DJS Vol. 36 (2013) 139-148

Delta Journal of Science
Available online at
https://djs.journals.ekb.eg/

Research Article

ZOOLOGY

ANAPERUS TRIFURCATUS (BELTAGI, S. 1983) 1ST RECORD ACOELAN TURBELLARIA, COLLECTED FROM BITTER LAKES SUEZ CANAL – EGYPT

Samir M. Beltagi

Department of Biological and Geological Sciences

Faculty of Education Ain Shams University, Cairo, Egypt.

ABSTRACT

An acoelan turbellaria "*Anaperus trifurcatus*" are collected for the first time, from the salt waters of the Bitter lakes of the Suez Canal – Egypt, as the ecological parameters are nearly similar to that existing in shallow sea water of Ghardaqa in the Red sea. These turbellarians are found living around the sea-weeds such as *Sargassum vulgare* and *Cystoseira myrica*.

It is greenish brown in coloration due to the presence of zooxanthellae symbiotic (brown algae). This animal is related to the genus *Anaperus* (Graff, 1912) and to the species *trifurcatus* (Beltagi, S. 1983) as it possesses 2 latero-ventral ciliated sensory pits, triforked posterior end and a well developed nervous system formed of a central brain mass giving rise to 5 pairs of nerve stems, a pair of dorsa-lateral nerve stems, a pair of latero-ventral stems, a pair of ventral nerve stems and a pair of longitudinal postero-dorsal nerve stems. The bursa seminalis is absent and 8 spermballs with their chitinised mouth pieces.

Keywords: **Key words: Acoelan Turbellaria - Taxonomical studies – Bitter lakes – Suez Canal – Egypt.**

INTRODUCTION

Since the opening of the Suez Canal (Fig. 1a) for navigation in June 1869, few studies have been carried out on its environment. Its waters are of mixed type from different sources: the Mediterranean, Red Sea and river Nile.

The exact structure of the medium is complex as a result of the influence of the salt bed especially at the floor of the Bitter lakes.

Suez Canal is the main connecting link between the Red sea in the south and the Mediterranean sea in the North. It crosses five lakes namely; lake Menzalah, lake Ballah, lake Timsah and the two Bitter lakes (Great Bitter lake and Little Bitter lake Fig. 1) which represent different habitats and in some cases hinder the migration activity of the zooplankton community from one sea to the other across the suez canal (Elsarehy *et al*. 2000).

As the salinity of the Bitter lakes gradually equalized with that of the Red sea, the Barrier to migration was removed completely. Great Bitter lake, is a salt water lake between the North and south part of suez canal. It is adjoined by the little Bitter lake (Fig. I). The Bitter lakes have together a surface area of about 250 Km^2.

Few scientists had worked upon Marine Turbellaria of the Red sea and Suez Canal such as Palombi (1928), Beltagi, S. Khafaji (1984), Beltagi, S. and Mandura (1989), (1991), Antonius, A. (1968), and Melouk, M. A., (1940).

2. Materials and Methods

Specimens of Turbellaria were obtained from the aquatic vegetation living in the shallow water near the city Fayed,

located at the western side of the great Bitter lake (Fig. 1a) these aquatic plants such as Sargassum vulgare, *Cystoseira myrica* and *Comodocea rotundata*.

These plants were washed with water current to detach different organisms from them in the laboratory specimens were collected and put into petri-dishes, where they were identified either by the naked eye or under a research microscope and then selected Turbellarians were best studied alive as they are allowed to swim freely at first, then being narcotized by adding few crystals of MgCl2 or MgSO4 and compressed to varying degrees between a glass slide and a Vaseline cover slip and examined through a compound microscope. Whole mount preparations of the specimens were stained with Borax carmine or alcoholic Eosin.

Histological preparations of materials were also made as the worms were killed in steinmanns fluid and fixed in 70% ethyl alcohol or zenkers fluid.

Materials fixed by the former fixative were stained with Alcoholic Neutral red. The specimens were then dehydrated in ascending grades of ethyl alcohol and cleared in cedar wood oil. The specimens were embedded in paraffin wax and sectioned at 6-8 µm thickness.

Serial transverse and longitudinal sections of the studied specimens were obtained for establishing a whole and complex reconstruction of the various organ systems of the body. Prepared serial sections of the specimens were stained by Haematoxylin & Eosin, then specimens were mounted in Canada balsam. A camera lucida was used to draw the outline of the stained specimens, while their photo micrographs were taken by a microscope with an automatic camera and complete recon struction of worm is made.

RESULTS And Discussion

Systematics:

Phylum: Platyhelminthes, Gegenbaur, 1859.

Class: Turbellaria, Ehrenberg, 1831.

Order: Archoophora (Westblad, 1948).

Suborder: Acoela: Uljanin 1870, Graff 1905.

Tribe: Proandropora-Abursalia (Westblad, 1948).

Family: Anaperidae (Dorjes, 1968).

Genus: Anaperus (Graff. 1911).

***Anaperus trifurcates*.**

General description (Fig. 2)

The animal has nearly an oval shape, having a length ranging from 0.6 mm to 1 mm and the maximum breadth from 0.3 mm to 0.5 mm. The brown pigmentation is due to the presence of brown symbiotic algae (zooxanthellae) embedded partly in the epidermal layer and the others in the parenchymatous tissue of the worm. These algae have the same structure as described in the case of *Amphiscolops australis* **(Haswell, 1905) and** *Amphiscolops carvalhoi* **(Marcus, 1952).**

The statocyst (Fig. 2, 3, 7– st.), is situated a little distance behind the anterior tip nearly in the median line of the body. Eyes are totally missing. The animal is very active and quick in motion and it has a positive response to light. The very characteristic and peculiar features of this animal, is that it has triforked posterior end (Fig. 1b, Lpbt). The animal begins anteriorly with the frontal organ (Fig. 2, 3-fg). The digestive system begins with the mouth aperture (Fig.2, 3, 6-ma) which is situated a little distance before the middle part of the body located at the ventral surface. It is penetrated by the necks of the large flask-shaped eosinophilous gland cells (Fig.2, 6-egc). The mouth leads to a sac-like digestive parenchyma cendocistim (Fig. 6-En) around which 8 spermballs (Fig. 2, 4-sb) with their chitinised mouth pieces (Fig. 2, 4-cmsb) and the two right and left ovaries are extending ventrally (Fig. 2, 3-Lov, rov). The bursa seminalis is totally absent.

Insemination May take place by dermal injection. Each sperm ball is embedded in the parenchymaterns tissue, has one cuticularized mouth piece placed anteriorly (Fig.2, 4-cmsb). The matrix of each mouth piece is formed of plasmatic tissue with its oval scattered nuclei (Fig.4-mecm). Each sperm ball is filled by the foreign sperms (Fig. 4-sp) which are short and filamentous in shape.

It possesses a median follicular testis (Fig. 2-t) which is situated dorsally in relation to the two ventrally placed ovaries (Fig.2, 3-Lov, rov). Vasa differentia and false vesicula seminalis and exitant organs are missing. The vesicula seminalis (Fig. 2, 3-5- vs) is pear-shaped situated at the last third part of the body, filled with thick and long curved threads (Fig.5-sp).

The male genital aperture (Fig.2, 3, 5-mga) leads to a tubular antrum musculinum (Fig.5-Am) surrounded by numerous male accessory genital gland cells leads to a muscular penis (Fig.5-pe) which opens endly to the vesicula seminalis. Nervous system is formed of a central brain mass (Fig. 2, 3, 7-bm) located just behind the frontal gland (Fig.2, 3-fg). The brain mass gives rise to 5 well developed pairs of nerve stems:

1- The dorsal nerve stems (Fig. 2, 3- rdns, Ldns).

2- The dorso-lateral nerve stems (Fig.2, 3-rdLns, LaLns).

3- Latero-ventral nerve stems (Fig. 2, 3-rLvns, LLvns).

4- The ventral nerve stems (Fig. 2, 3-rvns, Lvns).

5- The postero-dorsal nerve stems (Fig. 2, 3-Lpdns, rpdns).

The sense organs are the frontal gland and the statocyst and 2 ciliated sensory pits (Fig.2, 3, 8-Lcsp, rcsp) which are located on the extreme lateral side of the ventral surface a little distance before the male genital aperture.

Differential diagnosis:

This animal is related to the family Anaperidae as, it possesses no bursa seminalis. The male genital aperture is situated at the ventral side. The *antrum musculinum* is short and small. The penis is muscularized and not cuticularized as described by Westblad (1948).

It is related to the genus Anaperus (Graff, 1912) and also to the species Trifurcatus. (Beltagi, 1983) due to the followings:

1- The mouth opening is nearly situated at the Middle Ventral part of body.

2- The pharynx is absent.

3- The testis is follicular.

4- The bursa seminalis is absent (Graff, 1912).

5- The posterior part of the frontal gland is embedded in the anterior part of the brain mass.

6- The presence of two ciliated sensory pits, which are situated on the Latero-ventral sides, a little distance before the male genital aperture.

7- The complete absence of excitant organs.

8- The animal has triforked posterior end.

References

Antonius, A., 1968: Faunistische studien am Roten Meer im Winter 1961/62. Teil IV. Neue Convolutidae und eine Bearbeitung des Verwandtschaftskreses Convoluta (Turbellaria Acoela)-Zool. Syst. 95: 297-394.

Beltagi, S. and Khafaji, A. K., 1984: Amphiscolops marinelliensis Nov. sp. (Archoophora) convolutidae: A new specis of Acoelan Turbellaria from the Red sea North of

Jeddah. Proc. Symp. Coral Reef Environ, Red sea, Jeddah, Jan, 1984: 491-517.

Beltagi, S. and Mandura, A. S. 1989: Amphiscolops saudiensis nov. sp. (Archoophora) Convolutidae: A new species of Acoelan Turbellaria from the Red sea. Umm Al-Qura University Journal 1, 2: 285-331.

Beltagi, S., 1983: Anaperus trifuractus nov, sp (Archoophora: Anaperidae) A new species of Acoelan Turbellaria from the Red sea. Journal of the faculty of marine science vol. 3, 1404H.

Dorges, J., 1968a: Die Acoela (Turbellaria) der Deutschen Nordseekuste und ein neues system der Ordnung. Z. Zool. Stst. Evolat. Forsch. 6: 56-452.

Graff, L., 1905: Turbellaria; 1. Acoela. Des Tierreich (Preuss. Akad. Wiss.) 23 VIII, p. 35, Berlin.

Graff, L., 1911: Acoela, Rhabdocoela, Alloecoela des ostens der Vereinigten Staaten von America. Mit nachtragen zu den marinen Turbellarien Oratavas and der Kisten Europen. Zeitschr. F. wiss. Zool. 99: 1-108.

Haswell, W. A., 1905: Studies on Turbellaria. Quart. Journal. Micr. Sc. N. Ser. V. 49, 425-467, t. 25-27 London.

Marcus, E., 1952: Turbellaria brasileiros (10) Bol. Fac. Fil. Ci. Letr. Univ. Sao. Daute. Zoolog. 17, 5-187.

Melouk, M. A., 1940: A new polyclad from the Red sea, Cryptoballus aegypticus Nov. sp. Bu;;. Fac. Sci. Found 1. Univ. Cairo 22, 1940, PP. 125-140, psl. I-II.

Palombi, A., 1928. Reports on the Turbellaria (Cambridge Exp. Suez Canal 1924)Trans. Zool. Sac. London 22, part 5, Nr. 1, PP. 579-631, t. 1, London.

Uljanin, W., 1870: Turbellaria der Bucht von Sewastopol. Arb. D. 2. Vers. Russ. Naturf. Zu Moskou 1869, 2. Abt. Fur. Zool. Anat. U. physiol. Moskou.

Westblad, E., 1923: Studien uber skandinavische Turbellarien. Acoela V. Ark. Zool. 41A, Nr. 7, 1-82.

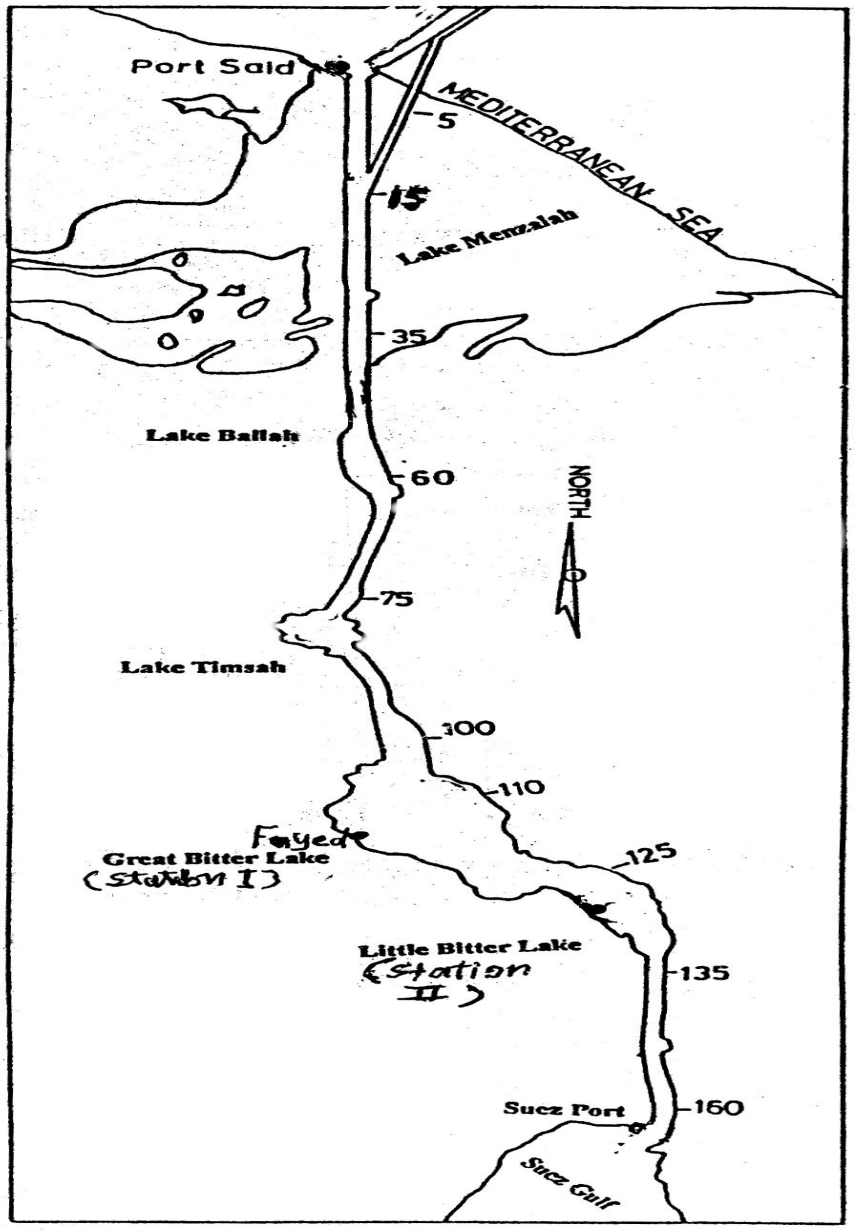

Figure 1a: A map of the Suez Canal Showing the sampling stations

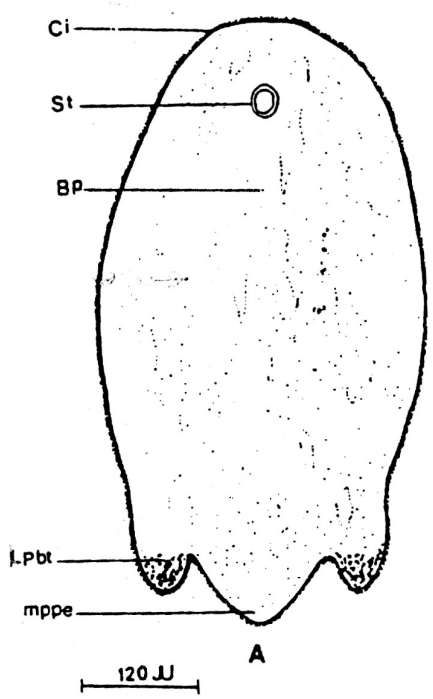

Fig. 1b: ***Anaperus trifurcates*** **1st record.**
-External Features.

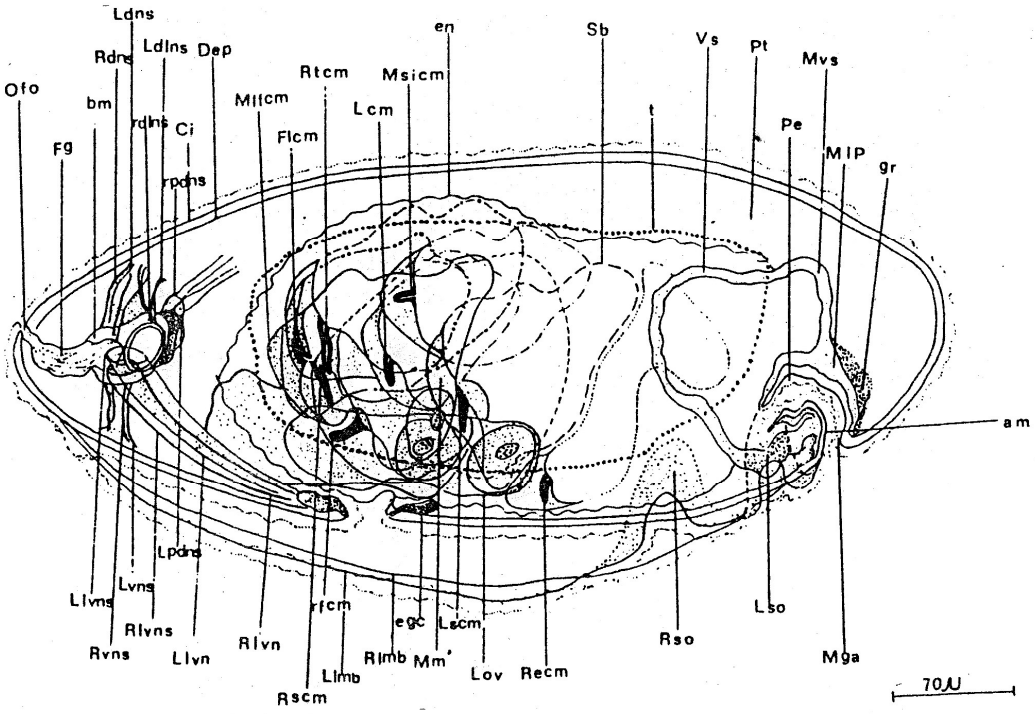

Fig. 2: ***Aneparus trifurcatus*** **1st record.**
- Reconstruction of internal Organisation.

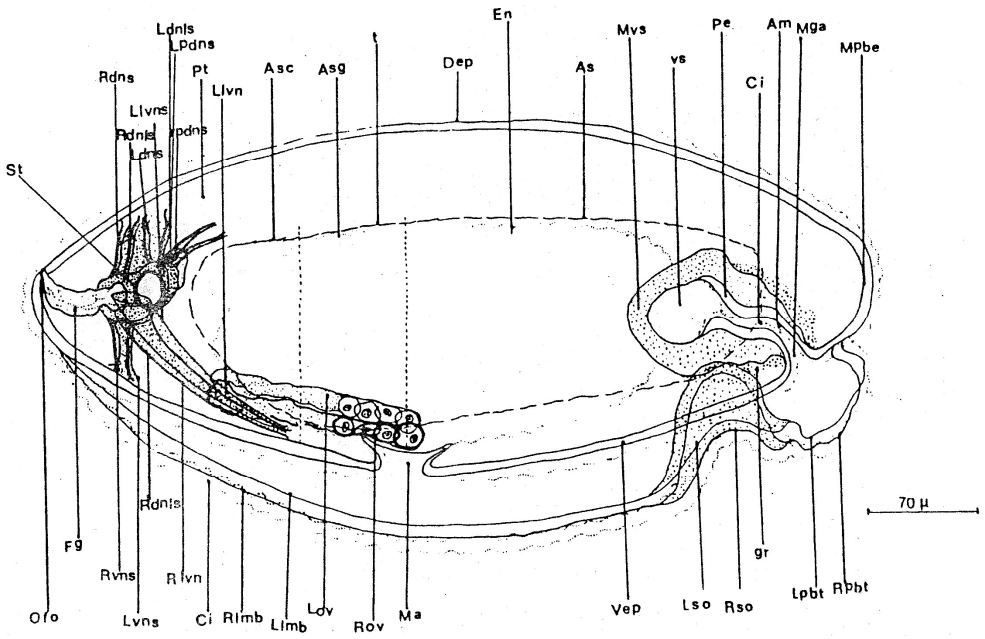

Fig. 3: ***Anaperus trifurcates*** **1st record.**
- **Reconstruction of internal Organisation of immature Specimen.**

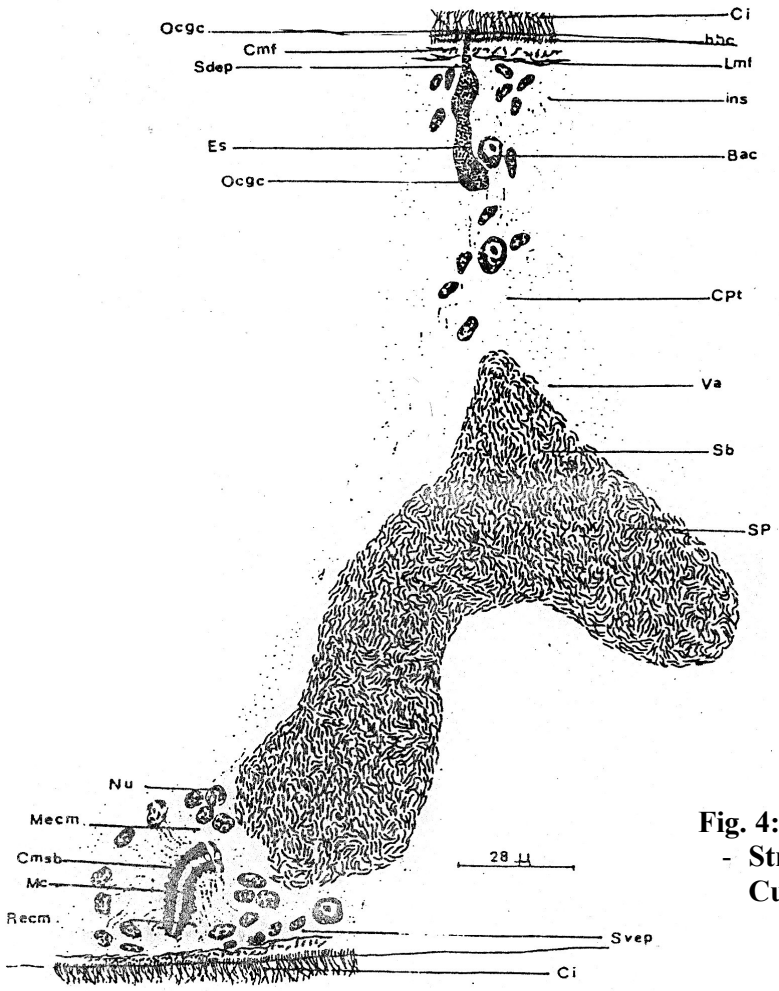

Fig. 4: ***Anaperus trifurcates*** **1st record.**
- **Structure of a sperm bail with its Cuticularised Mouth Piece (L.S).**

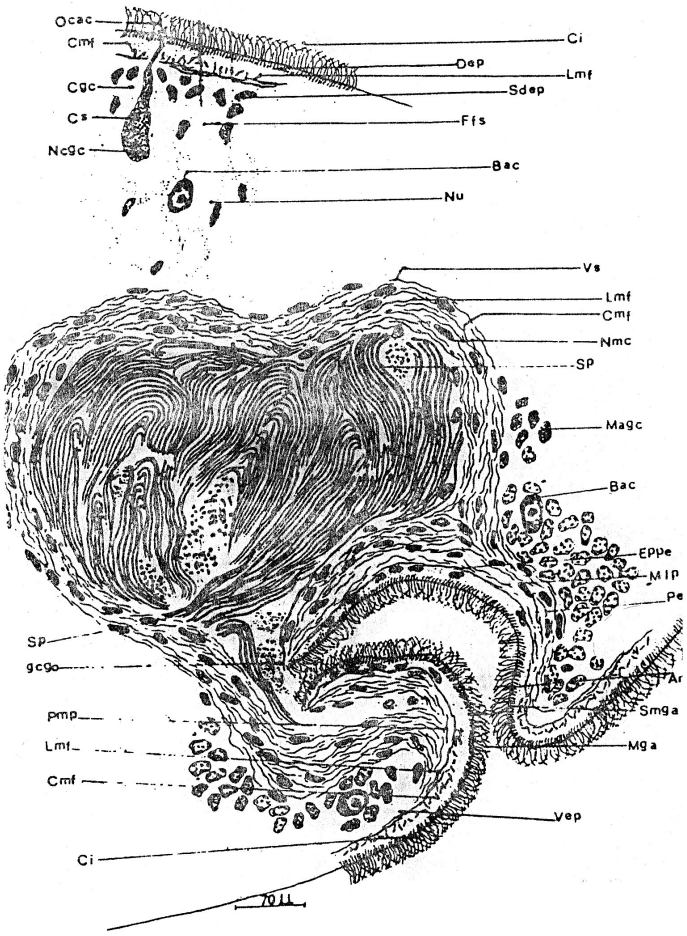

Fig. 5: ***Anaperus trifurcates*** **1st record.**
- **Structure of the male genital system (L.S)**

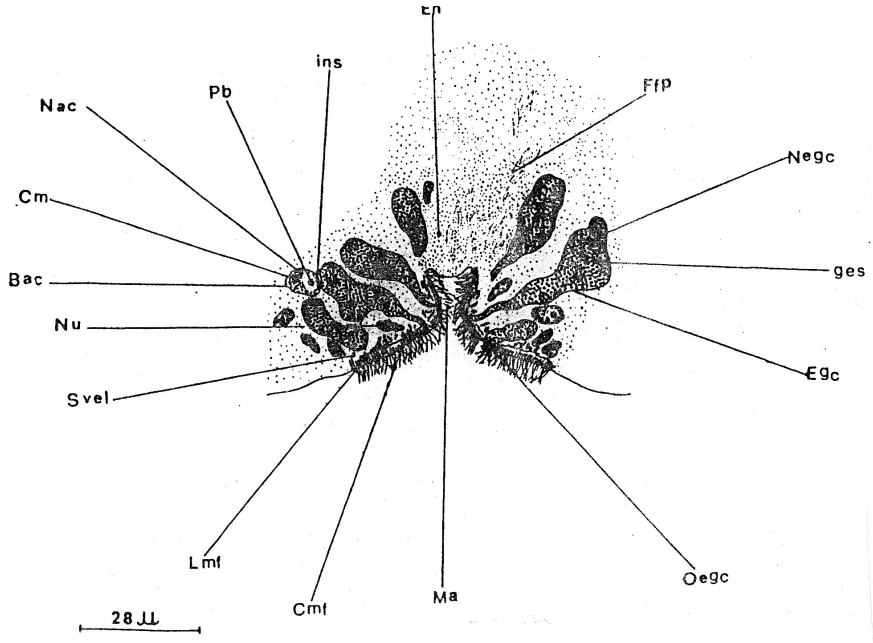

Fig. 6: ***Anaperus trifurcates*** **1st record.**
- **Mouth and Endocytium (Digestive Parenchyma).**

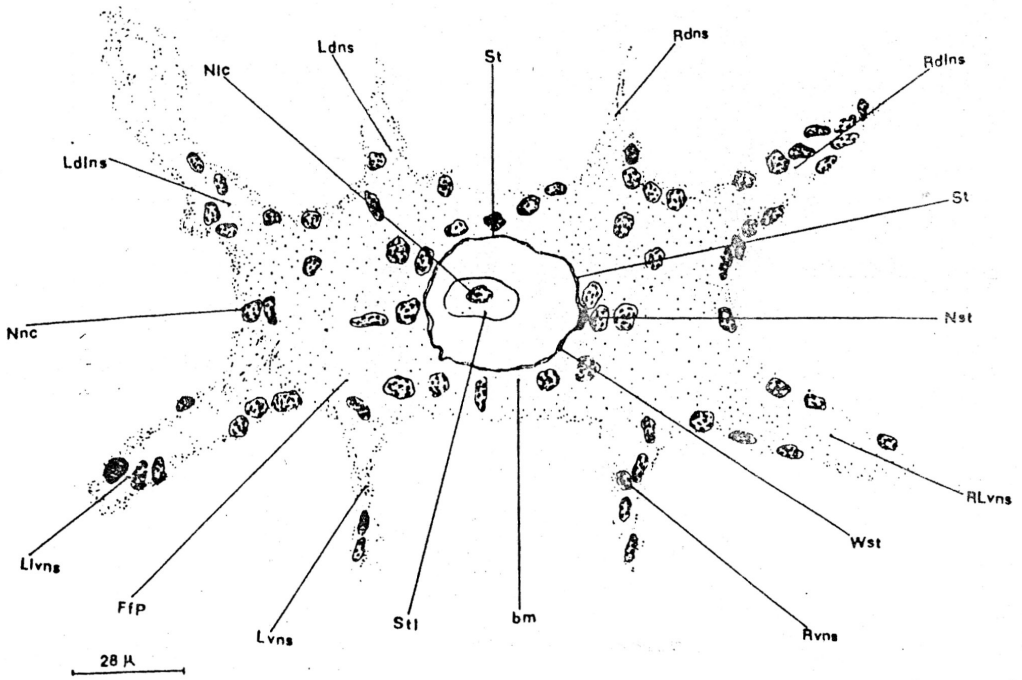

Fig. 7: *Anaperus trifurcates* 1st record.
- **Brain and Nerve Stems (T.S).**

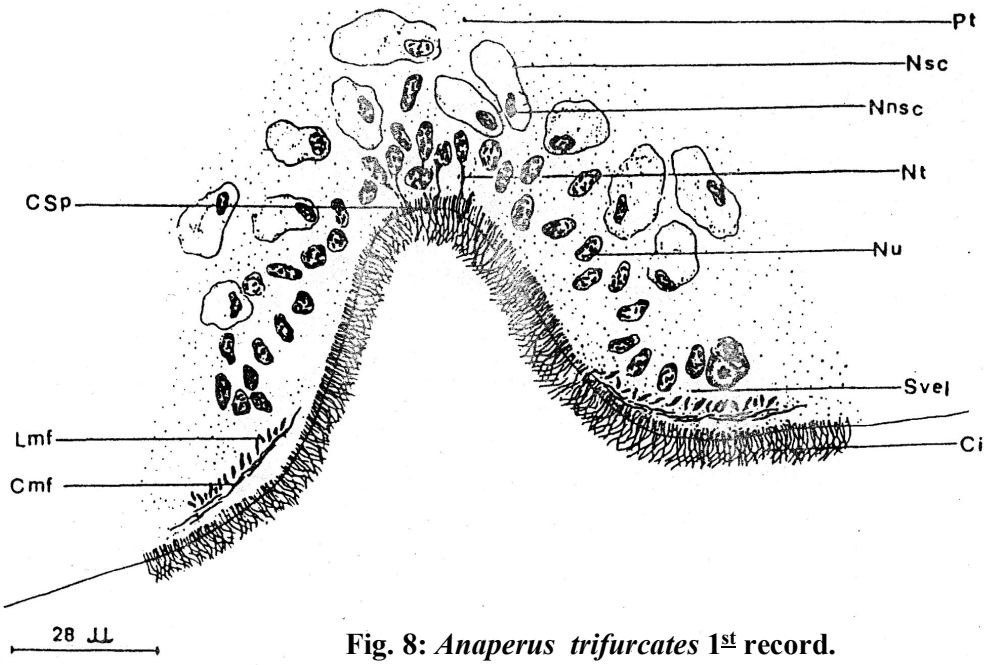

Fig. 8: *Anaperus trifurcates* 1st record.
- **Ciliated Sensory Pit (T.S).**

A LIST OF ABBREVIATIONS USED IN FIGURES

am	antrum masculinum	mscm	matrix of the sixth cuticularised mouthpiece
as	area of sperms	msecm	matrix of the second cuticularised mouthpiece
asc	area of spermatocytes	msicm	middle sixth cuticularised mouthpiece
asg	area of spermatogonia	mtcm	matrix of the third curicularised mouthpiece
bac	brown algae cell (Zooxanthella)	mvs	muscle layer of vesicula seminalis
bbc	basal body of the cilium	nac	nucleus of the algal cell
bm	brain mass	ncgc	nucleus of cyanophilous gland cell
bp	brown pigment	negc	nucleus of eosinophilous gland cell
ci	cilia	nlc	nucleus of lithocyte
ege	cyanophilous gland cell	nml	nucleus of a muscle cell
cm	chromatophore	nnc	nucleus of the nerve cell
cmf	circular muscle fibers	nnsc	nucleus of neuro-sensory cell
cpt	central purenchymatous tissue	nsc	neuro-sensory cell
cs	cyanophilous secretion	nst	nucleus of statocyst
cmsb	cuticulariscd mouthpiece of sperm ball	nt	nerve tissue
csp	ciliated sensory pit	nu	nucleus
dep	dorsal epithelial layer	ocgc	opening of the cyanophilous gland cell
egc	eosinophilous gland cell	oegc	opening of eosinophilous gland cell
en	endocytium (digestive parenchyma)	ofo	opening of the frontal organ
epl	epithelial layer	pb	pyrenoid body
eppe	epithelial layer of penis	pe	penis
es	eosinophilous secretion	pmp	protractor muscle of the penis
fcm	fifth cuticularised mouthpiece	pt	parenchymatous tissue
fg	frontal gland	rdlns	right dorso-lateral nerve stem
flem	first left cuticularised mouthpiece	rdns	right dorsal nerve stern
ffp	fine filamentous plasma	recm	right eight cuticularised mouthpiece
ffs	fluid-filled space	rfcm	right fourth cuticularised mouthpiece
gcgc	granules of cyanophilous gland cell	rlmb	right lateral margin of the body
ges	granular eosinophilous secretion	rlvn	right latero-ventral nerve
gr	grandular region	rlvns	right latero-ventral nerve stem
ins	interstitial space	rov	right ovary
lcm	left cuticularised mouthpiece		
ldns	left dorsal nerve stem		
ldlns	left dorso-lateral nerve stem		
llmb	left lateral margin of the body		
lmf	longitudinal muscle fibers		
llvn	left latero-ventral nerve		
llvns	left latero-ventral nerve stem		
lov	left ovary		
lpbt	left part of the body tail		

lpdns	left postero-dorsal nerve stem	rpbt	right part of the body tail
lscm	left seventh cuticularised mouthpiece	rpdns	right postcro-dorsal nerve stem
lso	left sense organ	rscm	right second cuticutarised mouthpiece
lvns	left ventral nerve stem	rso	right sense organ
m	mouthpiece	rtcm	right third cuticularised mouthpiece
ma	mouth aperture	rvns	right ventral nerve stem
magc	maleaccessory genital cells	sb	sperm ball
mc	median canal	sdel	sunk dorsal epithelial layer
mecm	matrix of the eighth cuticularised mouthpiece	smga	sphincter of the male genital aperture
mfcm	matrix of the fifth cuticularised mouthpiece	sp	sperm
mga	male genital aperture	st	statocyst
mlfcm	matrix of the lift first cuticularised mouthpiece	sta	semi-transparent area
mlp	muscular layer of penis	stl	statolith
mlscm	matrix of the left sixth cuticularised mouthpiece	svel	sunk ventral epidermal layer
mep	matrix of mouthpiece	t	testis
mppe	middle part of the posterior end	va	vacuole
mrcm	matrix of the fourth cuticularised mouthpiece	vep	ventral epithelial layer
		vs	vesicula seminalis
		wst	wall of statocyst