

**ULTRASTRUCTURE OF VITELLOCYTES IN *ELECTROTAENIA MALOPTERURI* (FRITSCH, 1886)
(CESTODA: PROTEOCEPHALIDAE) A PARASITE OF *MALAPTERURUS ELECTRICUS*
(SILURIFORMES: MALAPTERURIDAE) FROM EGYPT**

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ABSTRACT: This study describes the Ultrastructure of mature Vitellocytes of the Proteocephalidae Cestode *Electrotaenia malopteruri* (Fritsch, 1886) a parasite of the common catfish *Malapterurus electricus* using transmission electron microscopy (TEM). The vitellocyte is characterized by the perinuclear cytoplasm that contains numerous parallel cisternae of granular endoplasmic reticulum (GER), several Golgi complex, its peripheral cytoplasm contains, lipid droplets, shell globule clusters, proposed glycogen like particles. The most characteristic feature of the mature vitellocyte of this Cestode species is the concentric arrangement of shell globule clusters.

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1. INTRODUCTION

Cestode class is known to be one of classes that has the highest reproductive capacities of all animal classes, Conn (2000). Several TEM studies have been published on the Ultra structure and differentiation of vitellocytes in Cestodes, Swiderski and Xylander (2000). Vitellocytes in Cestodes have two important functions, i.e. egg shell formation and the nourishment of the early embryo, Swiderski, *et al.*, (1970 a, b); Swiderski and Xylander, (1998 and 2000). So many authors studied the characteristic features of mature vitellocytes in different Cestode groups.

On Amphilinidea, *Amphilina foliacea*, Xylander (1987; 1988) on Gyrocotylidae *Gyrocotyle urna*, Bruňanskà *et al.*, (2005), on Spathebothriidae *Cyathocephalus truncates*, Poddubnaya *et al.*, (2006), on *Didymobothrium rudolphii*, Brunanska *et al.*, (2005), on *Diplocotyle olrikii*, Brunanska *et al.*, (2009), on Caryophyllidea *Atractolytocestus huronensis* Swiderski *et al.*, (2004a), on *Caryophyllaeus laticeps* Swiderski and Mackiewicz (1976), on *Glaediacris catostomi.*, Swiderski *et al.*, (2004b), on *Khawia armeniaca*, Swiderski *et al.*, (2009), on *Wenyonia virllis*, Swiderski *et al.*, (2011), on Diphyllidea *Echeneibothrium euterpes*, Swiderski *et al.* (2006a) on *Trypanorhynchea Dollfusiella spinulifera*, McKerr (1985), on *Grillotia erinaceus*, Swiderski *et al.* (2007), on *Paracharistianella trygonis* Swiderski *et al.*, (2006b), on *Progillotia pastinace*, Mokhtar-Maamour and Swiderski (1976), on *Rhinebothriidea Echeneibothrium beaulchampi*, Swiderski and Mokhtar (1974), on

Bothriocephalidea *Bothriocephalus clavibothrium*, Levron *et al.*, (2007), on *Paraechinophallus japonicus*, Koeneva (2001) on *Triaenophorus nodulosus* Bruňanskà (1997), on Proteocephalidea *Proteocephalus exiguous* Swiderski and Subilia (1978), on *Proteocephalus longicollis*, Swiderski (1973); Swiderski *et al.*, (2000) and Li *et al.*, (2003) on Cyclophyllidea *Catenotaenia pusilla*, *Inermicapisifer madagascarinensis*, *Moniezia expansa* and *Mosgovoyia ctenoides*.

The aim of the work is to describe the aspect of Vitellocytes ultrastructure of *Electrotaenia malopteruri* a parasite of *Malapterurus electricus* to compare it with the results of previous reports of vitellocyte structure in other Cestode species.

2. MATERIALS AND METHODS:

2.1. Materials:

2.1.1. Specimens:

-Mature specimens of *E. malopteruri* were obtained from the intestine of the catfish, *Malapterurus electricus*, River Nile, Egypt.

- Living Cestodes were dissected in a 0.9% NaCl solution and different portion of mature proglottids containing laterally the vitellaria and reproductive system were routinely processed for TEM examination.

2.2. Methods:

2.2.1. Specimen preparation:

Specimen were fixed in cold (4°C) 3% glutaraldehyde in a 0.1M sodium cacodylate buffer at PH 7.2, rinsed in a 0.1M sodium cacodylate buffer at PH 7.2, post fixed in cold (4°C) Osmium tetroxide in

the same buffer, dehydrated in an ethanol series, and finally embedded in Epon resin.

2.2.2. Specimen examination

Ultra thin sections were obtained using a Reichert-jung Ultracut E. ultramicrotome, placed on copper grids and double-stained with uranyl acetate and lead citrate. Ultra thin sections were examined using a Joel 1010 Transmission electron microscopy (TEM) operated at 80 KV.

3. RESULTS

The vitellaria of *Electrotaenia malopteruri* (Fritsch, 1886) is an extensive system of numerous oval or elongated vitelline follicles enclosed by the parenchyma (Fig.1,A). The characteristic arrangement of concentric distribution of shell globules clusters (Fig.1,A).

Vitellocytes were generally having high Nuclei /cytoplasmic ratio (Fig. 1, A). The nucleus is round and contain large clumps of heterochromatin and the narrow cytoplasm contain large number of lipid droplets, proposed glycogen like droplets, (Fig. 1,B) and concentric rough endoplasmic reticulum (RER). The differentiation of vitellocytes was characterized by the increase of RER. Cisterna which is filled with an electron-dense material (Fig. 1, F), Golgi vesicle gave rise to large membrane-bound inclusions (Fig. 1, F). When completely mature they had a multigranular and were delimited by the smooth membrane. Oocytes are accompanied by the vitellocytes which have shell globules (Fig. 1, D, E), few mitochondria scattered in parenchyma (Fig. 1, C).

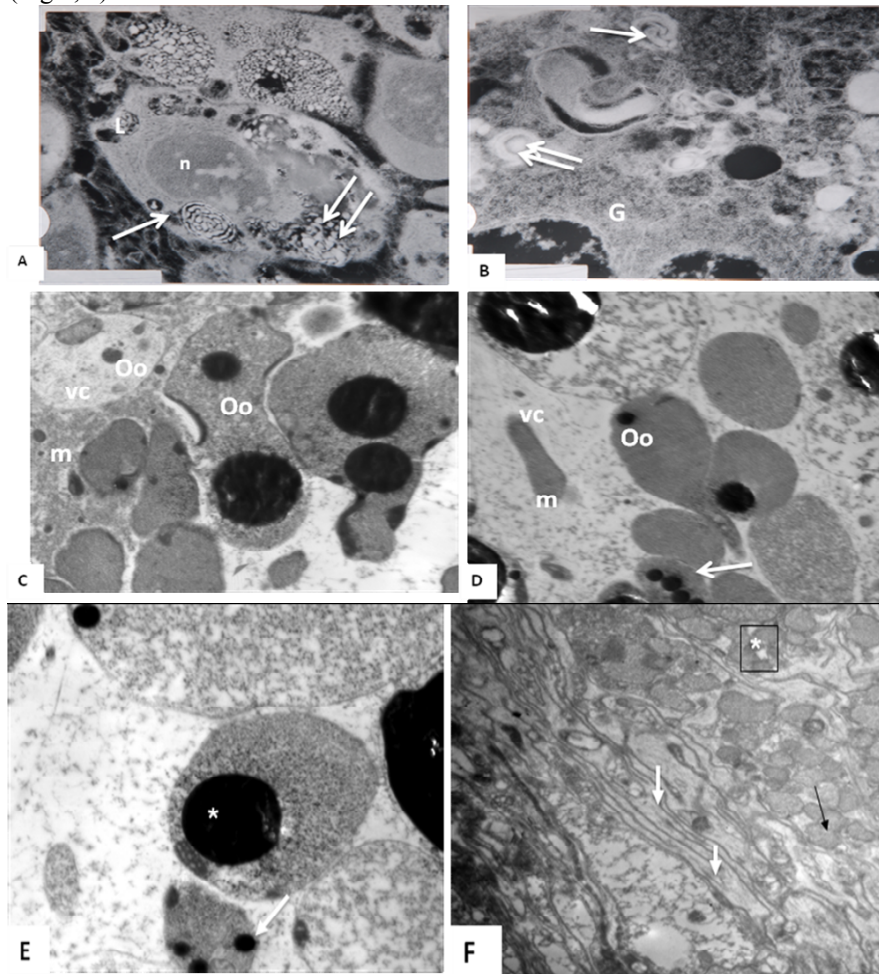


Figure (1): A-TEM micrograph illustrating the mature vitellocyte with the concentric shell globules (arrows), nucleus (n), Lipid droplets (L), 5000X. B- TEM micrograph illustrating the concentric arrangement of the endoplasmic reticulum (arrow, double arrow), proposed glycogen like-particles (G), Oil droplets, 7500X. C- TEM micrograph illustrating the developing Oocytes (Oo) adjacent to the vitellocyte (vc), note the mitochondria (m), 2500X. D-TEM micrographs illustrating the aggregation of shell globules (arrow), 2500X. E-TEM micrographs illustrating the scattered shell globules (arrows), 3000X. F-TEM micrograph illustrating the characteristic parallel

cisternae of endoplasmic reticulum (white arrows), large membrane bound inclusions of Golgi complex (black arrow), 8000X.

4. DISCUSSION

As summarized by Swiderski and Xylander (2000) in their extensive review, Cestode vitellocytes are very important for egg formation and embryonic development. They play two significant functions:

1-The formation of hard egg shell or a delicate vitelline capsule.

2- Supplying nutritive reserves for the developing embryo.

Both roles are closely connected with the presence of two types of cytoplasmic inclusions in Cestode vitelline cells such as:

* Egg shell globules, vitelline vesicles or shell globules clusters that taking part in the egg shell or vitelline capsule formation.

*Glycogen and/ or lipids (Sometimes mixtures of both in different proportion which represent recent various energy sources for the developing embryos).

Lipid droplets were localized only in the vitellocyte cytoplasm in *Paracharistianella trygonis*, Swiderski *et al.*, (2007) and never inside the cell nuclei. This report agreed with the present results. While in Tetrphyllidean *Echeneibothrium beaulchampi* by study of Mokhtar-Maamouri and Swiderski, (1976) and in *Didymobothrium rudolphii* studied by Poddubnaya *et al.*, (2006) it was reported inside the cell nuclei. Other studies on *Diplocotyle olrikii* by Bruňanská *et al.*, (2005) and on Caryophyllidea *Atractolytocestus huronensis* by Bruňanská *et al.*, (2009) their conclusion was that the lamellar heterogenous egg globules are represented in great amount, which was different from our studies that as we noticed that the egg shell globules have a characteristic concentric shape. Report of Swiderski *et al.*, (2004a) on *Caryophyllaeus laticeps* stated that lipid granules were absent in mature vitellocyte. Whereas, Swiderski and Mickiewicz (1976) work on *Glaediacris catostomi* found a great amount of cytoplasmic and nuclear glycogen. Study of Swiderski *et al.*, (2004b) on *Khawia armeniaca* reported the lamellar granules in the cytoplasm of this Caryophyllidean Cestode. Swiderski *et al.* (2009) work on *Wenyonia virllis* found moderate accumulations of cytoplasmic glycogen. In addition, Swiderski *et al.*, (2011) work on Diphyllidea *Echinobothrium euterpes* noticed a large amount of glycogen accumulations around the large, saturated lipid droplets of maturing and mature vitellocytes. Swiderski *et al.*, (2006a) work on *Trypanorhyncha Dollfusiella spinulifera* found very few glycogens in the cytoplasm. Many investigators ; Swiderski and Mokhtar (1974); Mokhtar-Maamour and Swiderski (1976); Swiderski and Subilia (1978); McKerr (1985); Bruňanská M., (1997); Swiderski *et al.*, (2000), Koeneva (2001), Swiderski *et al.*, (2006 b),

Swiderski *et al.*, (2007) and Levron *et al.*, (2007) discussed the ultrastructure of the vitellocytes in the following species: *Grillotia erinaceus*, *Paracharistianella trygonis*, *Echeneibothrium beaulchampi*, *Progillotia pastinace*, *Bothriocephalus clavibothrium*, *Paraechinophallus japonicus*, *Proteocephalus longicollis*, *Inermicapisifer madagascarinensis*, *Triaenophorus nodulosus*, *Catenotaenia pusilla*, *Moniezia expansa*, *Proteocephalus exiguous* and *Mosgovoyia ctenoides* and compared their contents.

The discovery that lipids vary in the vitellocytes of different families raised important questions regarding factors determining lipid types, functional significance and what role they might have in assessing evolutionary relationships at any level. As the nutrient reserves are related to the ecology and life cycle in some species and its accumulation in the vitellocytes may deflect the adaptation to the parasitic way of life in different groups of Cestodes, Swiderski and Xylander (2000).

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