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Goharia obscura NOV. GEN., NOV. SP. (ARCHOOPHORA : GOHARIDAE NOV. FAM.) A New Acoelan Turbellaria from the Red Sea

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ABSTRACT. Eight specimens of a new Acoelan Turbellaria, *Goharia obscura* nov. gen, nov. sp. which belongs to a new family "GOHARIDAE", were collected from a depth of about 50 cm in the sandy lagoon at Ghardaqa and north Jeddah in the Red Sea in 1986. The worm is dark brown with fine white longitudinal strands. Symbiotic algae and eyes are totally missing. It has a zeppelin shape. Reconstructions of the new Acoelan Turbellaria were drawn from the median sagittal position, by the examination of transverse, longitudinal and frontal sections of the worm stained by Mallory stain which gave excellent results. Camera lucida was also used.

This worm is related to a new family GOHARIDAE because it has a peculiar sense organ, situated near the anterior end, with a ventral aperture. The mouth is ventral and the pharynx is missing. The female genital aperture and the Antrum femininum are absent. The male genital aperture is located dorsally very near to the posterior end.

It is belonging to a new genus, due to the fact that it has from 4 to x cuticularized bursa mouth pieces. The number of the sperm balls are variable. The penis is cuticularized. The main retractor muscles of the sense organ pass through the brain mass, and ends before the statocyst. It is a new species, as it possesses a highly developed nervous system, consisting of a spherical submuscular nerve plexus, having 5 nerve stems and medio-dorso-ventral nerve commissure.

Bursa-seminalis is well developed, giving rise to 6 cuticularized bursa-mouth pieces. The penis has a cuticularized tube, opening into the antrum musculinum.

Introduction

Few scientists have worked on free-living turbellarians in the Red Sea. Palombi[1] discovered *Hofstenia minuta* from the Suez-canal, Melouk[2] worked on a new polyclad from the Red Sea, *Cryptoballus aegypticus* nov. sp. Antonius[3] had collected five new species of *Acoela, viz. Convoluta pygopora, Convoluta aegyptica, Conaperta brana* and *Conaperta thela.* Moreover, he also collected *Brachypea* nov. gen. from Ataka.

Beltagi[4] found *Anaperus trifurcatus* nov. sp. *Amphiscolops marinelliensis* nov. sp. was collected by Beltagi and Khafaji[5] from the Red Sea.

Therefore, it was thought worthy to continue our research work on Turbellarians which would have great importance from the phylogenetic, taxonomic, and anatomic point of view.

Material and Methods

Eight specimens of this worm had been collected from the sandy bottom of the lagoon in the shallow water near Ghardaqa and north of Jeddah in 1986. The worms were gathered from a depth of about 50 cm at low tide, using a dredge of heavy steel frame with a nonflexible "bridle" of steel rods and a bag of heavy-duty nylon setting with a finer-meshed inner lining. The dredge used has an aperture about 20 × 45cm and a bag of about 1m deep. The collected specimens were narcotized by using a saturated solution of Epsom $MgSo_4$. Reconstruction of this new species was drawn from the medio-sagittal position, by the examination of transverse, longitudinal, and frontal sections of the worm stained by Mallory stain using camera-lucida.

Systematic Position

Phylum : Platyhelminthes, Gegenbaur, 1859
Class : Turbellaria, Ehrenberg, 1831
Order : Archoophora, Westblad, 1948
Suborder : Acoela : Uljanin, 1870, Graff, 1905
Family : Goharidae nov. fam.
Genus : Goharia nov. gen.

Goharia obscura nov. sp.

Results and Discussion

External Features (Fig. 1a, 1b)

The worm is oval in shape (Fig. 1a). It has a zeppelin shape. The anterior end is somewhat broader than the posterior end. Thus, it bears similarity to *Anaperus australis*[10].

The length of the worm varies from 2 to 3 mm, while the width is about 0.6 to 1.0 mm. The body reaches its maximal breadth at the beginning of the second third region of the body. Almost rounded, but the anterior and posterior ends, which are

somewhat narrow. The worm is blackish brown with fine longitudinal strands (Fig. 1a-wls) which are very thin and white in color. The longitudinal white strands are attributed to the accumulation of the concrement similar in structure to that described in *Amphiscolops fuligineus*[11]. These white strands extend through the whole length of the body, beginning from the anterior tip till the posterior one. Its blackish brown coloration is due to the presence of small rounded blackish brown pigments (Fig. 1a-bbp) accumulated in the epithelial layer and the parenchymatous tissue. The eyes are missing as in *Amphiscolops gemelliporus*[12] and *Amphiscolops virescens* and most of the species of the genus *Anaperus*[13].

The statocyst (Fig. 1a, 1b, 2, 5) is lying deeply in the internal tissue of the body. It is situated at the end of the first anterior seventh part of the body and has a diameter of 35μ.

General Organization (Fig. 1b, 2)

The integument of the worm is covered by a thick coat of fine cilia (Fig. 1, 2, 7-ci) which has uniform length and distribution and also line the orifices of the body.

The brain mass (Fig. 2, 8-bm) and the nerve stems lie nearly at the middle of the first anterior fourth part of the body, just behind the frontal gland and they extend into a region of about 63μ. The brain mass is nearly spherical in shape giving rise to five pairs of nerve stems. The median dorsoventral nerve commissure (Fig. 2, 8-mdvnc) forms a principal part of the sense organ (Fig. 1a, 1b, 2,3,4,8). It also envelops the well-developed and strong dorso-ventral muscle fibres (Fig. 3, 4) which form the upper part of the sense organ. The aperture of the sensory organ (Fig. 1a, 1b, 2, 3) is located ventrally at the beginning of the second anterior seventh part of the body. It bears a slight resemblance in function to the ciliated pits of *Stenostoma*[20].

The mouth aperture (Fig. 1b, 2, 6-ma) is situated at the ventral surface, nearly in the middle region of the second third part of the body as in *Amphiscolops australis*[10]. It leads directly to the digestive parenchyma (Fig. 2, 6-dgp). It extends immediately after the brain mass till the end of the third fourth part of the body.

The Reproductive System (Fig. 1b, 2, 9, 10)

I. The Female Genital Apparatus (Fig. 1b, 2, 9)

This occupies the region extending a little distance before the middle part of the body till the middle part of the posterior half part of it. It is composed of a well-developed bursa seminalis (Fig. 2, 10) where a considerable number of pear-shaped sperm-balls are embedded. They are different in size, and some join with the neighboring sperm-balls. Six bursa mouth pieces (Fig. 1, 2, 9) which are strongly cuticularized and lamellated in structure, are coming off from the anterior part of the bursa seminalis. Each bursa mouth piece is surrounded by its matrix (Fig. 2, 9), thus, nearly resembling the case described by Graff[13], concerning *Amphiscolops langerhansii* and by Marcus[12] concerning *Amphiscolops carvalhoi.* The two right and left ovaries (Fig. 1b, 2-rov, lov) are embedded in the parenchymatous tissue ex-

tending ventrally.

II. The Male Genital Apparatus (Fig. 1b, 2, 10)

It is situated a little distance after the middle part of the body. The male genital aperture (Fig. 1b) is located on the posterio-dorsal part of the body which is one of the main characteristic features of this worm.

It leads to a short antrum masculinum (Fig. 1b, 2, 10-anm) connected with the penis by the penial canal (Fig. 2, 10-pec) which is supplied with an elongated cylindrical cuticularized tube (Fig. 2, 10-ctp) having a curved shape. A vesicula granulorum, 2 false seminal vesicles, right and left testes are present (Fig. 1b, 2, 10-vgr, rfsv, lfsv, rt, lt).

Epicytium (Fig. 2, 3, 4, 5)

The body of the worm is surrounded by an outer epithelial layer which is syncytial in structure. The epicytium has oval and sperical nuclei (Fig. 3, 4, 5-nu). The integument is covered by an outer coat of cilia (Fig. 1, 2-ci) of equal length and is distributed all over the body. The length of each cilium is about 7μ. The epithelial layer is interrupted by mucus secreting gland cells (Fig. 3). Mucus gland cells are more abundant at the ventral epithelial layer than at the dorsal one.

The necks of the subepidermal mucus gland cells (Fig. 5) penetrate the epithelial layer. Their bulbs are embedded in the peripheral parenchymatous tissue (Fig. 5). The dorsal epithelial layer (Fig. 2, 3-dep) is thicker than the ventral one (Fig. 2, 3-vep). The blackish brown pigments (Fig. 1a) are concentrated at the dorsal epithelial layer than at the ventral one.

Symbiotic algae are totally absent, thus it differs from *Amphiscolops lanerhansii*[13], *Amphiscolops marinelliensis*[5]. The basement membrane is missing.

The Muscular System (Fig. 3, 4, 5, 9, 10)

The worm has a well-developed muscular system. It consists of two main parts:

1. The sub-epidermal muscle fibres.
2. The parenchymatous muscle fibres.

1. *The Sub-epidermal Muscle Fibres* (Fig. 3, 4, 5, 7, 9, 10)

It is formed of a continuous layer surrounding externally the parenchymatous tissue where the different internal organs are embedded. It is composed of an outer circular muscle layer (Fig. 3-cml) and an inner longitudinal muscle layer (Fig. 3-lml). The dorsal sub-epidermal muscle layer is thicker than the ventral one. The thickness of the dorsal layer is about 8.4μ, while that of the ventral layer is about 5.6μ. The longitudinal muscle fibres (Fig. 3, 4, 5-lmf) are well developed. Each longitudinal muscle fibre has a thickness of about 1.4μ, while the circular muscle fibre (Fig. 3, 4, 5-cmf) has a thickness of about 0.6μ.

2. *The Parenchymatous Muscle Fibres* (Fig. 4, 5, 7, 9, 10)

Dorso-ventral muscle fibres (Fig. 4, 5, 7, 9, 10) are the most common and abun-

dant. They extend dorso-ventrally from the peripheral dorsal part of the parenchyma, crossing on their way, the central parenchyma (Fig. 4, 7) and the digestive parenchymatous tissue (Fig. 2, 6) to the ventral peripheral part of the parencyma, especially in the middle part of the body. The dorso-ventral muscle fibres are well developed, reaching a maximal length of about 56μ each and a thickness of about 1.4μ. They are found in great numbers, especially at the anterior third part of the body. The circular muscle fibres (Fig. 3-cmf) are very few and scattered in the parenchymatous tissue, especially at the anterior fourth part and the last fourth part of the body. It is very important to mention that the dorso-ventral muscle fibres penetrate the brain mass, especially the median dorso-ventral nerve commissure (Fig. 2, 8-mdvnc). Thus, they form the principal part of the peculiar and characteristic sense organ described for the first time in this worm (Fig. 2, 3, 4, 8).

Parenchymatous Tissue (Fig. 2, 3, 4, 5)

It extends through the whole internal bulk of the body and surrounds the other internal organs. The parenchymatous nuclei (Fig. 5, 7) are oval or rounded in shape. Each nucleus has a diameter of about 4.2μ. The peripheral parenchymatous tissue is enriched with large intercellular fluid-filled vacuoles (Fig. 5, 7). The parenchymatous tissue as a whole, is strongly differentiated and separated from the digestive parenchyma (Fig. 6), thus it differs from *Anaperus sulcatus*[14], where the parenchymatous tissue is very weakly differentiated from the digestive parenchyma. The vacuolated structure of the parenchymatous tissue resembles to large extent, that described in *Amphiscolops fuliineus*[11] and *Anaperus gadineri*[15].

The oesinophilous glands, especially the rhabdoid gland cells are totally absent. Thus, if differs from *Anaperus tvaerminnensis*[15], *Anaperus rubellus*[16] and *Anaperus trifurcatus*[4]. The blackish brown pigments (Fig. 1a) are scattered enormously and without order in all the plasmatic beams of (Fig. 7) the parenchymatous tissue. They are more concentrated at the dorsal part than at the ventral one. These plasmatic beams are strengthened by dorso-ventral muscle fibres (Fig. 7). The intercellular vacuoles are totally devoid of pigments. The cyanophilous type of gland cells lying in the parenchymatous tissue, includes the frontal gland (Fig. 2-fg) and the mucus gland cells (Fig. 5).

The Digestive Parenchyma (Fig. 2, 6)

It begins a little distance after the brain mass and extends posteriorly to the end of the third fourth part of the body. This tissue is surrounded by the parenchymatous tissue from all directions. It is syncytial tissue. The plasmatic substance is finely fibrillated and is considered to be a compact tissue of homogeneous structure interrupted in some places by large and small rounded food vacuoles (Fig. 6).

The nuclei of the digestive parenchyma (Fig. 6-ndgp) are either round or oval in shape. The diameter of the nucleus is about 5.6μ. The nuclei are scattered irregularly in the plasmatic material of the digestive tissue. They are more concentrated and compact together at the peripheral part than at the center.

Some of the food vacuoles are filled with fat particles. The intestine (Fig. 2, 6-in) is surrounded from outside by longitudinal and transverse muscle fibres which are concentrated in the middle part. The mouth aperture (Fig. 1b, 2, 6-ma) is nearly situated at the end of the first third part of the body, as in *Anaperus australis*[10]. The mouth opening is based upon the endocytial surface at the ventral side, as in *Amphiscolops gemelliporus*[17]. It is surrounded by a strong sphincter muscle (Fig. 6) which is an extension of the ventral sub-epidermal muscle layer. It leads directly to the digestive parenchyma (Fig. 6-dgp). Mucus gland cells (Fig. 6-mgc) are situated on both sides of the mouth aperture, especially at the point of junction between the mouth border and the digestive parenchyma. Coarse granules (Fig. 6-cg) fill the internal part of the mucus gland cell. They help the worm in catching its prey and ingesting it easily. The pharynx is missing as in most of the species of the two genera *Anaperus* and Amphiscolops. Symbiotic algae are totally absent.

Nervous System (Fig. 2, 5, 7, 8)

It is very important to describe the nervous system of this worm in full detail and compare its constituents with that of the other species. It is composed of a hollow spherical brain mass and five pairs of nerve cords. The brain mass (Fig. 2, 8) extends immediately after the frontal gland in a region of about 72μ. It is strongly fibrillated and is considered to be a syncytial nervous tissue in which numerous nuclei are embedded. The brain mass is opened from its anterior and posterior ends. The internal cavity of the brain mass is filled with the parenchymatous tissue. The nuclei (Fig. 5-nc) of the nerve tissue are spherical in shape (balloon-like). Each nucleus has a diameter of about 7.0μ. The brain mass gives rise to five main pairs of nerve stems:

1. *A Pair of Dorsal Nerve Stems*(Fig. 2, 8-dns)

They extend vertically from the dorsal part of the brain mass upwards till it reaches the sub-epidermal muscle layer, giving rise to very fine branches which supply the dorsal epithelial layer and the peripheral dorsal parenchymatous tissue. They extend forwards and backwards in the region of the first fourth anterior part of the body. The length of the base of each dorsal nerve stem is about 40μ. In this case, this worm differes from *Anaperus tvaerminnensis*[18], where there is a commissure uniting the two dorsal nerve stems. It also differs from *Amphiscolops australis*[19], where outer and inner nerve stems exist.

2. *A Pair of Outer Lateral Nerve Stems* (Fig. 2, 8-olns)

They extend laterally on both sides towards the superficial lateral parenchymatous tissue. The thickness of the lateral nerve stem is about 32.0μ. At the posterior end of each nerve stem comes out a longitudinal lateral nerve (Fig. 2, 8-lln) which extends posteriorly through the whole marginal lateral parts of the body.

3. *A Pair of Inner Lateral Nerve Stems* (Fig. 2, 8-ilns)

They extend near the laternal side then pass towards the ventral superficial parenchymatous tissue, thus supplying the parenchymatous tissue and the epithelial layer in this region with fine nerve branches. The thickness of this nerve stem is about 12.0μ.

4. *A Pair of Ventral Nerve Stems* (Fig. 2, 8-vns)

They extend ventrally giving rise to very fine nerve branches supplying the ventral parenchymatous tissue and the ventral epithelial layer. The thickness of the ventral nerve stem is about 24.0μ. A pair of longitudinal ventral nerves (Fig. 2, 8-lvn) is originated from the distal part of the ventral nerve stems. They extend posteriorly supplying the ventral part of the body by very fine nerve branches. In this respect, they differ from *Amphiscolops australis*[19] and *Anaperus tvaerminnensis*[18].

5. *A Pair of Longitudinal Nerve Stems* (Fig. 2, 8-lns)

They are originated from the dorsal posterior part of the brain mass, extending backwards for a short distance of about 20.0μ, then they are connected together forming one thick nerve stem surrounding the dorsal part of the statocyst, as in *Amphiscolops australis*[19]. The dorso-posterior longitudinal nerve stems (Fig. 2, 8-rpdns, lpdns) extend posteriorly giving rise to numerous fine branches supplying the remaining part of the dorsal superficial parenchymatous and the epicytical tissues. There is a median dorso-ventral nerve commissure (Fig. 8-mdvnc) connecting both the dorsal and ventral parts of the brain mass. It is in connection with the neuro-sensory ganglionic mass of the sense organ (Fig. 2, 3, 4, 8). The length of the median dorso-ventral nerve commissure is about 49.0μ and its thickness is about 10μ.

The Sense Organ (Fig. 2, 3, 4, 8)

The most important and characteristic organ of this worm is actually its sense organ (Fig. 2, 3, 4, 8) which is very highly developed in comparison with the other sense organs or ciliary pits of all species of Turbellarians. Thus, a detailed description of the structure of this new organ is very necessary. It is composed of the following parts:

1. The sense organ has a circular aperture (Fig. 1b, 2, 3) which is situated ventrally at the end of the first seventh part of the body. It has an aperture of about 16.0μ in diameter and the inner border of the aperture is ciliated as it is considered to be an extension of the ventral epithelial layer. It is sunk for a very short distance into the parenchymatous tissue. The cilia of the aperture is normal in length similar to the one covering the integument. Thus, it differs from what Kepner and Cash[20], concerning *Stenostomum* had described. The sensory aperture is surrounded by a strong sphincter muscle (Fig. 3-sph) as described by Kepner and Cash[20], concerning the ciliated pits of *Stenostomum*. Few integumentary mucous gland cells (Fig. 3-mgc) are found in the marginal border of the aperture.

2. The sensory aperture leads to a narrow sensory canal (Fig. 3-sc). Thus, it differs from the cup-shaped ciliated pits described by Kepner and Cash[20], concerning *Stenostomum* and the sensory pits of *Anaperrus trifurcatus*[4] and *Amphiscolops marinelliensis*[5]. The length of the sensory canal is about 28 μ and its breadth is about 4.2 μ. The inner border of the sensory canal is completely devoid of cilia. Thus, it deffers from *Plagiostomum, allostoma,* and *Pseudostoma.* The sensory canal is lined by very fine nerve endings of the neuro-sensory cells embedded in the ganglionic nerve mass of the sensory bulb (Fig. 3,4). The basal part of the sense organ is free from

mucous glandular cells. It is connected to the brain mass by the median dorso-ventral nerve commissure (Fig. 2,8-mdvnc). The sensory bulb (Fig. 2,4,8) has a diameter of about 35.0 μ. The whole sensory bylb is surrounded by small and thin longitudinal, diagonaland dorso-ventral muscle fibres (Fig. 4-1mf, dimf, dvmf) which are in some parts crossing one another, thus forming a muscular network structure which is missing in Stenostomum[20]. The dorso-ventral nerve commissure forms the upper principal part of the sense organ. It is penetrated and surrounded from outside by long strong and well developed dorso-ventral muscle fibres (Fig. 3,4) which are about 19 in number. The maximum length of the dorso-ventral muscle fibre is about 70.0 μ. Its thickness is about 1.4 μ. The ventral roots of most of these dorso-ventral muscle fibres are embedded in the dorsal part of the sesory bulb. The presence and function of these well-developed dorso-ventral muscle fibres are not mentioned in the description of the ciliated pits in *Stenostomum*[20], or in any other known sense organ belonging to the Turbellarians. The sense organ including the dorso-ventral nerve commissure and the ganglionic nerve mass of the sensory bulb are surrounded from outside by strong dorso-ventral muscle fibres.

The plasmatic material which forms the ganglionic mass of the sensory bulb, is penetrated not only nerve endings (Fig. 3,4), but also at intervals by thick elongated rod-shaped bodies (Fig. 3,4) which are stained dark blue by mallory, the same case described by[20], concerning the ciliated pits of the *Stenostomum*.

These rod-shaped bodies are considered to be neuro-sensory organs functioning as chemo-receptors. The muscle fibres surrounding the lateral sides of the sensory bulb are considered to be an extension of the sub-epidermal muscle fibres.

Protractor muscles (Fig. 3,4) of the sensory bulb are considered to be an extension of the ventral supepidermal muscle fibres. The dorso-ventral muscle fibres which penetrate and surround the median dorso-ventral nerve commissure and also the ganglionic nerve mass of the sensory bulb acts as retractor muscle (Fig. 3,4). In our opinion, the ganglionic sensory mass of the sensory bulb which is connected ventrally to the brain, is not a modified region of the general epidermis in contradiction to that mentioned by Kepner and Cash[20], conerning the development of the ciliated pits in *Stenostomum*. Besides, this ganglionic spheroidal mass of the sensory bulb is formed from the main central nervous system, owing to the fact that the nerve cells can migrate from brain mass to the ventral peripheral part of the parenchyma, placed just under the brain and forming this ganglionic sensory mass, while the ventral epithelial layer just beneath it, loses its cilia and the nuclei of the epithelial layer are sunk and are embedded in the ventral peripheral parenchymatous tissue surrounding the sensory bulb. The subepidermal muscle fibres in this region are upset and scattered without order, crossing each other and forming a lateral sheath of muscles surrounding the new formed ganglionic nerve mass. At the entrance of the sensory canal, few adhesive papillae (Fig. 3-adp) are located near its epithelial layer. In an attempt to describe the function of this new sense organ, one can imagine that at first, the sensory aperture will be opened and then the protractor muscles (Fig. 3,4) will push the sensory bulb to the outside. The group of muscle fibres surrounding the sensory bulb will contract and thus the size of the sensory bulb decreases and can be pushed easily

to the outside. The sensory canal is in the form of a stocking which is drawn ventrally and when the bulb is in contact with the external environment, the lateral muscles surrounding the sensory bulb expand and thus the area of the sensory surface increases. The sensory rods will enable the worm to detect very slight changes in its outer surrounding medium, and for tasting the substances the worm may find on its way. On the opposite side, when tasting is over, the retractor muscles (Fig. 4) will pull the sensory bulb inward and the lateral muscles surrounding the bulb will contract, thus the bulb will become smaller in size and will be withdrawn inward passing through the sensory aperture which will be closed afterwards. It is obvious that this peculiar and well-developed sensory organ, existing in this worm is definitely a new type of sense organ.

The Frontal Gland (Fig. 2-fg)

It is situated in the region between the anterior tip of the body and the brain mass. It is formed of a compact number of elongated cyanophilous gland cells (Fig. 2-cgc) which are embedded in the parenchymatous tissue and extend to the anterior tip of the body. They form a bundle of cyanophilous glands opening to the outside by a common round aperture which is slightly directed towards the ventral side. Its diameter is about 7.0μ. The thickness of the frontal gland is about 30.0μ and its length is about 84.0μ. The nucleus of each cyanophilous gland cell is oval in shape, having a diameter of about 4.2μ The aperture of the frontal gland is devoid of cilia or other type of glands. Its shape and structure are similar to *Convoluta schultzii,* described by Yves Delage[21]. Symbiotic algae are totally absent in the parenchymatous tissue, thus, resembling in this respect *Amphiscolops fuligineus*[11], *Amphiscolops cinereus*[22], *Amphiscolops evelinae*[23], *Amphiscolops zeii*[24] and *Amphiscolops emellinorus*[17].

Statocyst (Fig. 1a, 1b, 2, 5, 8)

It is situated medio-dorsally nearly at the end of the first sixth part of the body. The dorsal half of the statocyst is surrounded by the thick longitudinal dorsal nerve as in the case of *Amphiscolops australia*[19]. The other part of the statocyst is embedded in the parenchymatous tissue. The statocyst is spherical in form having a diameter of about 28m. It has an outer thin wall (Fig. 5). Its thickness is about 14μm and it contains an elongated and flattened nucleus inside. The statolith (Fig. 5) is situated inside the statocyst nearly at the anterior ventral part. Its shape and structure is the same as described by Luther[18], concerning *Anaperus tvaerminnensis.* The statocyst is surrounded by a very fine thin layer of nerve fibres (Fig. 5-nf) surrounding the remaining ventral half of the statocyst. The eyes are missing in this worm as most of the species of *Anaperus, Amphiscolops gemelliporus*[17] and *Amphiscolops virescens*[18].

The Reproductive System

1. *The Female Genital Apparatus* (Fig. 1b, 2, 9)

It is composed of a well-developed bursa seminalis (Fig. 1b, 2, 9) which includes a various pear-shaped sperm balls (Fig. 1b, 2, 9) of different sizes. Six bursa mouthpieces (Fig. 1b, 2, 9) extend from the anterior part of the bursa seminalis and are di-

rected forwards. The female genital aperture and the vagina are totally absent, thus, it differs from all the species of the genus *Amphiscolops* in this particular characteristic feature. On the other hand, it is similar to some of the species of the genus *Convoluta* such as *Convoluta karlingi*[23] and *Convoluta norvegica*[25] and all species related to the genus *Anaperus*. Every sperm ball is embedded in the syncytial tissue of the bursa seminalis as in *Amphiscolops marinelliensis*[5]. The sperms (Fig. 9) are accumulated together to form a pear-shaped ball. The sperms are short and thin. The length of the sperm is about 7.0μ and its thickness is about 0.7μ.

The six bursa mouthpieces (Fig. 1b) are originated from the anterior part of the wall of the bursa seminalis as in *Amphiscolops marinelliensis*[5] just from the middle and both right and left lateral sides. In this case, the worm resembles what has been described by Graff[26] concerning *Amphiscolops langerhansii* and *Amphiscolops carvalhoi*[12]. Each bursa (Fig. 1b) is a well-developed, thick and strongly cuticularized tube. The thickness of the cuticularized wall of the bursa mouthpiece is about 5.6μ, while its canal is about 2.4μ in diameter. The six bursa mouthpieces extend anteriorly directly forwards and open freely in the parenchymatous tissue as in the case of *Amphiscolops lanherhansii*[26], *Amphiscolops tvaerminnensis*[18], *Amphiscolops carvalhoi*[17], *Anaperus trifurcatus*[4], and *Amphiscolops marinelliensis*[5]. Every bursa mouthpiece is surrounded by its special matrix (Fig. 9) which is formed of a densely fibrillated plasmatic substance with scattered nuclei (Fig. 9). They are either oval or spherical in form. Its diameter is about 5.6μ. These nuclei are more concentrated and packed together at the peripheral part of the matrix. Each bursa mouthpiece is surrounded externally by a thin layer of special secretion sticking to the matrix, which is secreted by special gland cells located in the matrix. The bursa mouthpieces are different in length and shape but have the same diameter. The length of the first right bursa mouthpiece (Fig. 2, 9) is about 94.5μ. It is directed straight towards the anterior part of the body and slightly sloping towards the dorsal side, in its extension. The second right bursa mouthpiece (Fig. 1b, 2, 9) is about 84μ in length, and it is curved in its extension towards the anterior part of the body. The third right bursa mouthpiece (Fig. 1b, 2, 9) is about 98μ in length. It is curved in its extension downward and then extends upwards at the end.

The fourth right bursa mouthpiece (Fig. 1b, 2, 9) is short and extends forwards. The fifth left bursa mouthpiece (Fig. 1b, 2, 9) is slighly curved. The last sixth left bursa mouthpiece (Fig. 1b, 2, 9) is very short and extends straight forwards.

The bursa seminalis is surrounded by an outer longitudinal and inner circular muscle fibre (Fig. 9-lf, cf). Two left and right ovaries (Fig. 1b, 2-lov, rov) are situated lateroventrally in the parenchymatous tissue. They extend from the end of the first fourth part of the body, till the posterior end of the bursa seminalis.

Longitudinal and circular muscle fibres (Fig. 9-lf, cf) surround the tissue of the bursa seminalis, especially from the outer ventral and dorsal sides. Right and left ovaries (Fig. 1, 2-rov, lov) are located in the ventral parenchymatous tissue. They extend from the beginning of the second fourth part of the body, till the end of the bursa seminalis. In this respect, the worm differes from *Anaperus australis*[10] where one

ovary is present.

2. *The Male Genital Apparatus* (Fig. 10)

It is located in the last third part of the body and is embedded in the parenchymatous tissue. The male genital pore (Fig. 10-mgp) is situated dorsally at the beginning of the last ninth part of the body and thus it differs from most of species of Acoelan Turbellarians. It leads to a short and narrow tubular antrum musculinum (Fig. 2, 10-am) which is considered to be an extension of the dorsal epithelial layer. It is in sunk in the region of the antrum musculinum.

It extends ventrally and connects with the penis (Fig. 10-pe). No accessory gland cells are opening into the antrum musculinum. Thus, it differs from *Amphiscolops langerhansii*[26], *Amphiscolops caravalhoi*[12], and *Amphiscolops japonicus*[27]. The male genital pore is surrounded by a sphincter muscle (Fig. 10-sph). The in-sunk subepidermal muscle fibres are surrounding the antrum musculinum and penial canal (Fig. 2, 10-pec).

A long cylindrical, cuticularized tube (Fig. 2, 10-ct) is situated in the middle part of the penial canal, having a length of about 100μ and a diameter of 5.6μ. In this respect, the worm differs from most species of the genera *Anaperus* and *Amphiscolops*. The thickness of the penial muscle layer is about 14μ.

The epithelial layer of the penis reaches a length of about 70μ and it is supplied by numerous gland cells at its anterior part, while its inner posterior part is considered to be the vesicula granulorum (Fig. 2, 10-vgr). The glandular tissue of the vesicula granulorum is syncytial and it is filled by numerous coarse cyanophilous granules, especially in the region very near to the penis, and it is similar to that in *Anaperus tvaerminnensis*[18].

Two false vesicula seminalis (Fig. 1b, 2, 10-rfvs, lfvs) open in the medio-dorsal part of the vesicula granulorum. Each false vesicula seminalis is connected with a long strand filled by numerous short, thick and curved sperms. They are embedded in the parenchymatous tissue. The length of each sperm measures about 7μm and a breadth of about 1.1μm. A true vesicula seminalis is missing.

The presence of 2 false vesicula seminalis and 2 vasa defere give great similarity to *Anaperus tvaerminnensis*[18]. Two right and left testes (Fig. 2-rt, lt) are embedded in the parenchymatous tissue dorso-laterally.

Differential Diagnosis

This worm is related to a new family "*Goharidae*" owing to the facts that:

1. It possesses a new and peculiar sense organ.
2. The mouth aperture is ventral.
3. The pharynx is absent.
4. The female genital aperture and the antrum femininum are missing.
5. The male genital aperture is located dorsally, a little distance before the posterior end.

It is belonging to a new genus "*Goharia*" according to the following:

1. It has from 4-X cuticularized bursa mouth pieces.
2. Sperm-balls are variable in number.
3. The penis is cuticularized.
4. The main retractor muscle fibres of the sense organ pass through the brain mass and end dorsally in front of the statocyst.

The worm is a new species due to the following reasons:

1. It possesses a highly developed nervous system consisting of a spherical sub-muscular nerve plexus.
2. The brain mass gives rise to 5 main nerve stems and a medio-dorso-ventral nerve commissure.
3. The bursa seminalis is well-developed giving rise to 6 cuticularized bursa mouthpieces.
4. The penis has a cuticularized tube which opens into the antrum musculinum.
5. The worm has a blackish brown coloration with fine white longitudinal strands.

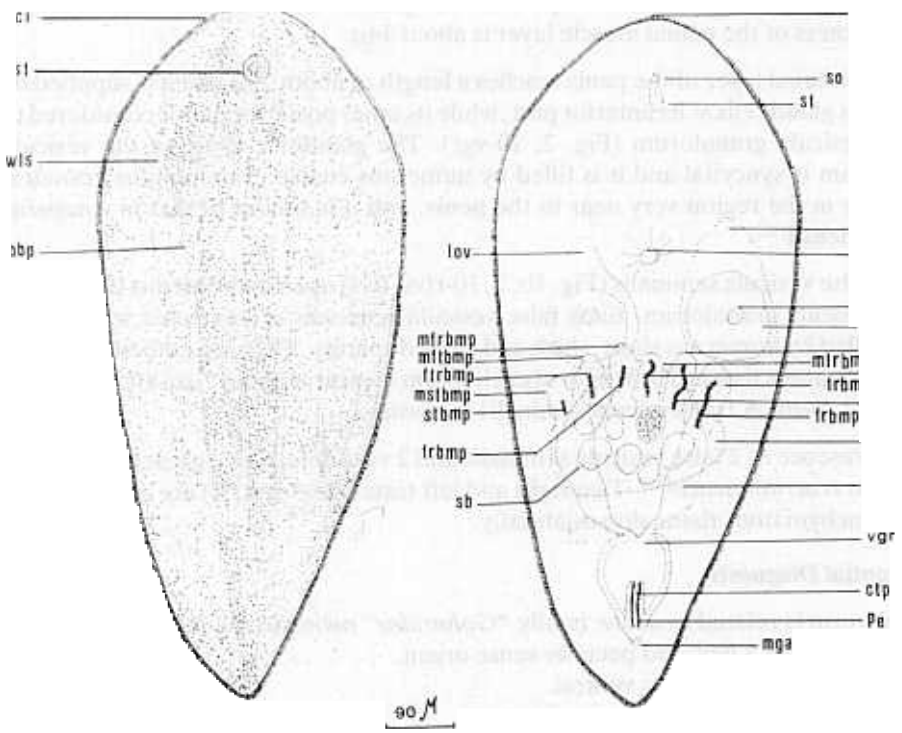


FIG. 1. *Goharia obscura* nov. gen. nov. sp.
a. External features.
b. External features and Internal organisation from squeezed preparation.

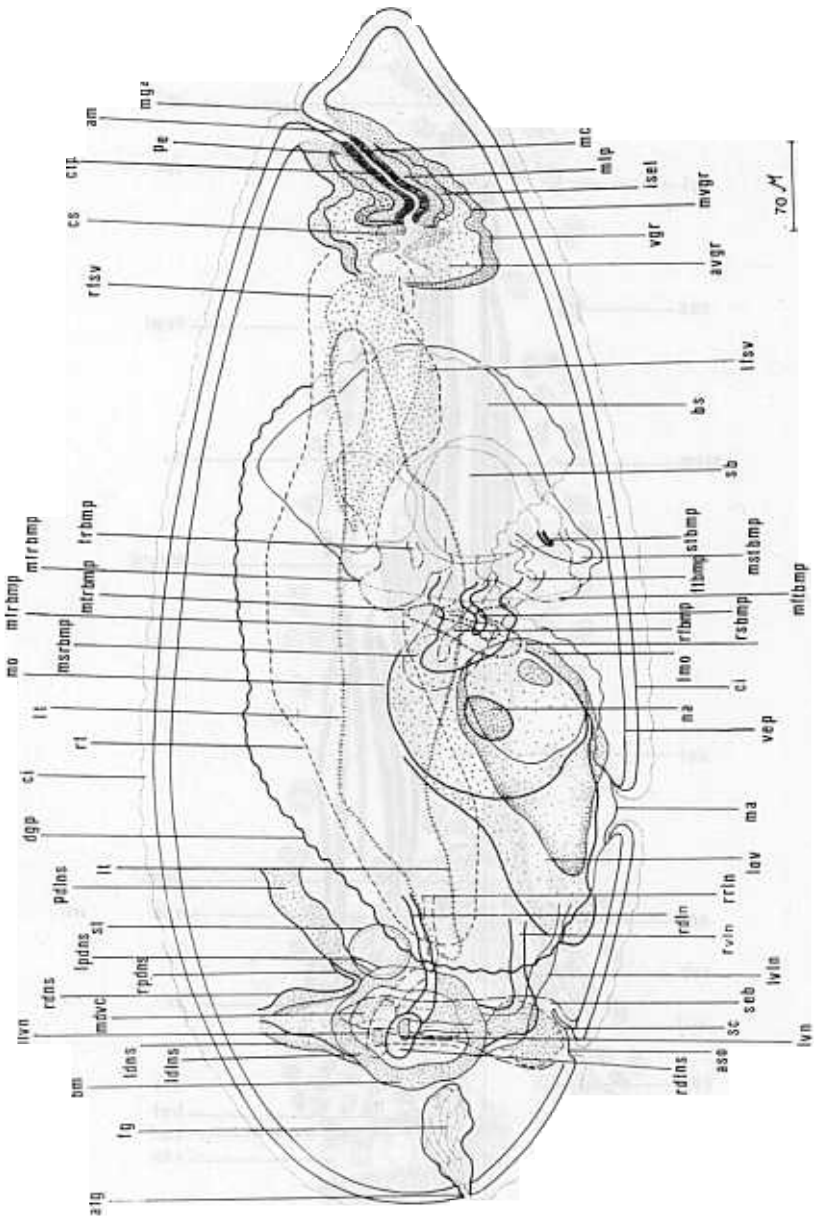


FIG. 2. *Goharia obscura* nov. gen. nov. sp.
Reconstruction of Internal organisation.

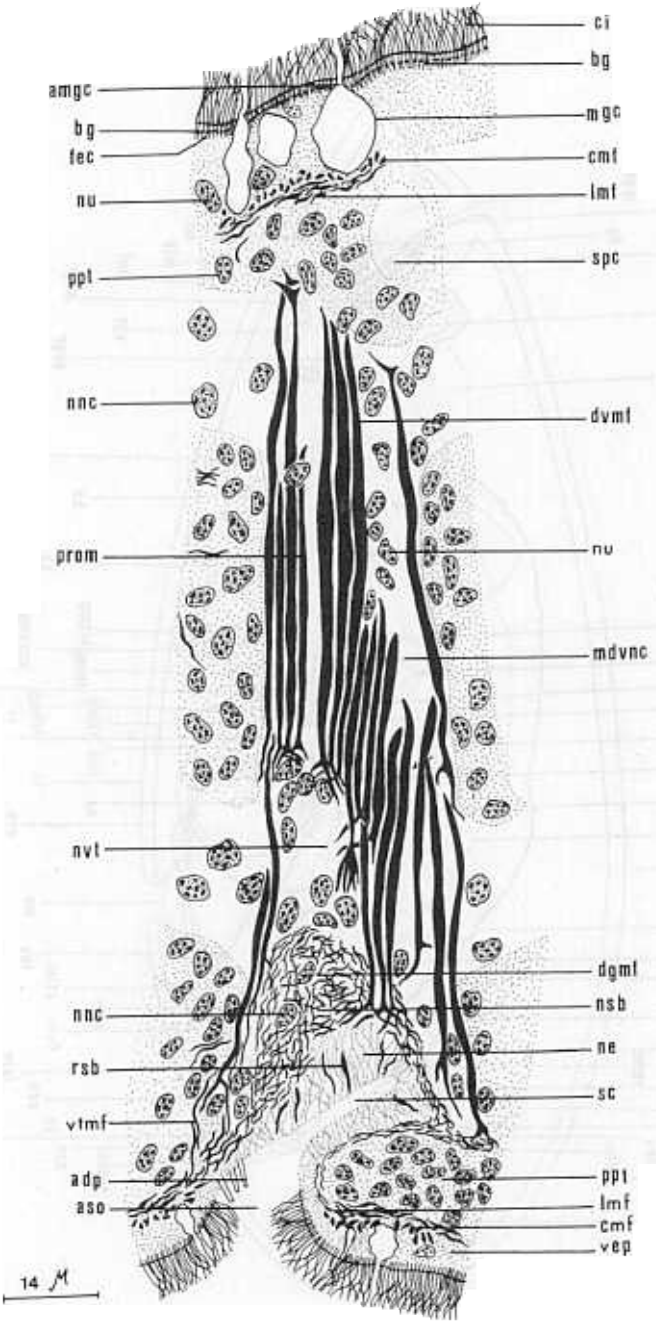


FIG. 3. *Goharia obscura* nov. gen. nov. sp.
Reconstruction of the Sense Organ.

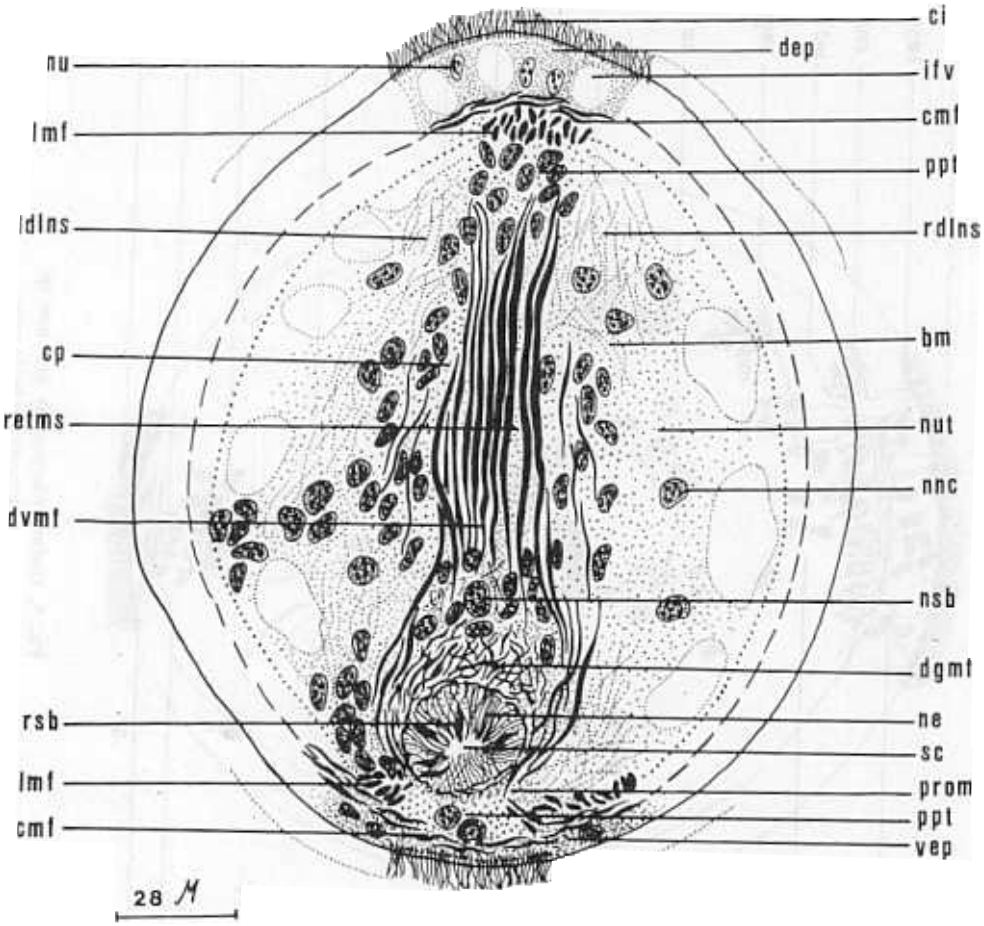
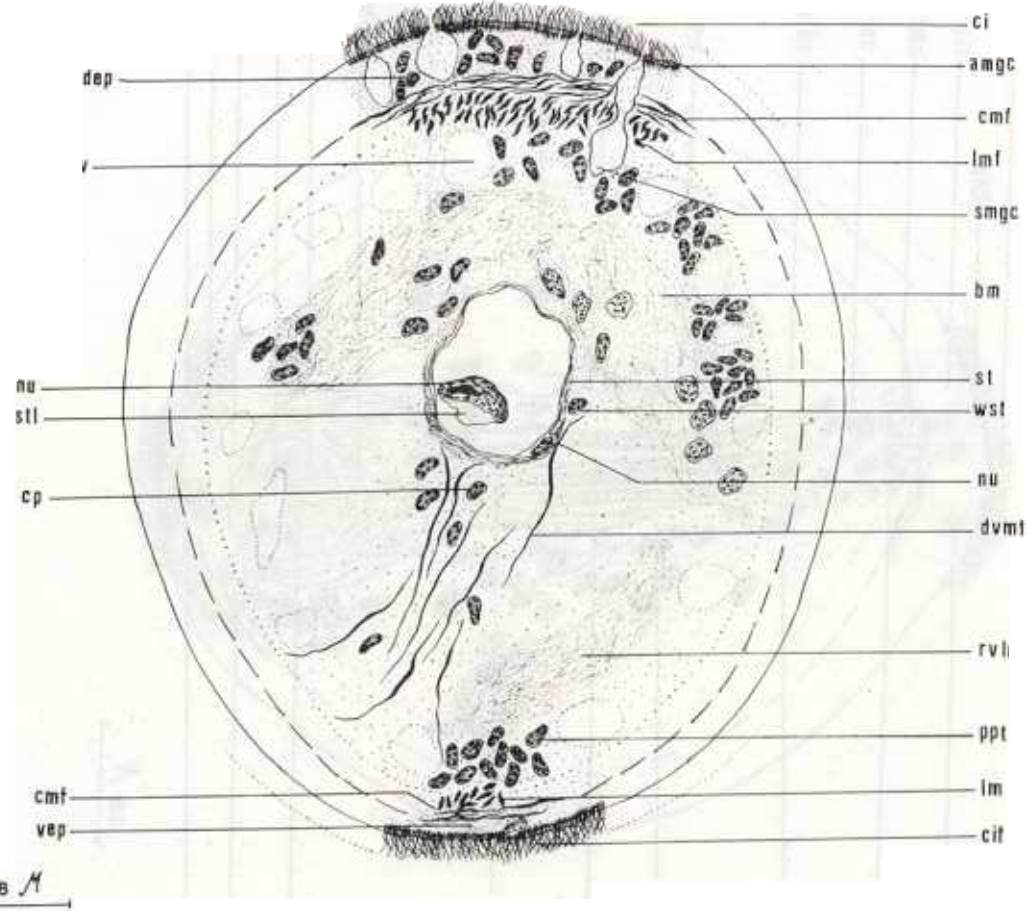


FIG. 4. *Goharia obscura* nov. gen. nov. sp.
T.S. in the sense organ.



Goharia obscura nov. gen. nov. sp.
T.S. in statocyst and brain mass

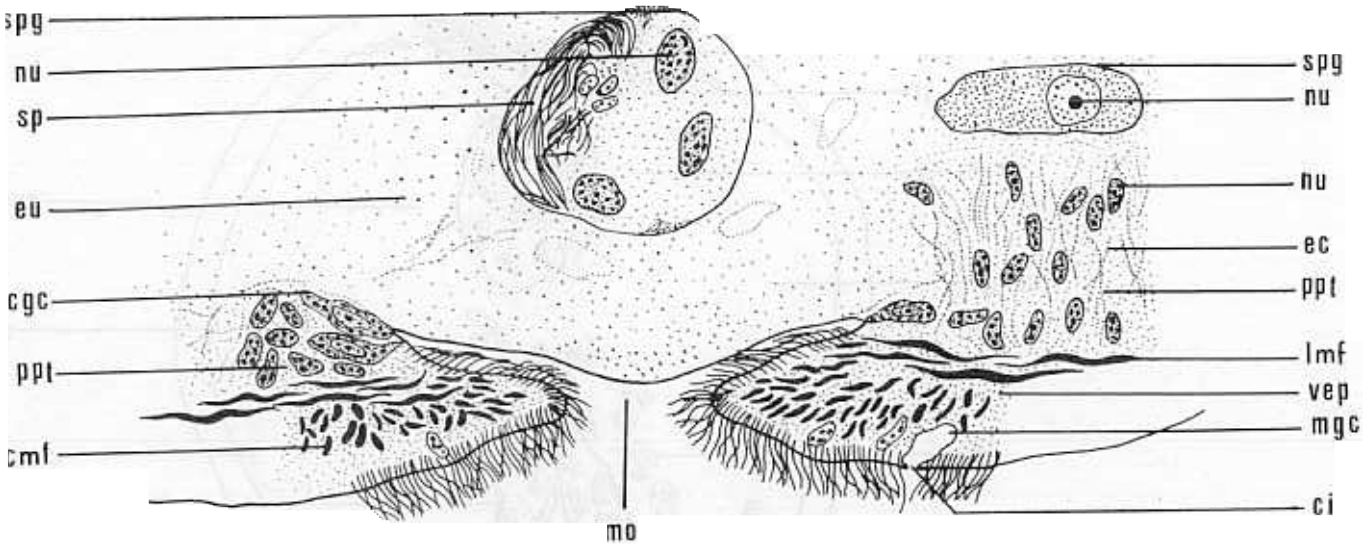


FIG. 6. *Goharia obscura* nov. gen. nov. sp.
Mouth and Endocytium (Digestive parenchyma).

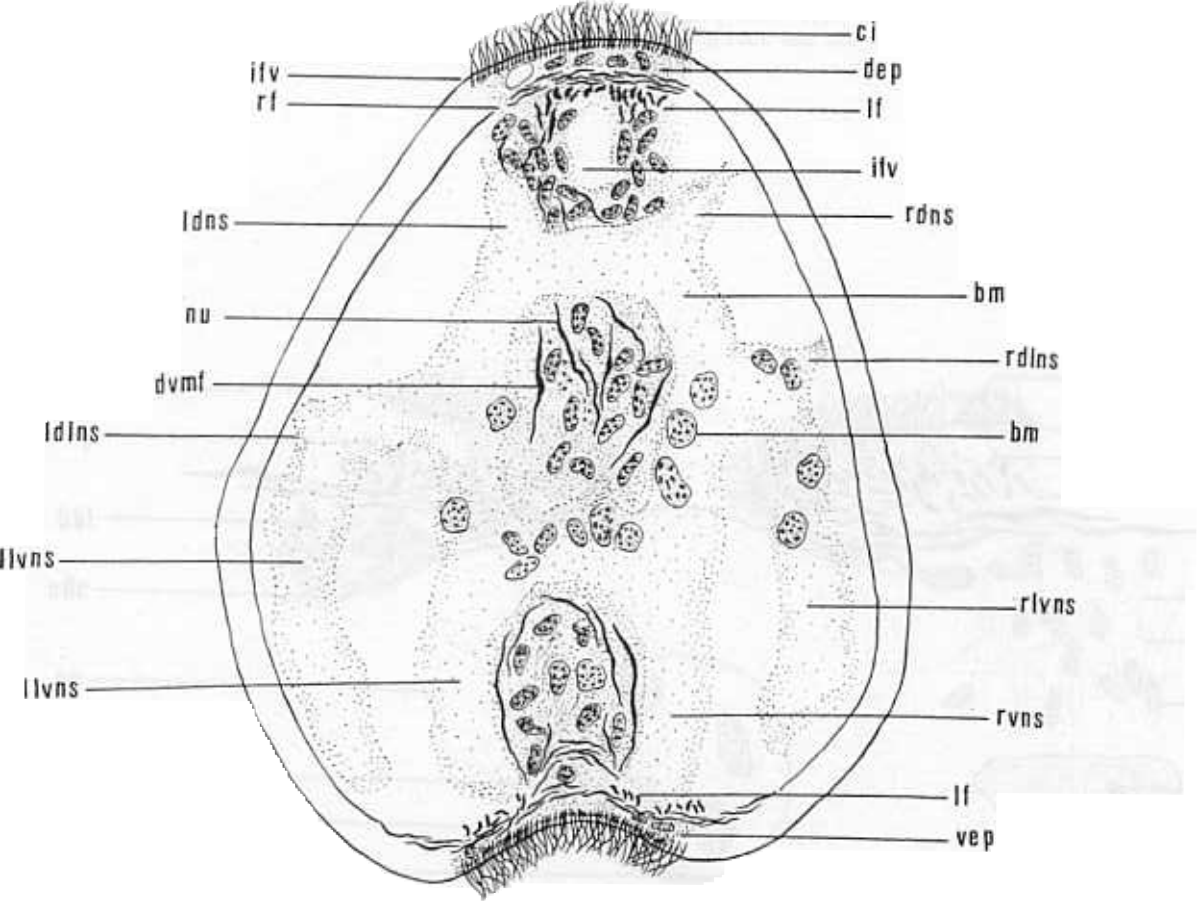
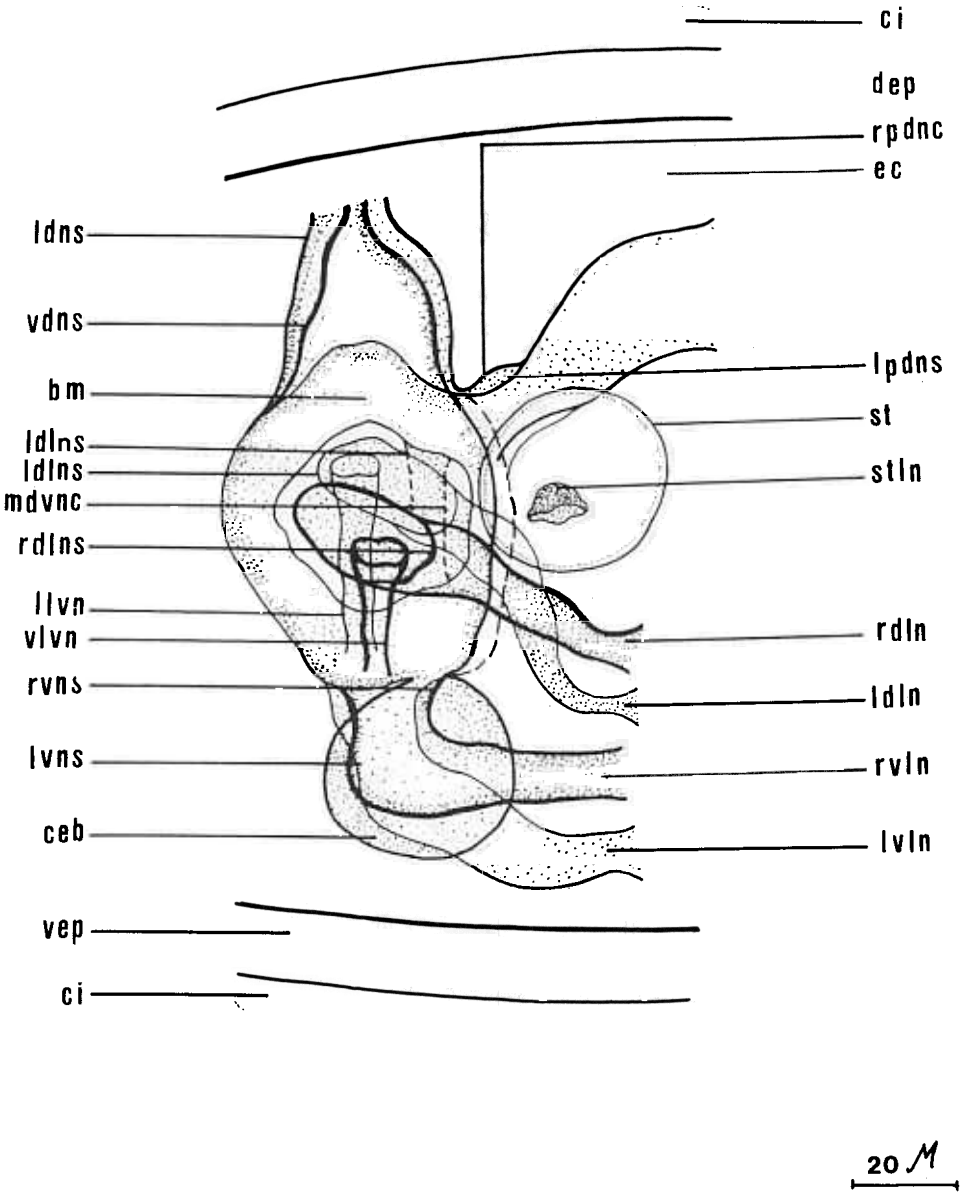


FIG. 7. *Goharia obscura* nov. gen. nov. sp.
T.S. in brain and nerve stems.

28 M



8. *Goharia obscura* nov. gen. nov. sp.
Reconstruction of the brain, nerve stems, statocyst and sense organ (T.S.

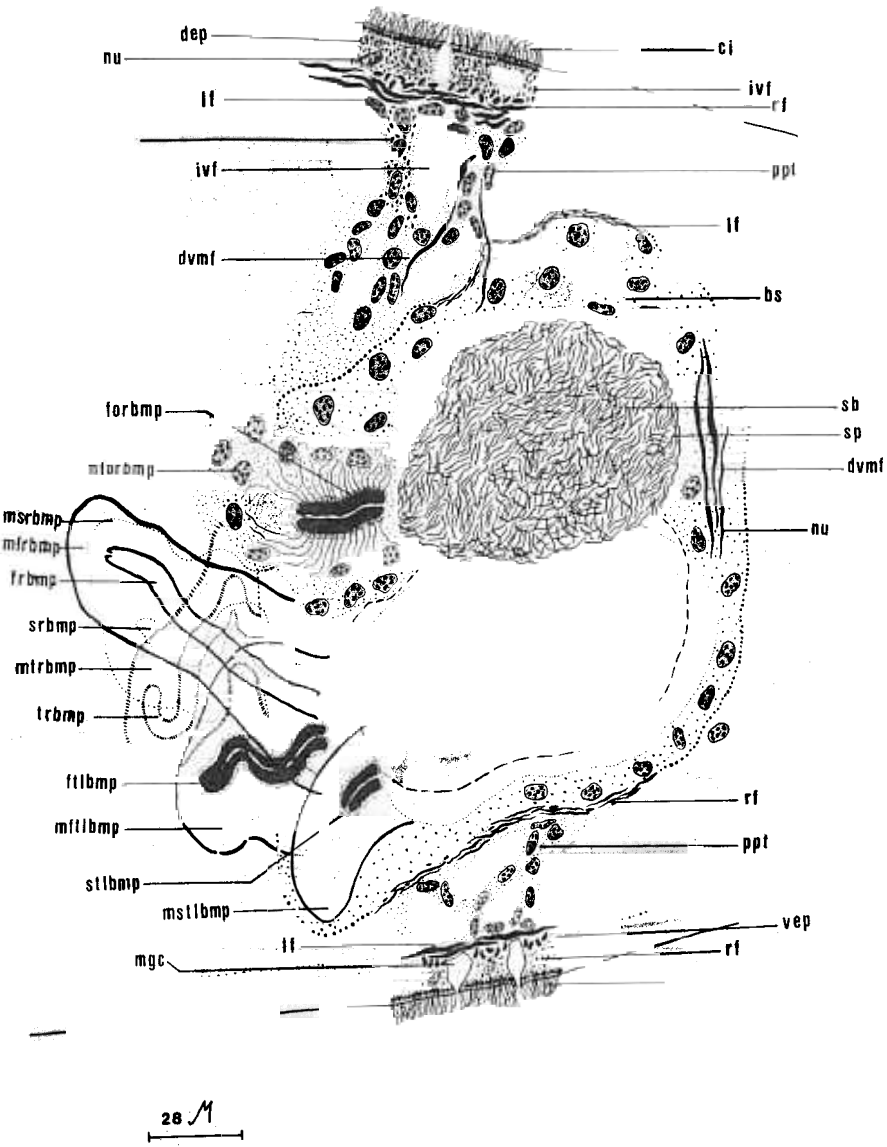


FIG. 9. *Goharia obscura* nov. gen. nov. sp.
Reconstruction of the female genital system (L.S.

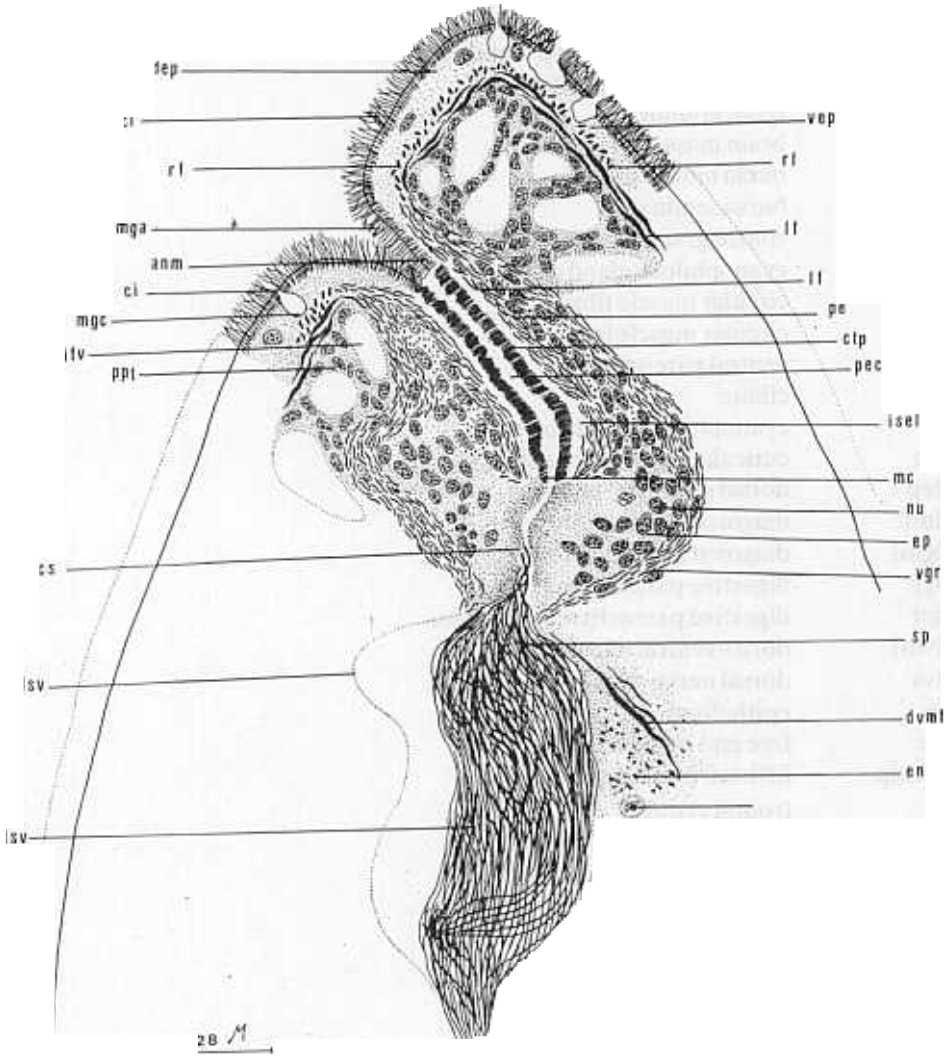


FIG. 10. *Goharia obscura* nov. gen. nov. sp.
Reconstruction of the male genital system (L.S.).

List of Abbreviations

adp	adhesive papilla
anm	antrum musculinum
aso	aperture of sense organ
avgr	anterior part of vesicula granulorum
bbp	blackish brown pigment
bg	basal granule
bm	brain mass
bmp	bursa mouth piece
bs	bursa seminalis
cg	coarse granules
cgc	cyanophilous gland cell
cmf	circular muscle fibre
cml	circular muscle layer
cp	central parenchymes
	cilium
cs	cyanophilous secretion
ctp	cuticularized tube of penis
dep	dorsal epithelial layer
dmf	diagonal muscle fibres
dgmf	diagonal muscle fibres
dgp	digestive parenchyma
dpt	digestive parenchymatous tissue
dvmf	dorso-ventral muscle fibres
dvs	dorsal nerve stem
ep	epithelium
fec	free end of the cilium
ftlbmp	fifth left bursa mouth piece
fg	frontal gland
forbmp	fourth right bursa mouth piece
frbmp	first right bursa mouth piece
flbmp	fifth left bursa mouth piece
fv	food vacuole
in	intestine
ilnc	inner lateral nerve cord
isel	insunk epithelial layer of penis
ifv	intercellular fluid-filled vacuoles
lml	longitudinal muscle layer
lov	left ovary
lt	left testis
ldlns	left dorso-lateral nerve stem
ldns	left dorsal nerve stem
llvn	left latero-ventral nerve
lvln	left ventral longitudinal nerve
lmo	left mature ovum

lmf	longitudinal muscle fibre
lns	longitudinal nerve stem
lpdns	left postero-dorsal nerve stem
lfsv	left false vesicula seminales
ma	mouth aperture
mat	matrix
mc	median canal
mdvnc	median dorso-ventral nerve commissure
mlp	muscle layer of penis
mfrbmp	matrix of the first right bursa mouth piece
mflbmp	martix of the fifth left bursa mouth piece
mforbmp	matrix of the fourth right bursa mouth piece
mga	male genital aperture
mstlbmp	matrix of the sixth left bursa mouth piece
mgc	mucus gland cell
msrbmp	matrix of the second right bursa mouth piece
mtrbmp	matrix of the third bursa mouth piece
mov	mature ovum
mvgr	muscle layer of vesicula granulorum
nnc	nucleus of verve cell
nvt	nerve tissue
ndgp	nuclei of the digestive parenchyma
nu	nucleus
ne	nerve ending
nf	nerve fibre
pt	parenchymatous tissue
ppt	peripheral parenchymatous tissue
pec	penial canal
pdlns	postero-dorsal longitudinal nerve stem
pnc	parenchymatous nuclei
prom	protractor muscle
retms	retractor muscles
rov	right ovary
rgc	rhabdite gland cell
rdlns	right dorso-lateral nerve stem
rdns	right dorsal nerve stem
rpdns	right posterio-dorsal nerve stem
rt	right testis
rvln	right ventral longitudinal nerve
rlvn	right latero-ventral nerve
rfvs	right false vesicula seminalis
so	sense organ
smgc	subepidermal mucus gland cell
st	statocyst
srbmp	second right bursa mouth piece

stlbmp	sixth left bursa mouth piece
seb	sensory bulb
spc	space filled with fluid substance
sc	sensory canal
stl	statolith
sb	sperm ball
sp	sperm
sph	sphincter muscle
trbmp	third right bursa mouth piece
te	testis
vep	ventral epithelial layer
vgr	vesicula granulorum
vns	ventral nerve stem
wst	wall of statocyst
wlb	white longitudinal band

Acknowledgement

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نوع جديد من الديدان المفلطحة غير السيلومية أُطلق عليه اسم جوهاريا أُوبسكيورا تابع لعائلة جديدة من عائلة الديدان المفلطحة أُطلق عليها اسم «جوهاريدي»

سمير بلتاجي و علي عدنان عشقي
قسم بيولوجية البحار ، كلية علوم البحار ، جامعة الملك عبد العزيز
جـــدة ، المملكة العربية السعودية

المستخلص . جمعت عدة عينات من الديدان المفلطحة غير السيلومية بالقرب من مدينة الغردقة بشمال البحر الأحمر عام ١٩٨٣م وذلك في منطقة المد والجذر من المناطق الرملية وعلى عمق ٥٠ سم تقريبًا أثناء الجذر . وجمعت نفس العينات من منطقة شمال جدة عام ١٩٨٦م ومن بيئة رملية شبيهة بمنطقة الغردقة .

وقـد لوحظ أن هذه الديدان المفلطحة غير السيلومية تختلف في الخواص الشكلية والتشريحية عن قريناتها من عائلات الديدان المفلطحة الأخرى مما عزا بالباحث بتصنيفها في عائلة منفصلة في عوائل الديدان المفلطحة معتمدا على الاختلاف في التراكيب الشكلية والتشريحية لهذه العائلة عن العوائل الأخرى . ومن الاختلافات في التراكيب الشكلية : اللون البني الداكن مع وجود خطوط بيضاء طولية دقيقة على طول الجسم ، وكذلك موقع الفم من الناحية البطنية للدودة . أما فيما يتعلق بالتركيب التشريحي ، فلأفراد هذه العائلة من الديدان المفلطحة أجهزة احساس خاصة تقع في الطرف الأمامي للدودة وعدم وجودها في العائلات الأخرى للديدان المفلطحة . وكذلك يتميز أفراد هذه العائلة بعدم وجود بلعوم والفتحة التناسلية للذكر تقع في الجهة الظهرية من جسم الدودة المفلطحة بالقرب من الطرف الخلفي أما فيما يتعلق بانتمائها إلى جنس جديد فقد عزا الباحث ذلك إلى وجود عدد أربعة أو أكثر من الجيوب الفمية ذات جدار صلب نوعًا حيث إنه يتكون من مادة الكيوتكل . كما يميزها من الأجناس الأخرى وجود أعداد متغايرة من الأكياس المنوية والقضيب غير مرن حيث إنه أيضًا يتكون من مادة الكيوتكل . أيضًا ، يميز هذا الجنس من الديدان المفلطحة العضلات القابضة لأعضاء الحس ، إذ تختلف عن الأجناس الأخرى من الديدان المفلطحة بمرورها من خلال الدفاع وتنتهي في مراكز الاتزان .

أما فيما يتعلق بانتماء هذه الدودة المفلطحة إلى نوع جديد ، فقد اعتمد الباحث في ذلك على وجود جهاز عصبي معقد يختلف عن الأجهزة العصبية في عائلات الديدان المفلطحة الأخرى بشكلٍ عام .