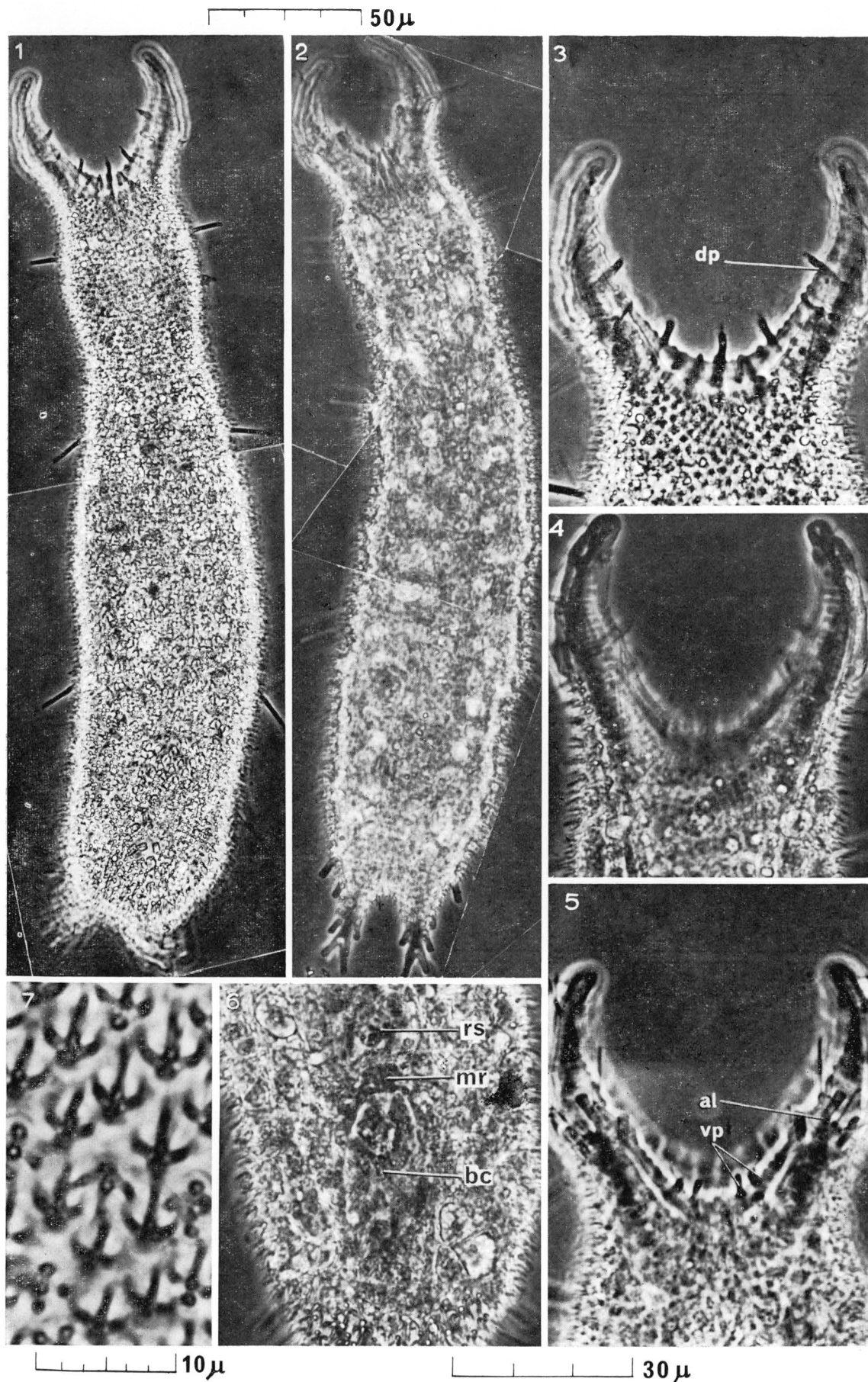
Six extractions produced five individuals of *P. cataphracta*, two of which were documented photographically. Six individuals of *P. plumosa* were obtained from the same sample, one of which was photographed. Five individuals of *P. roscovita* were registered and



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PLATE I

1, *P. plumosa*, showing epidermal glands; 2, *P. plumosa*, enlargement of stalked scales; 3, *P. plumosa*, lateral view of stalked scales; 4, *P. roscovita*, dorsal view; 5, *P. roscovita*, medial view; 6, *P. roscovita*, juvenile.



three were documented photographically. All specimens of the three species were studied and drawn while living, using Wild phase contrast equipment and drawing tube. The extraction technique is outlined by Riedl (1969).

To facilitate the interpretation of positions and proportions relative to the total body length, the total length of each individual in the following descriptions is taken as 100 units (U). Positions (e.g. U30-U40) or proportions (e.g. 50U) are defined by this relative scale beginning at the tip of the prebuccal extensions and extending to the end of the pedicles.

DESCRIPTION

PSEUDOSTOMELLA PLUMOSA NOV. SPEC.

General appearance and behavior.

Pseudostomella plumosa is small and band-shaped and has a slight lateral constriction (U31) at the level of the end of the pharynx (Text - Fig. I, Plate I, 1).

The anterior end is formed into the "prebuccal apparatus" characterizing the genus *Pseudostomella*. The posterior end bears two pedicles, each carrying four tubules. Triancres cover the entire dorsal surface and extend to the ventrolateral portions of the body. The arrangement of these unusual spines, to be discussed later, lends an atypical appearance to the epidermis. Instead of the usual spinous profile, the epidermis appears comparatively smooth and streamlined.

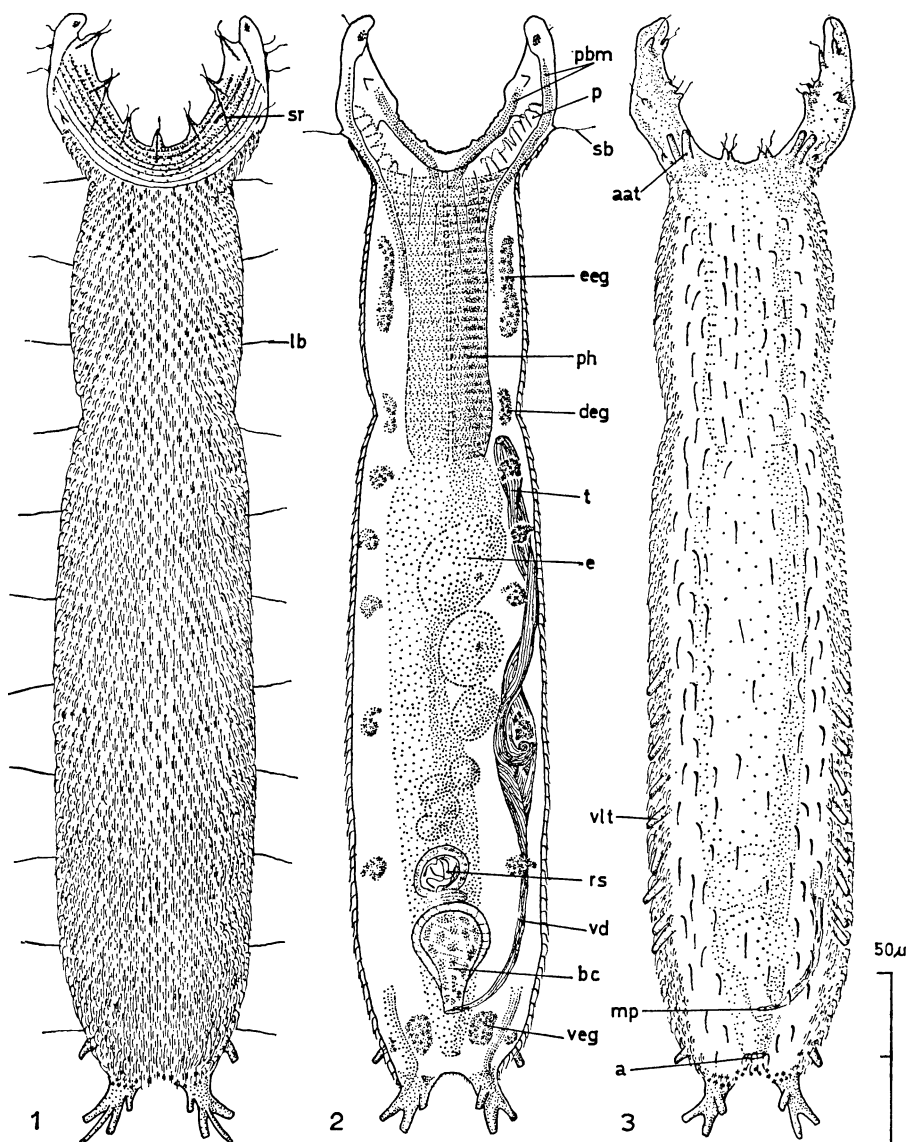
The total length of the animal reaches 400 μ (mean 320 μ) from the distal end of the prebuccal apparatus to the end of the pedicles. The length of the prebuccal apparatus reaches 38 μ (mean 35 μ). The width of the head behind the prebuccal apparatus attains 55 μ (mean 48 μ); at the pharyngeal constriction, up to 45 μ (mean 43 μ), at the nearly parallel body sides, 58 μ (mean 54 μ) and at the posterior end in front of the pedicles, 40 μ (mean 37 μ). The length of the pedicles reaches 25 μ (mean 22 μ). There are approximately ten lateral bristles (10 μ) arranged regularly along the border of the body. In addition, a single pair of long sensory bristles (12 μ), each supported by a short papilla (2-3 μ), projects laterally from the bases of the prebuccal processes. The ventrolateral tubules are generally not visible unless the animal is bracing against the force of a jet of water from a pipette, in which case 3-5 tubules may be seen.

In the Petri dish, the animal moves continuously with the prebuccal apparatus held in a more or less fixed position. If the animal

PLATE II

1, *P. cataphracta*, dorsal view; 2, *P. cataphracta*, mid-frontal optical section; 3, *P. cataphracta*, enlargement of mouth region, dorsal aspect; 4, *P. cataphracta*, enlargement of mouth region, mid-frontal aspect; 5, *P. cataphracta*, enlargement of mouth region, ventral view; 6, *cataphracta*, enlargement of female reproductive system; 7, *P. cataphracta*, pentancres.

is agitated, it retreats in the typical fashion by alternately attaching the anterior and posterior tubules and executing a "leech-like" movement.



TEXT-FIG. I

1, *P. plumosa*, dorsal view; 2, *P. plumosa*, mid-frontal optical section showing internal organization; 3, *P. plumosa*, ventral view.

List of abbreviations

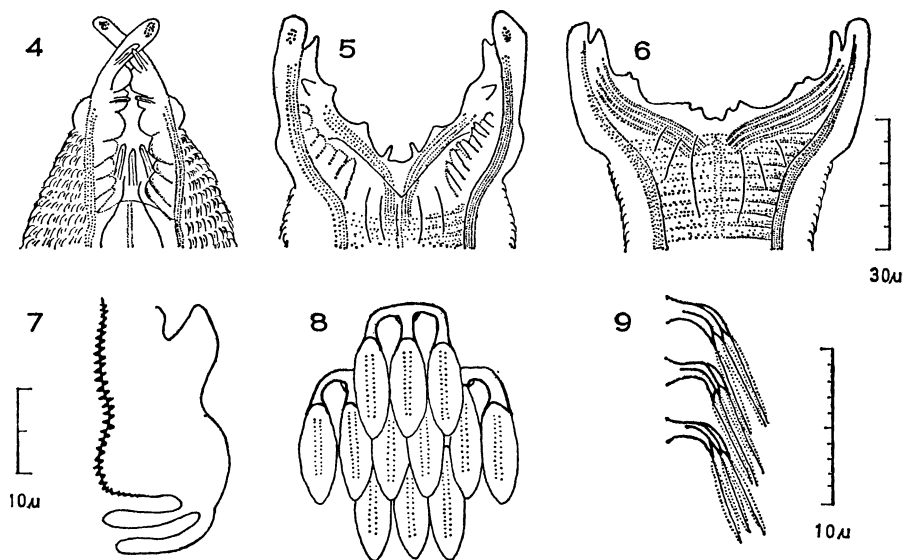
a: anus; aat: anterior adhesive tubules; bc: bursa copulatrix; deg: dorsal epidermal gland; di: digitiform projection; dp: dorsal papillae; e: egg; eeg: elongated epidermal gland; lat: lateral adhesive tubules; lb: lateral bristles; mp: male pore; mr: muscle ring; p: parenchyma; pbm: prebuccal musculature; pf: posterior foot; ph: pharynx; rs: receptaculum seminis; sb: sensory bristle; sc: scale; sr: stiffening rods; ss: supporting spine; t: testis; veg: ventral epidermal gland; vd: vas deferens; vlt: ventrolateral tubules; vp: ventral papillae.

Prebuccal apparatus.

The prebuccal apparatus in *P. plumosa* resembles that found in the genus diagnosis given by Swedmark (1956). The dorsal part of the apparatus extends over the more ventral portion and the inner margin bears three papillae on each side and one positioned medially (Text Fig. II, 4-6).

The dorsal papillae measure 5-60 μ in length and 2 μ in diameter. Each of the papillae is supported by stiffening rods and they have on their distal ends a short (1-2 μ), movable projection. Arising with this projection are one short (2-3 μ) and one long cilium (5 μ).

Along the ventral border of the apparatus are two groups of adjoining papillae, on each side of the median line. The first group



TEXT-FIG. II

4, *P. plumosa*, prebuccal apparatus in closed position; 5, *P. plumosa*, prebuccal apparatus in normal position; 6, *P. plumosa*, prebuccal apparatus in open position; 7, *P. plumosa*, spermatozoon; 8, *P. plumosa* stalked scales dorsal view; 9, *P. plumosa*, stalked scales, side view.

consists of two papillae and lies immediately adjacent to the median line. These reach a length of 4-5 μ . The second group of three lies midway between the median line and the distal tip of the prebuccal process and has the dimensions of the former group. Each of these also supports a pair of cilia. Surrounding the entrance to the mouth are darkened folds of epidermal and parenchymal tissue, giving a pleated appearance to this area. The creases reach a length of 20 μ . In the area between the creases are 8-12 epidermal cells and their conspicuous nuclei.

The parenchymal area covering the anterior portion of the pharynx is dark brown, reflecting the presence of a well developed musculature in this vicinity. The apparatus may be expanded such that the aperture reaches 65 μ in diameter or closed with the distal

portions overlapping one another (Text-Fig. II, 4-6). Muscle fibres insert in the distal processes and extend to the sides of the pharynx and function in opening the apparatus. A group of four muscle fibres inserting in the same position and originating in the median line, function in closing the apparatus (Text-Fig. II, 6). Circular muscles are readily seen surrounding the pharyngeal region.

Numerous sensory cilia are located on the prebuccal apparatus. The ventral surface of each process bears two such cilia. Near the distal tip of each process is a 4μ long cilium supported by a 2μ long protuberance. The second cilium is also supported by an epidermal projection and lies at the level of the anterior adhesive tubules. Three additional cilia arise from the lateral margins of the prebuccal processes; the most anterior (5μ) inserts directly into the epidermis, the next (7μ) arises from a 1.5μ projection and the last from a widened (3μ wide) projection.

Tubules.

The anterior tubules are represented by two tubules located on the ventral surface at the level of the base of each prebuccal extension. This number was constant for each animal observed. Their length is 10μ and their diameter 2μ .

The ventrolateral tubules were very difficult to observe and could be seen only from lateral view of the animal. There are approximately ten ventrolateral tubules measuring $8-10\mu$ in length. Beginning anteriorly there are seven single tubules located at U52, U57, U60, U62, U70, U73 and U75. A pair of tubules is located at U79-U80 and a single tubule is situated at U87.

The posterior tubules are represented by those borne on the pedicles and a single tubule (10μ) arising from the medial part of the base of each pedicle. The pedicles support two ventral tubules (6μ) in the plane of the body and a long tubule (12μ) extending dorsally from between the two shorter ones. Each of the tubules was seen to consist of a less dense or hollow core and a more dense solid peripheral portion.

Cuticular structures.

The dorsal surface, from the bases of the pre-buccal processes to the bases of the pedicles, is covered with regular alternating rows of triancres. There are some 80-90 transverse rows of triancres and 15-20 longitudinal rows. The triancres consist of a small base (1μ) embedded in the epidermis, a vertical part (3μ) and a portion nearly parallel to the body surface and directed caudally (3μ). The latter two subtend an angle of 120° . Each of the three caudally directed spines then widens (1.5μ) to form a socket-like structure which holds a thin, almost transparent, feather shaped scale (Text-Fig. II, 8-9 ; Plate I, 2-3). The length of the scales reaches 7μ and the breadth at their widest point, 2μ . The scale is supported by a central shaft 0.5μ wide.

The scales, with bases $3-4\mu$ apart, confer a neat imbricated appearance to the dorsal surface. Furthermore, since the rows alternate

with regard to their insertion into the epidermis, the scales of one horizontal row of spines overlap the spaces between the scales of the immediately posterior row, thus forming a "second skin" over the surface of the animal (Text-Fig. II, 8-9). There is, in addition, a noticeable reduction in the size of the triancres, in the head region and along the ventrolateral surfaces.

Ciliation.

The ventral ciliation is entire but becomes reduced in the midbody region beneath the gut. There is a dense cluster of cilia around the anal opening.

Epidermal glands.

The epidermal glands are arranged in two rows (8-10 each) along the lateral portions of the body. They are quite prominent in this species. Lying on each side of the pharynx at U16-U28, is a very elongated gland (40μ), having the same granular consistency as the dorsal glands. The diameters of the typical glands range from $5-10\mu$ and their shape from nearly round to irregular. More medially, slightly anterior to the anus, are rounded ventral glands (U82-U87) with a diameter of $10-12\mu$, having the same consistency as the other glands.

Digestive system.

The mouth opens directly behind the pre-buccal processes into a very wide pharynx which narrows progressively until joining a widened intestine. The pharynx extends to U48. No distinct pharyngeal pores are present. The pharynx is very granular with a high concentration of granules surrounding the lumen. The ratio of pharynx length to body length is 0.4-0.5. When no eggs were present, the intestine formed a straight tube narrowing caudally to the anus (U90-U91), the latter opening ventrally between the pedicles.

Male reproductive system.

The male reproductive system extends from the level of the hind end of the pharynx to a ventral opening beneath the "neck" of the bursa copulatrix (U36-U91). The single dorsal testis, lying on the right side of the body, forms the anterior part of the system with the vas deferens extending caudally and ventrally, toward the median line to the male pore. Occasionally, a widening of the vas deferens (U55-U66), containing a large number of spermatozoa, is seen midway along its course from the testis to the male pore. The spermatozoa are quite long (135μ) and have a very finely spiralized tip (35μ , Text-Fig. II, 7). The size of the spirals is sufficiently small to disallow counting their number.

Female reproductive system.

Several oocytes (8) and one mature egg were seen in this species. Development begins in the space immediately anterior to the recepta-

culum seminis and continues forming mature eggs lying dorsally on the right side of the body, just behind the pharynx (U44-U64). The developing eggs displace the intestine to the left side of the body (U44-U76).

The bursa copulatrix is a conspicuous pear-shaped organ positioned in the posterior midline of the body. The organ is wrapped in a sheath of muscle tissue. Its narrow, caudally directed neck is 8μ in diameter and its length 10μ . The female pore opens ventrally and is surrounded by a ring of circular muscle (5μ). The body of the bursa (15μ wide) contains many groups of very refractive granules. The overall length of the bursa reaches 30μ .

A spherical receptaculum seminis (U76-U79) adjoins the bursa anteriorly by a pore surrounded by a circular muscle ring (8μ). A sheath of muscles also envelops the receptaculum whose diameter ranges between 10 - 14μ . In all specimens examined, the receptaculum was filled with spermatozoa. They were not observed in the bursa copulatrix.

PSEUDOSTOMELLA CATAPHRACTA NOV. SPEC.

General appearance.

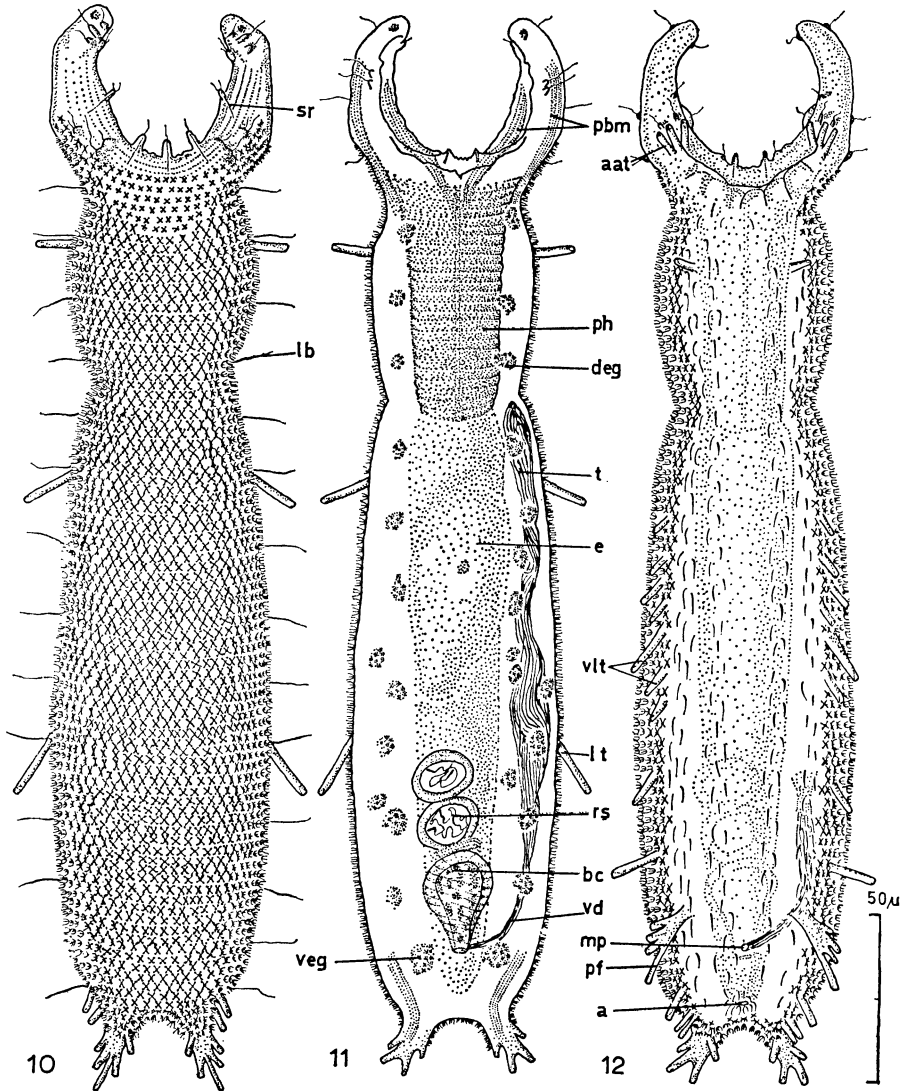
Pseudostomella cataphracta is flat and band-shaped with a slight lateral constriction (U33-U36) at the level of the hind end of the pharynx (Text-Fig. III; Plate II, 1-2). The anterior end is formed into a prebuccal apparatus characterizing the genus. Pentaneres cover the dorsal and ventrolateral body surfaces. Over the head area are conspicuously smaller pentaneres arranged in a triangular fashion. The small size of the pentaneres, to be described in detail later, do not give *Pseudostomella cataphracta* the harsh-textured profile common in other Thaumastodermatids.

The total length of the animal reaches 300μ (mean 280μ) from the distal end of the prebuccal apparatus to the end of the pedicles. The length of the prebuccal apparatus reaches 45μ (mean 43μ). The width of the head behind the prebuccal apparatus attains 40μ (mean 40μ); at the pharyngeal constriction, up to 50μ (mean 45μ); at the parallel body sides, 55μ (mean 50μ); and at the posterior end in front of the pedicles, 30μ (mean 30μ). There are 16 lateral bristles in regular arrangement along the sides of the body. They consist of a 10μ long proximal portion and a very fine 3μ long distal hair. Three pairs of long lateral tubules, to be considered later, are visible. Two pedicles, each composed of five tubules, are present. The remaining ventrolateral tubules are not readily visible unless the animal is bracing itself.

Prebuccal apparatus.

The prebuccal apparatus has the dorsal portion extending over the more ventral part. Along the inner dorsal margin are three papillae on each side of the median line and one positioned medially (Plate II, 3).

The dorsal papillae measure 5μ in length and have a diameter of 2μ . Each is supported by two stiffening rods, with the exception of the most anterior of the papillae which is reduced to a small projection (2μ), and has no stiffening rods. The papillae carry on their distal ends a pair of one short (2μ) and one long (4μ) cilium.



TEXT-FIG. III

10, *P. cataphracta*, dorsal view; 11, *P. cataphracta*, medial view showing internal organization and two seminal receptacles; 12, *P. cataphracta*, ventral view.

The ventral border of the apparatus (Plate II, 5) has a single group of two adjoining papillae on each side of, and adjacent to the median line. Each measures 5μ in length. Between this group and

the tip of the process, a rounded bulge, $3\ \mu$ high, is present and supports a single $3\ \mu$ cilium.

The prebuccal processes have numerous epidermal projections, supporting cilia, over their dorsal, lateral and ventral surfaces; these are depicted in figures 10-12.

Immediately behind the mouth opening, the epidermis and parenchyma become very folded and quite dark in color (Plate II, 4). The opacity of this area reflects the presence of the highly developed prebuccal musculature. Muscle fibres are quite distinct arising from the vicinity of the median line and sides of the pharynx and extending into the prebuccal processes. Also very distinct is the circular musculature around the pharynx.

Tubules.

Three anterior tubules are located on the ventral surface at the level of the base of each prebuccal extension. This number was the same in all specimens observed. The central tubule measures $8\ \mu$ and the flanking tubules $5\ \mu$.

Three pairs of long, lateral tubules ($15\text{--}20\ \mu$) are present along the sides of the body. The first pair is situated just behind the head area (U22), the second group behind the pharyngeal constriction (U39-U46) and the third pair an equal distance posteriorly (U63-U70).

The ventrolateral tubules were observed from a ventral view of the animal. Anteriorly and immediately beneath the first long lateral tubule is a very short ($5\ \mu$) tubule (U22). The next group begins behind the end of the pharynx and consists of nine tubules ranging in length from $5\text{--}18\ \mu$, the fifth in the series being considerably longer than the others (U48, U52, U54, U57, U59, U63, U66, U71, U78). At the level of the genital apparatus, is a posterior "foot" (U80) consisting of four tubules, arising from a common base, and measuring, anteriorly to posteriorly, $5, 5, 8$ and $15\ \mu$. Between this posterior "foot" and the bases of the pedicles, are three additional tubules ranging in length from $5\text{--}7\ \mu$ (U89, U93, U96).

The pedicles support five tubules. Two of the distal tubules are ventral in position and in the plane of the body ($8\ \mu$); from between them, directed dorsally, is a long tubule $12\ \mu$ in length. A $2\text{--}3\ \mu$, filiform projection was seen on the end of this tubule. In addition, there is a single tubule arising from the pedicle bases on both the medial and lateral sides ($5\ \mu$, Fig. III, 10-12). The pedicle shaft contained three conspicuous refractile granules. Also quite distinctive is a bulbous swelling, $3\ \mu$ in diameter, at the bases of the two distal tubules lying in the plane of the body.

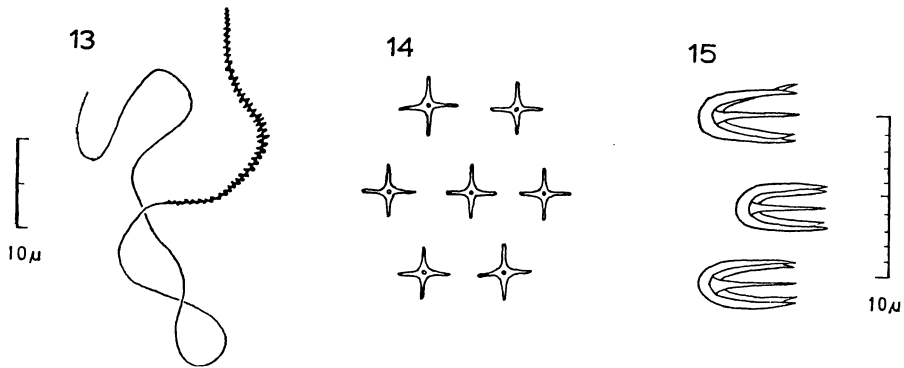
Cuticular structures.

The dorsal and ventrolateral surfaces from the bases of the prebuccal processes extending onto the pedicles are covered with small pentaneres set in diagonal rows. There are approximately 80-90 transverse rows of pentaneres and 15-20 longitudinal rows present. The five spines are of equal length ($5\ \mu$) and are four peripheral and one central in arrangement (Text-Fig. IV, 14-15; Plate II, 7). The distance

between opposite peripheral spines is 3μ . The diminutive pentancrees, occurring in the triangular area of the head, measure 1μ between their opposite spines. This area forms an equilateral triangle, apex directed posteriorly, 20μ per side. The size of the pentancrees becomes reduced in the ventrolateral portions of the body and on the pedicles.

Ciliation.

Pseudostomella cataphracta is ciliated ventrally in four longitudinal rows, two on each side of the median line. The medial row inserts into the epidermis along the lateral portion of the gut and the second row lies along the lateral portion of the body. There is a cluster of cilia around the anal opening.



TEXT-FIG. IV

13, *P. cataphracta*, spermatozoon; 14, *P. cataphracta*, pentancrees, dorsal view; 15, *P. cataphracta*, pentancrees, side view.

Epidermal glands.

The dorsal glands are arranged in two, irregular, lateral rows on each side of the gut. There are from 12-18 in each row consisting of irregular bodies $5-10\mu$ in diameter, bearing highly refractile granular inclusions. Located at each side of the intestine near the anus (U81-U89) is a large (10μ) ventral gland with the same internal consistency as the dorsal glands.

Digestive system.

The mouth opens behind the prebuccal processes into a wide pharynx which narrows and joins a widened intestine. The long pharynx (U36-U44) has no pharyngeal pores and the ratio of pharynx to body length is 0.32-0.37. There is a high concentration of granular material which becomes even more dense around the lumen of the tube. The intestine forms a long straight tube, narrowing gradually to the anus which opens ventrally at the posterior end of the body (U88-U90). The presence of a large mature egg did not cause the intestine to be displaced to either side of the body cavity (one specimen).

Male reproductive system.

The male reproductive organs extend from the level of the end of the pharynx to the male pore (U44-U85) which opens ventrally beneath the "neck" of the bursa copulatrix. The testis is single and lies on the right side of the body. From this extends the long vas deferens which curves medially to the male pore. No penis is present.

The spermatozoa (Text-Fig. IV, 13) are very long (130μ). The head portion is spiraled and measures 32μ in length. The spirals in this species are recognizable as such but below the level of resolution necessary to count the number of turns.

Female reproductive system.

A single egg was observed (one specimen) lying middorsally (U46-U69) and measuring 60μ in length. In one specimen, a 10μ diameter refractive gland (U79-U82) was seen to lie dorsally, in the median line between the receptaculum seminis and the large egg. This may represent the ovary.

The bursa copulatrix (Plate II, 6) (U70-U93) is pear-shaped with the narrow end directed posteriorly as the "neck" of the bursa. Its length reaches 45μ (mean 39μ). At both anterior and posterior ends of the bursa, 2μ diameter pores are present; one opening ventrally to the outside of the body and the other to the receptaculum seminis. Both pores are surrounded by a ring of circular muscle. The entire bursa is also surrounded by muscular tissue. The internal composition of the bursa consists of a mass of densely packed, refractive granules.

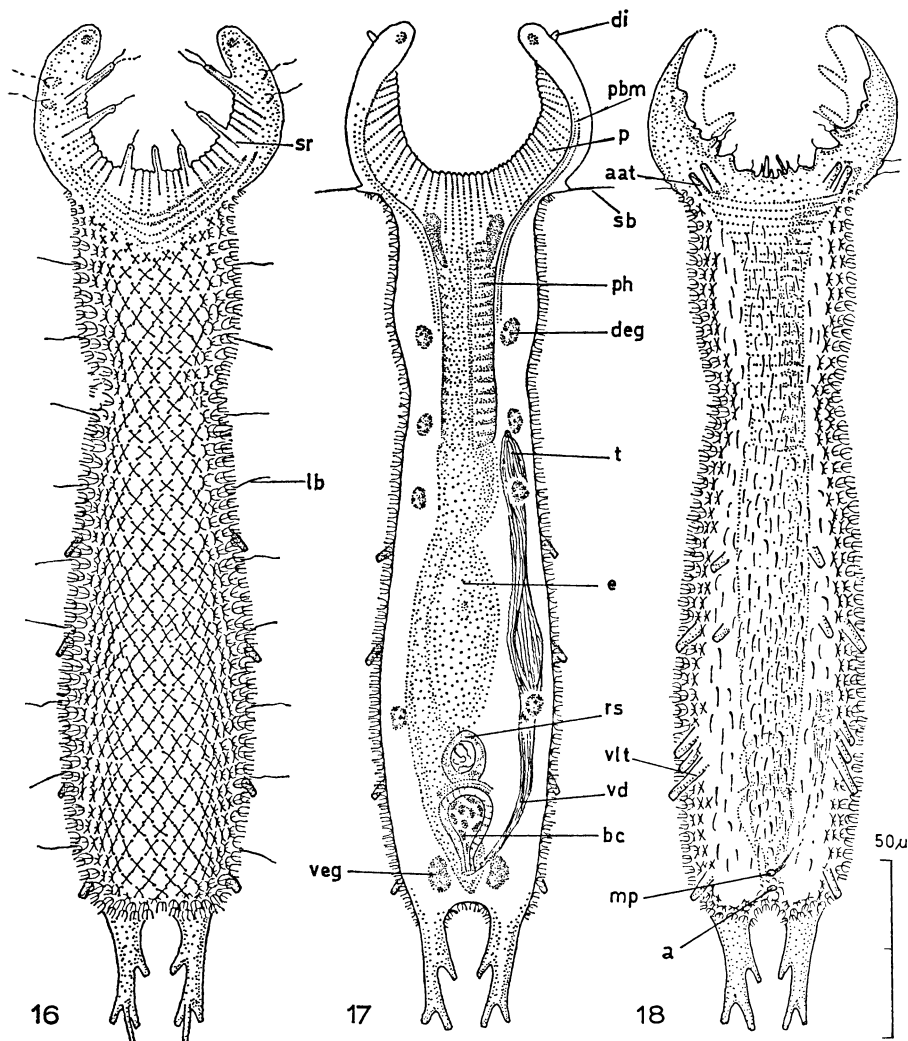
The receptaculum seminis (U82-U85) ranges from 15μ - 20μ in diameter. Like the bursa, it is surrounded by a conspicuous sheath of muscle tissue. In all cases it was filled with spermatozoa. One specimen, however, showed a second receptaculum (U61-U70, both) immediately anterior to the first, both containing spermatozoa.

PSEUDOSTOMELLA ROSCOVITA* SWEDMARK 1956*General appearance.**

Pseudostomella roscovita is quite small, band-shaped and bears a slight lateral constriction at the level of the hind end of the pharynx (U36) (Text-Fig. V; Plate I, 4-6). The anterior end is formed into the typical prebuccal apparatus, characteristic of the genus. The posterior end supports two pedicles each consisting of four tubules. Tetrancres cover the dorsal and ventrolateral body surfaces with the exception of an area above the mouth opening, triangular in shape, which is not covered with tetrancres. The tetrancres are arranged in diagonal rows and are large and conspicuous. A single pair of long (12μ) sensory bristles arising from a 3μ papilla extends laterally from the bases of the prebuccal processes (Text-Fig. V, 17). Lateral bristles occur along the body sides in a regular series of 10-14 and are 10 - 12μ in length. Four of the seven ventrolateral tubules are commonly seen from a dorsal view of the animal, all occurring in the posterior half of the animal (Text-Fig. V, 16). The pedicles are long

in this species, projecting $30\ \mu$ (U86-U100) from the surface of the body. In only one specimen were the tetrancres seen to extend onto the pedicles; the pedicles in all other specimens being completely exposed (Plate I, 6).

The total length of *Pseudostomella roscovita* reaches $270\ \mu$ (mean $230\ \mu$) from the distal end of the prebuccal apparatus to the distal end



TEXT-FIG. V

16, *P. roscovita*, dorsal view; 17, *P. roscovita* mid-frontal optical section showing internal organization; 18, *P. roscovita*, ventral view.

of the pedicles. The diameter of the body behind the prebuccal apparatus reaches $40\ \mu$ (mean $33\ \mu$). The lateral constriction lies between U32-U38, the width at this position being as wide as $32\ \mu$ (mean $30\ \mu$). The breadth of the nearly parallel body sides attains $48\ \mu$ (mean $41\ \mu$) and tapers to a maximum of $30\ \mu$ (mean $27\ \mu$) in front of the caudal pedicles.

Prebuccal apparatus.

The inner margin of the dorsal part of the apparatus supports three papillae on each side and one positioned centrally (Text-Fig. V, 16). They are 10μ in length. The most anterior of these papillae is supported by two stiffening rods which extend from the end of the papilla to 10μ into the parenchyma. The other papillae have only one stiffening rod which similarly continues 10μ into the parenchymal tissue. Each of the papillae supports a long cilium (8μ) which is vesiculated distally. In addition, the most anterior of the papillae has a second shorter cilium (3μ) arising from its tip. The inner margin, between the papillae, has a scalloped appearance with approximately 3-5 undulations between adjacent papillae. The dorsal half of the process "overhangs" the ventral portion by 4-5 μ .

Each lateral border of the dorsal portion of the apparatus bears three distinct sensory cilia. The most anterior, supported by a short projection (2μ), is 6μ in length and lies 15μ posterior to the tip of the prebuccal process. The second and third, arising 10μ posterior to the first and adjoining one another, are 6μ in length and are each positioned atop a 1μ projection.

The epidermis and parenchyma, lying just behind the mouth opening, are considerably folded and produce a pleated appearance.

A mit-frontal optical section of the prebuccal apparatus (Text-Fig. V, 17) shows quite clearly the folding of the parenchymal tissues. Also present on the lateral border of the apparatus is a digitiform protuberance (4μ), arising 10μ from the tip of the prebuccal process. At the level of the base of the prebuccal process is a projection, 2μ long, which supports an elongated sensory cilium (12μ).

The inner margin of the ventral surface (Text-Fig. V, 18) has several groups of papillae which support cilia. The most anterior group, group 1, consists of two adjoining papillae (3μ) each bearing a 5μ long cilium. Adjacent to group 1 and toward the median line is a single broad (5μ wide at base) papilla carrying a 5μ long cilium. Continuing medially, there is a small rounded papilla (2μ) supporting a cilium 3μ in length. Abutting the median line is group 2, consisting of three papillae. Two lie in the same plane while the third is between and slightly dorsal. The former two are 3μ long and carry a 2μ cilium; the third is 8μ long and supports no cilium. In addition to these, there are 3-4 other non-ciliated papillae, ranging in size from $1-3\mu$, in the area anterior to group 1.

Along the outer margin of the process are two lateral cilia (6μ) arising from small projections ($1-2\mu$) at the level of the anterior tubules. The musculature in the prebuccal area is very distinct. Longitudinal fibres arise from the sides of the pharynx and from the medial portion of the pharyngeal area and extend into the prebuccal processes. Circular muscles are also apparent surrounding the pharynx.

Tubules.

The anterior tubules lie at the bases of the prebuccal processes, are two in number, and measure 8μ in length. Their number was constant for all specimens observed.

The ventrolateral tubules are present in four groups. Group 1 consists of one tubule (7μ) and is situated between U48-U55; group 2 is composed of two tubules (10μ and 5μ), the second more medial, and lies between U56-U57; group 3 consists of three tubules arranged linearly (8μ , 4μ , 12μ), between U75-U84; and group 4, being a single tubule (8μ) in front of the pedicles U89-U96.

The pedicles support 4 tubules; one medio-basal, two distal, and in the plane of the body and a single distal tubule directed dorsally. The medio-basal tubule is 5μ long and has 2-3 refractile granules at its base. The shafts of the pedicles contain 3-4 large, conspicuous granules. The two distal tubules in the plane of the body measure 12μ (medial tube) and 10μ (lateral tube); each contains two granules. The dorsally directed tubule is 12μ long and holds 4 granules. In addition each of the tubules supports distally 1-2 very fine filiform projections $2-3\mu$ in length.

Cuticular structures.

The entire dorsal surface with the exception of a large triangular area above the anterior end of the pharynx, is covered with large tetrancres. The tetrancres also extend to the ventrolateral portions of the body. The bare area, above the pharynx, forms an equilateral triangle 20μ on a side with the apex directed posteriorly.

The tetrancres measure 5μ between the opposite spines and their length varies between $7-8\mu$ (Text-Fig. VI, 20-21). The tetrancres are noticeably reduced behind the head area and on the ventrolateral surfaces. They are not generally present on the pedicles.

Ciliation.

The ventral surface is totally ciliated and becomes more densely so in the region beneath the gut. There is a dense cluster of cilia around the anal opening.

Epidermal glands.

The dorsal glands form two longitudinal rows along the lateral portions of the body. They number 4-6 in each row, are nearly spherical and measure $5-7\mu$ in diameter. At the level of the bursa and lying on each side of the gut is a larger ventral gland, 10μ in diameter and having the same refractile, granular consistency as the dorsal glands.

Digestive system.

The mouth opens directly behind the prebuccal processes into a very wide pharynx which narrows progressively until joining a widened intestine. The pharynx, in the specimens observed, extended 38-45 U and had no pharyngeal pores.

The intestine forms a straight tube, narrowing to the anus at 87-96 U. In specimens which contained a large egg, the intestine was displaced to the left. Both the pharynx and the intestine showed a typical, granular consistency, with a higher concentration of granules surrounding the lumen of both tubes.

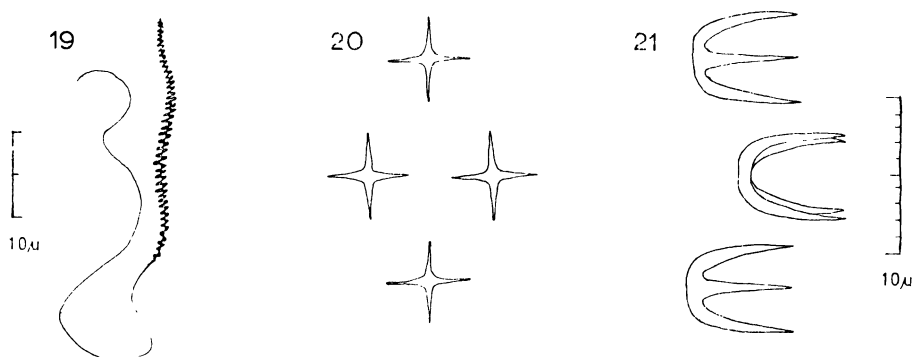
Male reproductive system.

The male reproductive system, in all specimens observed, is situated between U38 and U91. The testis is single, dorsal, and lies on the right side of the body. Occasionally, it shows a local widening midway along its route to the male pore. The vas deferens curves sharply upon nearing the male pore which opens ventrally in the midline beneath the « neck » of the bursa copulatrix. There is no penis present.

The spermis composed of a distinct spiralized head portion and a long tail. The length of the head is 22μ and it has approximately 40 turns. The tail portion is 30μ long (Text-Fig. VI, 19).

Female reproductive system.

Several oocytes (6) and one large mature egg were seen in this species. Single mature eggs (65μ), in the specimens observed, were always seen to lie between U52 and U76 on the right side of the body.



TEXT-FIG. VI

19, *P. roscovita*, spermatozoon; 20, *P. roscovita*, tetrancres, dorsal view; 21, *P. roscovita*, tetrancres, side view.

The oocytes, when present, were positioned immediately anterior to the receptaculum seminis.

The bursa copulatrix, located between U82 and U96, is large ($20\text{--}25\mu$) and pear-shaped with the thinner end (5μ) directed caudally and ventrally. The entire bursa is surrounded by a sheath of muscle tissue and consists internally of densely packed globular clusters of refractile granules. With the animal in lateral orientation, the bursa forms a considerable "bulge" in the dorsal surface of the body, attesting to the thickness of the organ. While in this position, it was also noticed that the female pore did not open to the outside of the body, but rather to the parenchyma within it. The female pore, 2μ in diameter, is surrounded by a ring of circular muscles, 5μ in width. At the anterior end of the bursa, a second pore of diameter 2μ communicates with the receptaculum seminis; this pore also being surrounded by a ring of circular muscle, 8μ in diameter. This ring of muscle, seen from either the dorsal or ventral side of the animal, appears to form a muscle band between the bursa and the receptaculum seminis. The bursa was never seen to contain any spermatozoa.

The receptaculum seminis is situated between U74 and U84 and has a diameter of 15 μ . This organ is also ensheathed in conspicuous muscle tissue. In all specimens observed, the receptaculum contained spermatozoa.

DISCUSSION

It is clear that the gross morphology of the prebuccal apparatus is the same in *P. plumosa* and *P. cataphracta* as it is in the other described species. Differences do occur, however, within the structure itself. Regarding the dorsal papillae, all species share the same pattern of three lateral and one central, but *P. cataphracta* has the most anterior of these markedly reduced in size. It is nevertheless true that all species of the genus show the same number and arrangement of the dorsal papillae.

The ventral papillae differ in all the described species. *P. plumosa* has a group of two and a group of three, the Carolina form of *P. roscovita* bears a group of two and a group of three and several single papillae, while *P. roscovita* Swedmark has two lateral, one central and one on each side of the central papilla; *P. cataphracta*, a single group of two papillae and a rounded ciliated bulge and, finally, *P. malayica* Renaud-Mornant, two lateral and one single papillae on each side of the median line. The manifoldness of the ventral papillae is, therefore, a diagnostic species character. In addition, the Carolina form of *P. roscovita* possesses a long papilla on the antero-lateral border of each prebuccal process which is not present in any of the other species of the genus, except, perhaps, the Kiel form. It is also evident that all species in the genus have the dorsal part of the apparatus extending over the ventral portion.

The number and pattern of the adhesive tubules in the three species described here proved to be a constant species character. The Kiel form of *P. roscovita* (Forneris 1961), however, has three anterior tubules whereas the Carolina, Roscoff, and Waltair specimens have only two. The ventrolateral tubules of the Roscoff form are also variable (Swedmark 1956). These data indicate therefore that this character is probably variable intraspecifically as well as interspecifically. Based on the constancy of numbers in my observations, however, I reason that the posterior foot and additional tubule on the pedicles in *P. cataphracta* provide diagnostic species characters.

The three pairs of long lateral tubules in *P. cataphracta* are also present in *P. malayica*, although somewhat shorter in length. The other species do not show this character. The Waltair form of *P. roscovita* possesses adhesive tubules between the two pedicles, which is unique in the genus as well as within the species. Filiform processes were only noticed on the posterior tubules of the Carolina form of *P. roscovita* and *P. cataphracta*. They may prove to be characteristic of the genus *Pseudostomella*; data, however, is lacking in *P. plumosa*, the Kiel, Waltair, and Roscoff forms of *P. roscovita* and *P. malayica*.

All the species of *Pseudostomella* possess elaborate cuticular modifications. The tetrancres of *P. roscovita* and *P. malayica*, the pentancres of *P. cataphracta* and the scaled triancres of *P. plumosa* provide excellent diagnostic species characters. Furthermore, species with tetrancres and pentancres show a relation in their cuticular structures to species of other genera in the Thaumastodermatidae. Stalked scales, on the other hand, have no affinities anywhere in the Macrodasyoidea and are therefore regarded as significant at only the species level organization.

The distribution of spines on the dorsal surface of the body is different in all the species so far described. Its large bare triangular area above the mouth clearly differentiates from the other species. The same is true for *P. cataphracta*, with its triangle of conspicuously smaller pentancres located in the same vicinity. *P. malayica* and *P. plumosa* have no bare area, but the tetrancres and scaled triancres are slightly reduced in size above the mouth area.

The ventral ciliation in the Roscoff form of *P. roscovita* is total as it is in the Kiel and Waltair forms. *P. malayica* has its medioventral area more densely ciliated than the other regions, as does the Carolina form of *P. roscovita*, while *P. plumosa* is nearly opposite with the ciliation reduced in the medio-ventral area and *P. cataphracta* has four longitudinal rows.

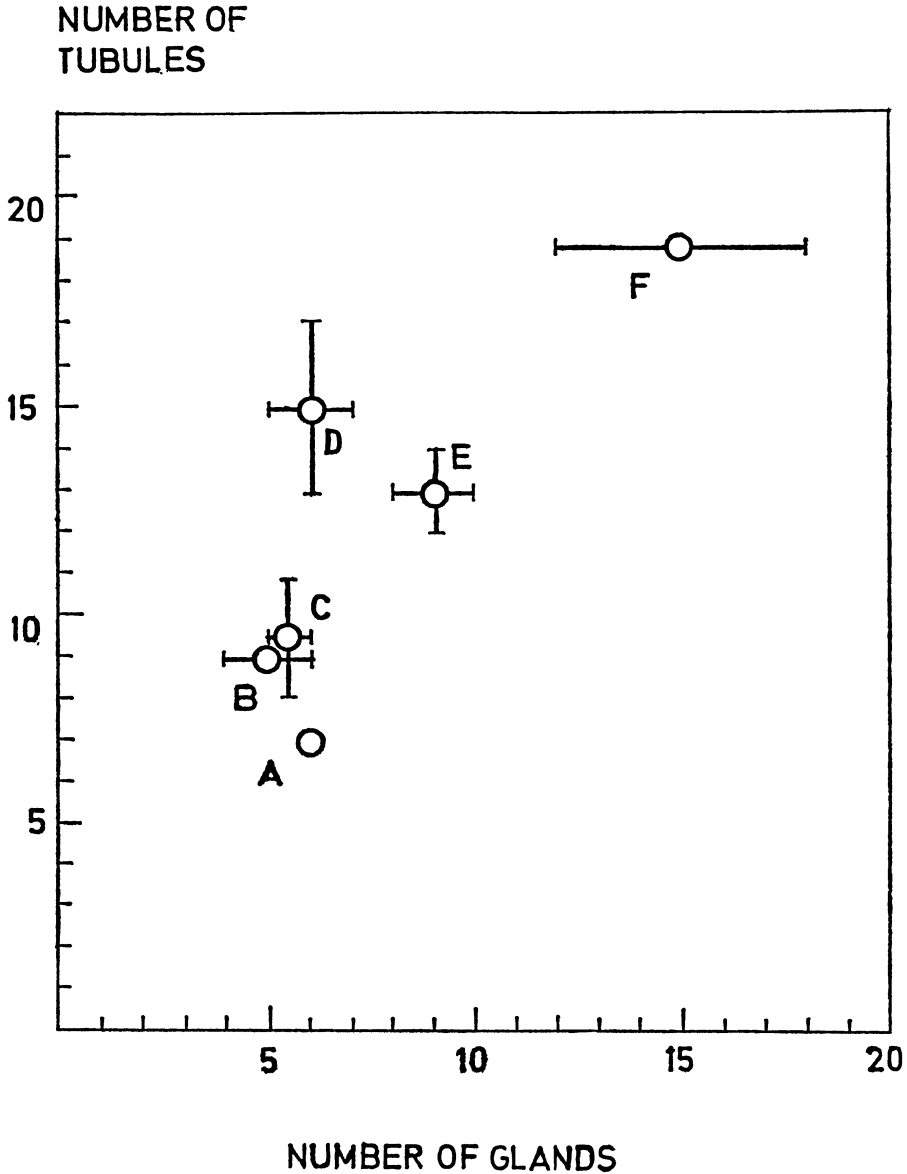
The single pair of large sensory bristles on the base of the pre-buccal apparatus originates dorsally in the Roscoff and Waltair forms of *P. roscovita*, laterally in the Carolina form and *P. plumosa*, modified and ventrally in *P. malayica* and are lacking in *P. cataphracta*. The lateral bristles in *P. cataphracta* have a distinctively thicker proximal portion and a thinner distal process. Both *P. plumosa* and the Carolina form of *P. roscovita* possess lateral bristles which are constant in diameter along their length. No data are available from the other species. Sensory bristles on the lateral and anterior portions of the body are common in the Thaumastodermatidae as well as in other families of the Macrodasyoidea and Chaetonotoidea.

The epidermal glands are of the granular type described by Remane (1929). Their number varies among the species and forms of the genus. Furthermore, there appears to be a correlation between the number of adhesive tubules and the number of epidermal glands (Text-Fig. VII). The number of glands in one longitudinal row is plotted against the total number of tubules on one side of the body, considering the pedicles and posterior "foot" (in *P. cataphracta*) as one tubule each since they arise from a single base. It is seen that the data from the Roscoff, Kiel and Carolina forms of *P. roscovita*, *P. malayica*, *P. plumosa* and *P. cataphracta* fall very nearly on a straight line. Only the Waltair form deviates from this pattern. It is interesting to note that the single large ventral glands present in all specimens, lying on each side of the gut end, are quite close to the bases of the pedicles. Additionally, refractile granules, similar to those in the epidermal glands, were found in the ventrolateral and posterior tubules of *P. cataphracta* and the Carolina form of *P. roscovita*.

The digestive system is very similar in all the described species with the exception of *P. malayica* which possesses a pair of small

pharyngeal pores at the posterior end of the pharynx. The remaining species have no pharyngeal pores.

The male reproductive systems of all the species except *P. malayica* are quite similar. In all cases there is a single testis on the right side of the body with spermatozoa extending to a pore near the



TEXT-FIG. VII

Graph showing relationship of numbers of adhesive tubules versus number of epidermal glands. Vertical and horizontal lines show variability.

A: *P. malayica* Renaud-Mornant 1967, B: *P. roscovita* (Carolina form), C: *P. roscovita* Swedmark 1956 (Kiel and Roscoff forms), D: *P. roscovita* (Waltair form), E: *P. plumosa*, F: *P. cataphracta*.

opening of the bursa copulatrix. *P. malayica*, however, has a distinct, elongated testis with spermatozoa extending both anteriorly and posteriorly from it. The spermatozoa of *P. plumosa* and *P. cataphracta* are very similar under phase optics. The Carolina form of *P. roscovita*, however, has an obviously different sperm shape and length. It may be that the similarities of the spermatozoa of *P. plumosa* and *P. cataphracta* are only apparent because an insufficient number of details were observed. Generally, the male system is characteristic of the family Thaumastodermatidae excluding the genus *Diplodasys*.

The female reproductive system was virtually identical in the three species described in this paper. *P. malayica* and the Roscoff form of *P. roscovita* are also very similar. The female system, then, conforms to the general type found in the family Thaumastodermatidae.

DEFINITIONS

An emendation of Swedmark's diagnosis of the genus *Pseudostomella* is given below since it is now possible to predict with greater assurance additional genus characters. Diagnoses of all the known species of the genus and all forms of the species *P. roscovita* are presented to assist in practical recognition and to clarify and define character differences.

Pseudostomella Swedmark 1956.

Thaumastodermatidae with two anterior extensions formed into a prebuccal apparatus. A distinctive prebuccal musculature is present. Inner, dorsal margin of the apparatus with one central and three lateral papillae. Epidermis with modified cuticular structures. Two pedicles posteriorly.

P. cataphracta nov. spec.

Pseudostomella with small pentancres. Posterior foot present, having four tubules. Pedicles with five adhesive tubules, two of which are basal in position. Bulbous swelling present on base of two distal pedicle tubules. Anterior prebuccal papilla reduced. Three anterior tubules present. Pentancres present on pedicles. Cilia in four longitudinal rows. Triangular area above mouth with conspicuously smaller pentancres. Three, long, lateral adhesive tubules present. Additional small adhesive tubule beneath first long lateral tubule.

P. plumosa nov. spec.

Pseudostomella with triancres consisting of inverted L-shaped spines, supporting feather-like scales. Elongated glandular structure present on each side of the pharynx. Cilia reduced in the midbody region beneath the gut. No distinct triangular area above the mouth. Triancres do not extend on to the pedicles.

P. roscovita Swedmark 1956 (Roscoff form).

Pseudostomella with large tetrancres ($5\mu \times 5\mu$). With large triangular area above the mouth without tetrancres. Long dorsolateral

sensory bristle at bases of prebuccal processes. The ventral surface is totally ciliated. Two anterior and 6-10 lateral adhesive tubules present.

P. roscovita Swedmark 1956 (Kiel form, Forneris 1961).

Pseudostomella with large tetrancres. With digitiform protuberance on the anterior margin of each prebuccal process. Three anterior tubules present.

P. roscovita Swedmark 1956 (Waltair form, Ganapati and Rao 1967).

Pseudostomella with large tetrances (4-5 μ). With triangular area above the mouth lacking tetrancres. Long, dorsolateral sensory bristle at bases of prebuccal processes. Two anterior and 8-12 lateral adhesive tubules present. Lateral tubules spaced evenly. Four tubules present between the pedicles.

P. roscovita Swedmark 1956 (Carolina form).

Pseudostomella with large tetrancres (5 $\mu \times 5 \mu$). With large bare triangular area above the mouth. Having a digitiform protuberance on the anterior margin of each prebuccal process. Long, lateral sensory bristle at bases of prebuccal processes. Ventral surface totally ciliated, becoming more densely so beneath the gut. Two anterior tubules and 7 ventrolateral tubules present. Pedicles long.

KEY

1. Body covered with large tetrances, 4-6 μ between opposite spines 4
1. Body covered with scaled triancres, small tetrancres or pentancres 2
2. Body covered with tetrancres, 2 μ high and 2 μ between opposite spines. With small pharyngeal pores at end of pharynx. Elongated testis with sperms extending anteriorly and posteriorly *P. malayica* Renaud-Mornant 1967
2. Body covered with scaled triancres or pentancres. With no pharyngeal pores. Testis anterior with sperms extending posteriorly to the male pore 3
3. Body covered with small pentancres, 5 μ high and 3 μ between opposite peripheral spines. Pedicles with 5 adhesive tubules.— Additionally, posterior foot with 4 tubules. Three pairs of long lateral tubules *P. cataphracta* nov. spec.
3. Body covered with imbricated scaled triancres. Pedicles with 4 adhesive tubules. —Furthermore with long, sensory bristle at base of prebuccal processes. Elongated gland on each side of the pharynx *P. plumosa* nov. spec.
4. Bare triangular area above the mouth. Long sensory bristle at base of prebuccal processes. No pharyngeal pores. With two anterior tubules 5
4. The same with three anterior tubules. With digitiform projection from anterolateral margin of each prebuccal process
..... *P. roscovita* Swedmark 1956, Kiel form

5. Digitiform projection from anterolateral margin of each prebuccal process. Group of three ventral prebuccal papillae on each side of the median line. Long, sensory bristle arising laterally at the base of each prebuccal process *P. roscovita* Swedmark 1956, Carolina form
5. No digitiform projection. Medioventral, prebuccal papilla present and a pair of ciliated papillae with the two anterior tubules. Long, sensory bristle arising dorsolaterally at base of prebuccal processes 6
6. Lateral tubules arranged in four groups *P. roscovita* Swedmark 1956, Roscoff form
6. Lateral tubules spaced evenly. Tubules also present between pedicles *P. roscovita* Swedmark 1956, Waltair form

Occurrence

Sediment and associated fauna :

A grain size analysis was made on samples I (locality of *P. plumosa* and *P. cataphracta*) and II (locality of *P. roscovita*) using a standard sieve series. Sample I gave the following results: fractions coarser than 4 mm = 0 p. 100, 2-4 mm = 0 p. 100, 1-2 mm = 0.07 p. 100, 0.5-1 mm = 2.25 p. 100, 250-500 μ = 62.38 p. 100, 63-125 μ = 5.29 p. 100, 37-63 μ = 1.91 p. 100, silt-37 μ = 0.62 p. 100, silt = 2.31 p. 100; clay 1.32 p. 100. Sample II: fractions coarser than 4 mm = 8.55 p. 100, 2-4 mm = 10.05 p. 100, 1-2 mm = 1.78 p. 100, 0.5-1 mm = 11.52 p. 100, 250-500 μ = 28.58 p. 100, 125-250 μ = 27.49 p. 100, 63-125 μ = 4.58 p. 100, 37-63 μ = 1.86 p. 100, silt-37 μ = 0.75 p. 100, silt = 4.66 p. 100, clay = 0.18 p. 100.

The associated Gastrotrich fauna in the samples consisted of the undescribed species of several genera.

Sample I contained in addition to the two *Pseudostomella* species: *Cephalodasys* sp., *Paradasys* sp., *Mesodasys* sp., *Urodasys* sp., *Crasiella* sp., *Acanthodasys* sp., *Tetranchyroderma* sp., *Diplodasys* sp., *Ptychostomella* sp., *Thaumastoderma* sp., *Neodasys* sp.

Sample II included: *Lepidodasys* sp. I, *Lepidodasys* sp. II, *Paradasys* sp., *Mesodasys* sp., *Thaumastoderma* sp., *Tetranchyroderma* sp., *Halichaetonotus* sp. and *Xenotrichula* sp.

Summary

Two new species of the genus *Pseudostomella* are described. *P. plumosa* nov. spec. is distinguished by a covering of stalked scales, a unique feature in the Macrodasypoidea. *P. cataphracta* nov. spec. is characterized by a covering of small pentaneres. A Carolina form of *P. roscovita* Swedmark 1956 is described and the necessity of making more detailed descriptions is discussed. Diagnoses for all the known forms and species of the genus are given and a key is presented. All specimens were taken in samples along the coast of North Carolina.

Zusammenfassung

Beitrag zur Kenntnis von *Pseudostomella* Swedmark (1956) mit Beschreibungen von *P. plumosa* nov. spec., *P. cataphracta* nov. spec. und einer Form von *P. roscovita* Swedmark 1956 der westlichen amerikanischen Küste des atlantischen Ozeans.

Der Autor beschreibt zwei neue Arten der Gattung *Pseudostomella* *P. plumosa* nov. spec. ist charakterisiert durch eine Bekleidung mit gestielten Schuppen, einziges Beispiel dieses. Merkmals bei den Macrodasyoidea. *P. cataphracta* nov. spec. ist gekennzeichnet durch eine Bekleidung mit kleinen Fünfhakern. Aus Carolina wird eine Form von *P. roscovita* Swedmark 1956 beschreiben. Der Autor diskutiert auch die Notwendigkeit sehr detaillierter Beschreibungen. Er gibt Diagnosen aller bekannten Formen und Arten der Gattung und einen Bestimmungs-Schlüssel. Alle zitierten Exemplare stammen von der Küstenzone und vom unittleven Schelf von Nord-Carolina.

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