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Ultrastructural Observations on *Dactylogyrus vastator* Nybelin, 1924 from Common Carp *Cyprinus carpio* L.

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ABSTRACT. *Scanning and transmission electron microscopic studies were carried out on D. vastator. The outer layer of the epidermis is a syncytial structure. Circular and longitudinal muscles are found beneath this outer layer. The muscle bands are not uniform in thickness. Epidermal secreting cell bodies are located below the muscle layers and communicate with the outer layer via ducts. Possible epidermal sensillae are unequally distributed over the worm's body. The parasite has four cephalic lobes each of which is provided with a cup-like opening at the border.*

Clean sclerites prepared by using an ultrasonication technique were examined under the electron microscope. The hamuli of adult and immature dactylogyrids are divided into internal and external processes joins and which continues as a shaft and at the proximal edge ends in a spike. Marginal hooks have a blade and spike. The adult and immature worms can be differentiated by the structure of the auxiliary sclerite. In mature specimens, the outer and inner surfaces of the auxiliary sclerite remain separate. The surface of the hamuli has an interlocking array of striations which might presumably strengthen the attachment to the host.

INTRODUCTION

Electron microscope investigations on fish parasitic platyhelminths have so far relatively neglected the Monogenea and have been more extensive on the endoparasitic digeneans and cestodes (Burton, 1966a, b, c; Lumsden, 1966; Morris and Threadgold, 1967; Bråten, 1968; Charles and Orr, 1968 and Erasmus, 1973).

The tegument of *Dactylogyrus* follows the same general pattern as in other monogeneans, but with some variations in the individual species.

Monogeneans are identified by means of their opisthaptoral armature. Shinn *et al.* (1993) developed a sonication method to separate the opisthaptoral sclerites from live worms and Mo and Appleby (1990) used the digestion method to free the sclerotised parts of the opisthaptor. The main objective in this experiment is to study the detail structure of the organs and sclerotised parts of *D. vastator*.

MATERIALS AND METHODS

Carp infected with *D. vastator* were decerebrated and infected gill filaments were removed individually from separate gill arches. A one in 1,500 solution of phenoxyethanol was used as a parasite anaesthetic to aid dislodgement of the parasites from gills (Shinn, 1994).

Sonication technique

Active, live, fresh *D. vastator* were collected in pointed 10 ml glass centrifuge tubes containing 3 ml distilled water. They were then sonicated in a sonic water bath.

Post - sclerite release procedure

Following sclerite release, the resultant sonicate was centrifuged for 5 mins, and the supernatant decanted. The final pellet was resuspended in 3 ml distilled water and washed thoroughly. The final pellet was agitated with a minimum amount of water and pipetted onto 11 mm round coverslips. The coverslips were then screened for the presence of sclerites under the light microscope (Olympus BH2 stereomicroscope) using 100 times magnification.

Scanning and Transmission Electron Microscopy

Gill arches from the fish with attached worms were washed in 0.05% Rossapol and then fixed in cold 3% glutaraldehyde in 0.2 M cacodylate buffer and left overnight at 4°C and followed the standard technique as mentioned by Shinn *et al.* (1993).

RESULTS

Scanning electron microscopy and light microscopy reveals *D. vastator* as an elongated worm with four anterior cephalic lobes and which attaches in between adjacent secondary gill lamellae by means of the posterior opisthaptor. The opisthaptor is a flattened circular organ 0.12 mm in diameter, bearing a large pair of hooks or hamuli at the centre and fourteen marginal hooks. The curved shape of the hamuli together with the striations enable the worm to attach firmly to its host. Hamuli have both internal and external roots which join to form a stiff shaft and which continues to a sharp point with a spike. The auxiliary sclerite is a double filament found on the dorsal surface of the shaft and point regions of each hamulus. There is variation in the attachment of the sclerite between adult and immature worms. In immature specimen, the outer and the inner surfaces of the auxillary sclerite remain separate. In adults, the auxilary sclerite originates as double filament at the dorsal side of the shaft region and ends as a single filament closer to the point region.

As shown by transmission electron microscopy the structure of the tegument from different regions of the worm shows some differences. The body wall from the anterior region has a diffuse epidermal layer, in which cell boundaries cannot be discriminated in the outer tegumental region. The tegument is separated from the underlying muscular layer by a basement membrane, the hypodermal layer. The thickness of the tegument, between the anterior end and the ovarian region is greater than the anterior edge section. The muscular layer is found to be thicker in the region which opposite to the hamuli and ovarian region. The epithelium of the uterus is a syncytium and contains several mitochondria and rough endoplasmic reticulum in the form of parallel arrays.

DISCUSSION

The general body tegument of adult *D. vastator* is similar in its basic structure to other monogeneans so far studied including *Cichlidogyrus halli typics* (El-Naggar, 1992), *Dactylogyrus amphibothrium* (El-Naggar and Kearn, 1983a) and *Gyrodactylus eucaliae* (Lyons, 1970). Basically the body tegument has a syncytial cytoplasmic layer connected to cytons lying beneath the tegumentary muscle layers, except in the regions of hamuli where some membranes can be seen. The latter has not been recorded in other monogeneans. Myofibrils in the body wall of *D. vastator* resembles those of nonstriated muscles of *Gyrodactylus eucaliae* and other in invertebrates. The

muscle layer of the tegument is not in uniform thickness in *D. vastator* and is thicker wherever muscular function is important, for example in the hamulus region.

The hamuli have two root processes and which are provided with muscular attachment surfaces which must allow the hook to move back and forth while achieving its function of anchoring the worm to the primary gill lamellar cartilage. The interlocking striations found on the hamuli shaft presumably increase the strength of attachment by providing a non-smooth surface in contact with host tissue. Although the hamuli provide the main attachment mechanism, the marginal hooks probably prevent the edges of the opisthaptor moving inwards, increasing the efficiency of the worm's attachment to its host.

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