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ON THE COPULATORY ORGAN MUSCULATURE OF THE MONOGENEAN GILL PARASITE *CALCEOSTOMA POLYORCHIS* (VALA AND EUZET, 1977) ABU SAMAK, 2001

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ABSTRACT

The muscular system associated with the copulatory organ of the monogenean gill parasite, *Calceostoma polyorchis* consists of three groups of muscle fibers. The first group forms a sleeve around the longitudinal axis of the copulatory organ that help protrudes the copulatory tube from the male genital opening during copulation. The second group is short, attaches with the base of the copulatory organ and acts in the withdrawal of the copulatory tube inside the body of the parasite after copulation. The third group connects the terminal ends of both the sclerotized piece and the copulatory tube. It help inserts the anterior region of the copulatory tube inside the vaginal opening and maintains this position during copulation.

INTRODUCTION

A knowledge of the reproductive systems functioning of parasitic platyhelminthes would be useful, not only from biological standpoint but also in searching for possible avenues for control of parasitic diseases of humans and domestic animals (Nollen, 1983). Therefore, copulation in monogeneans and the role of the copulatory organ were described by some authors (Bychowski, 1966; Kearn *et al.*, 1993; Tappenden *et al.*, 1993). They reported that during cross-insemination, the paired worms alternately inserted their copulatory organs in the other worm's vagina. The functional interpretations of the copulatory organ have been studied in some monogeneans: *Amphibdella* spp., *Amphibdelloieds* spp. (Llewellyn, 1960), *Ergenstrema labrosi*, *Ligophorus anagustus* (Llewellyn and Anderson, 1984), *Cichlidogyrus halli typicus* (El-Naggar and Khidr, 1985) and *Pseudodactylogyrus anguillae* (El-Naggar *et al.*, 1993).

These authors found that the muscular system associated with the copulatory organ has important and essential role during cross-insemination of the monogenean parasites.

The copulatory organ of *Calceostoma polyorchis* consists of a ventral hollow copulatory tube, a dorsal elongated outgrowth and a small curved sclerotized piece (Abu Samak, 2001). To date, no functional interpretation of the copulatory organ musculature of this monogenean parasite has been yet offered. Therefore, the present study was aimed to shed some light on the musculature of the copulatory organ of the monogenean gill parasite *C. polyorchis* and its suggested function during copulation.

MATERIAL AND METHODS

The marine sciaenid fishes, *Argyrosomus regius* were obtained from the fishermen at Ras El-Bar on the Mediterranean Sea, Damietta Governorate, Egypt as described by Abu Samak (2001). The present study depends on careful examination of living and stained adult specimens of *C. polyorchis*. For whole mount preparation, the adult specimens of the parasite were flattened under a coverslip, fixed in 4-10% formaldehyde stained with alum carmine and fast green, dehydrated in alcohol, cleared in terpeniol and mounted in canada balsam.

RESULTS

Observations on the living and stained specimens of *C. polyorchis* have revealed that the copulatory organ of this parasite is provided with three groups of muscle fibers (Fig. 1A). The first group is assembled into a protractor muscle. This muscle forms a sleeve around the copulatory organ. It originates from the right side of the copulatory outgrowth, directs anteriorly and turns to the left side behind the copulatory tube. It attaches with the subtegumental muscle fibers before directing posteriorly, where it encircles the anterior region of the copulatory outgrowth. Finally, it inserts into the left side of the copulatory outgrowth. The second group forms a short retractor muscle, which attaches to the posterior end of the copulatory organ. The third group encloses delicate accessory fibers connecting between the terminal clavate end of the small curved sclerotized piece and the terminal end of the copulatory tube via a round tendon-like structure.

Moreover, the copulatory organ was observed in one of two positions. Mostly, the anterior half of the copulatory tube is found in a straight position forming 180° with the copulatory outgrowth. Meanwhile, the angle between the copulatory sclerotized piece and the position of the copulatory outgrowth is 140° (Fig. 1B). In the other position, the anterior half of the copulatory tube is curved, forming an angle of 130° with the copulatory outgrowth. Also the angle between the copulatory sclerotized piece and the position of the copulatory outgrowth is 130° (Fig. 1C).

DISCUSSION

The role of the muscular system associated with the copulatory organ has been studied by some authors (Llewellyn, 1960; Llewellyn and Anderson, 1984; El-Naggar and Khidr, 1985; El-Naggar *et al.*, 1993). These authors found that at least two muscle groups are associated with the copulatory organ, namely protractor and retractor and three other groups of muscles associated with the accessory sclerite(s) if present, namely; protractor, adductor and abductor groups. They also reported that the suggested functions of these muscle groups depend on their position, size and shape. The protractor muscle group of the copulatory organ is the most predominant, forming a sleeve around this organ and may produce a protrusion of the distal part of the copulatory tube from the genital opening. On the other hand, the retractor muscle group of the copulatory organ is short, associated with its base and may produce a withdrawal of the copulatory tube inside the body of the parasite after copulation. Moreover, the muscle groups of the accessory sclerites may create grasping or gaffing motion that form anchorage of the copulatory or tube with the vagina during copulation.They suggested these functions of the accessory sclerites be affected with the shape of these sclerites, which have terminal ends either like spencers, peaks or hooks. In this respect, the clavate terminal end and the two positions of both the copulatory tube and the copulatory sclerotized piece of *Calceostoma polyorchis* might serve to maintain the position of the copulatory tube during copulation.

Regarding to the two positions of the copulatory tube and the orientation of the musculature associated with the copulatory organ of *C. polyorchis*, it seems likely that they control its mode of action. A contraction of the protractor muscle group and a relaxation of both

retractor and accessory muscle groups help the protrusion of the anterior region of the copulatory tube through the male genital opening. Then a contraction of the accessory muscle group would insert that anterior region into the vaginal opening and permit a firm attachment of the copulatory tube to the vaginal opening by ensuring an essential non-movable component of the copulatory tube during copulation. After copulation, relaxation of both the protractor and accessory muscle groups and contraction of the retractor muscle group would produce releasing and withdrawal of the anterior region of the copulatory tube inside the body of the parasite.

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EXPLANATION OF FIGURES

Fig. 1. Schematic drawing of the muscular system associated with the copulatory organ of the monogenean parasite *Calceostoma polyorchis* (A) and two different positions of the copulatory organ (B&C). acm, accessory muscle group; cog, copulatory outgrowth; cos, copulatory sclerotized piece; ct, copulatory tube; pm, protractor muscle group; rm. retractor muscle group. Scale bar = 20μm.

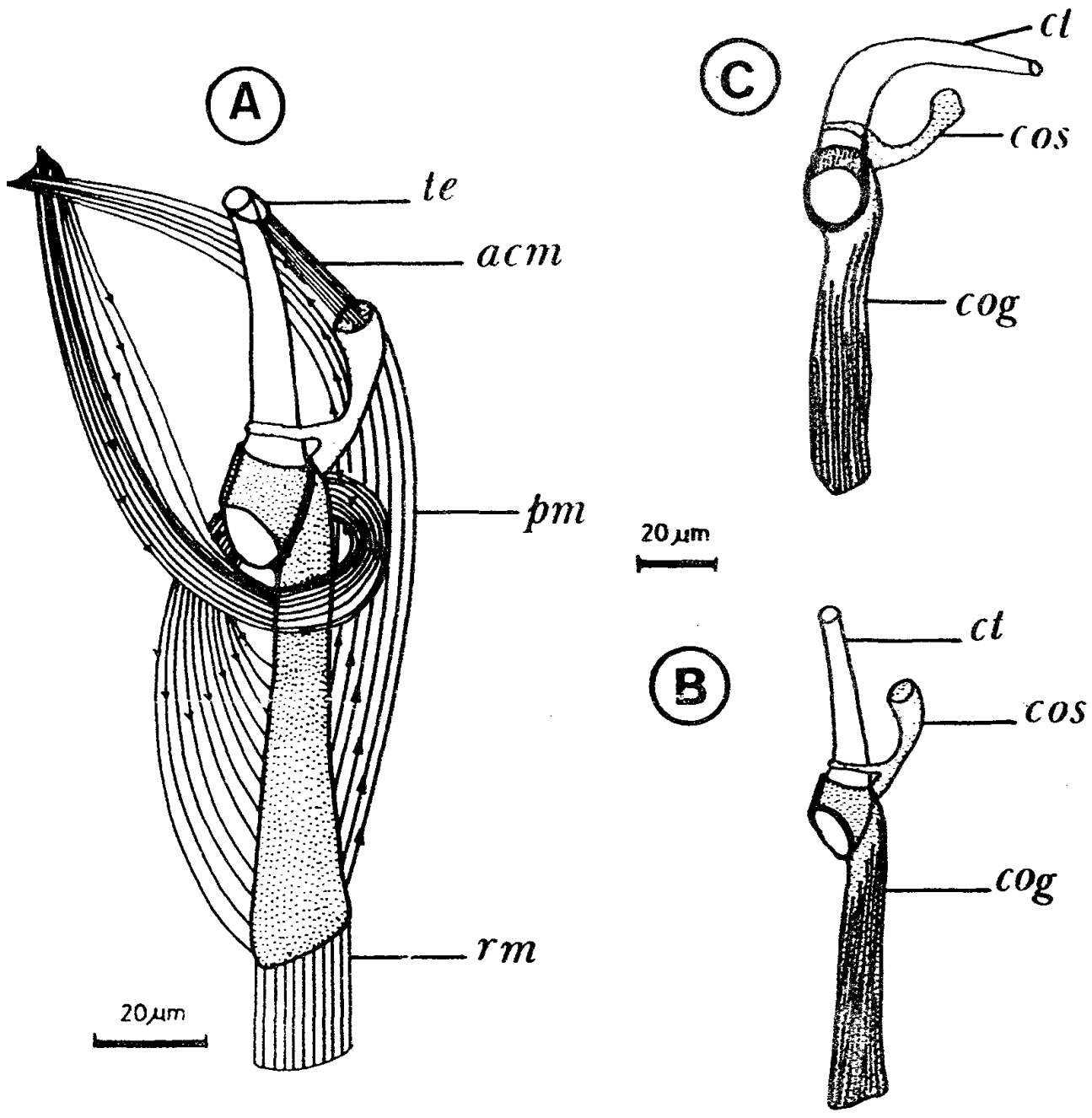

Fig. 1