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Ultrastructure of the spermatozoon of *Anomotaenia quelea* (Mettrick, 1961) (Cestoda, Cyclophyllidea, Dilepididae), an intestinal parasite of *Quelea quelea* (Aves, Ploceidae) in Senegal

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ABSTRACT

The mature spermatozoon of *Anomotaenia quelea* exhibits an apical cone of electron-dense material and two helicoidal crest-like bodies. The apical cone near its base is surrounded by a lucent cytoplasm and a spiraled layer of cortical microtubules. The crest-like bodies are of different lengths, spiraled and make an angle of 30–40° to the hypothetical spermatozoon axis. The axoneme is of the 9 + '1' trepaxonematan pattern and is surrounded by a periaxonemal sheath of electron-dense material. The cytoplasm contains in regions III and IV numerous electron-dense granules situated between the periaxonemal sheath and the cortical microtubules. The posterior extremity of the spermatozoon of *A. quelea* exhibits a nucleus and a disorganized axoneme and cortical microtubules. This type of posterior extremity of the mature spermatozoon has never been described previously in a Dilepididae. Similarly, two crest-like bodies have not been observed before in a dilepidid cestode.

1. Introduction

The order Cyclophyllidea comprises 15 families (Khalil et al., 1994) including the Dilepididae which are parasites of birds and mammals (Yamaguti, 1959; Schmidt, 1986). The Dilepididae exceeds one hundred genera, and is no longer considered a monophyletic assemblage (Khalil et al., 1994). Even today, the taxonomic status of the group is highly controversial, and the phylogeny of genera assigned to it, remains unclear. To clarify the existing controversies, we consider that a combination of new information from morphological, ultrastructural and molecular studies is needed to bring us forward. For this it is necessary to increase the ultrastructural studies of the mature spermatozoon in this group.

According to Levron et al. (2010), ultrastructural data of the spermatozoon of dilepidids are scarce and no published data were available until 2001. To our knowledge, only four species of Dilepididae have been the subject of ultrastructural studies of spermiogenesis and/or the spermatozoon. These are *Dilepis undula* (Schrank, 1788 in Thomas, 1935), *Kowalewskiella glareola* (Burt, 1940), *Angularella beema* (Clerc, 1906) and *Molluscotaenia crassiscolex* (von Linstow, 1890) (see Świderski and Tkach, 1996; Świderski et al., 2000, 2002; Yoneva et al., 2006; Marigo et al., 2011a). In this paper, we present the fifth study of the ultrastructure of the mature spermatozoon of a dilepidid cestode belonging to a genus that so far has been unexplored, the genus *Anomotaenia* with the analysis of the species *A. quelea* (Mettrick, 1961).

2. Materials and methods

The specimens of *A. quelea* were gathered live from the small intestine of naturally infected *Quelea quelea* (Passeriformes, Ploceidae) from Dakar (Senegal). The worms were kept active in physiological saline solution (0.9% NaCl) and then fixed in cold (4 °C) 2.5% glutaraldehyde in a 0.1 M sodium cacodylate buffer at pH 7.4 for 1 h, rinsed in a 0.1 M sodium cacodylate buffer at pH 7.4, postfixed in cold (4 °C) 1% osmium tetroxide with 0.9% potassium ferricyanide in the same buffer for 1 h, rinsed in milliQ water, dehydrated in an ethanol series and propylene oxide, embedded in Spurr and polymerized at 60 °C for 48 h. Ultrathin sections were obtained using a Reichert-Jung Ultracut E ultramicrotome. Subsequently, they were placed on copper grids and double stained with uranyl acetate and lead citrate. The copper grids were examined using a JEOL 1010 transmission electron microscope at 80 kV in

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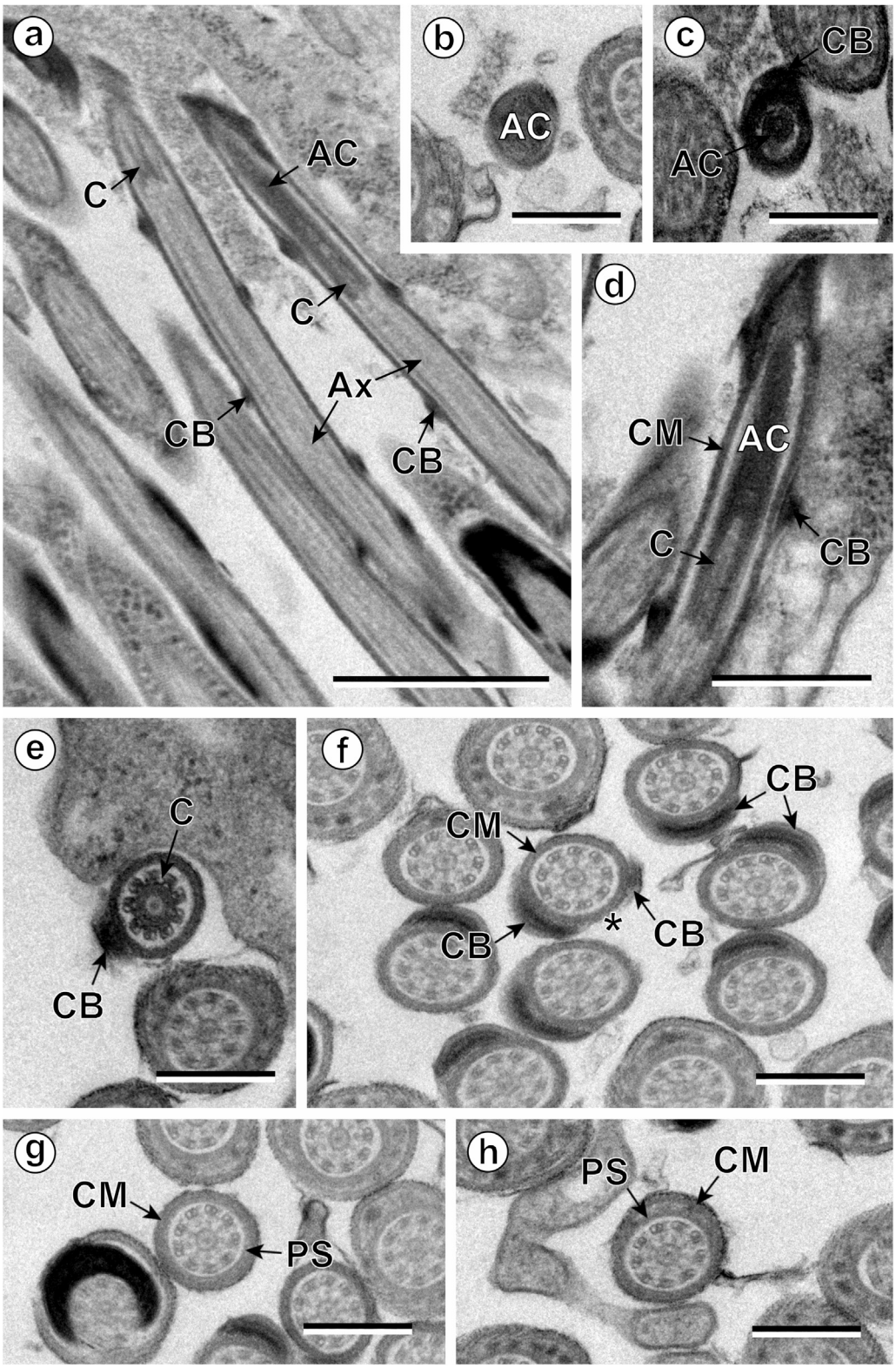

Fig. 1. Mature spermatozoon of *Anomotaenia quelea*. (a) Longitudinal sections of Region I showing the apical cone (AC), the centriole (C), the crest-like body (CB) and the axoneme (Ax). Scale *bar* 1 μm. (b) Cross-section at the level of apical cone (AC) before the appearance of the first crest-like body. Scale *bar* 0.3 μm. (c) Cross-section of the apical cone (AC) at the level of the crest-like body (CB). Scale bar = 0.3 μm. (d) Longitudinal section of Region I showing the apical cone (AC) surrounded by a lucent cytoplasm, cortical microtubules (CM) and the crest-like body (CB). Scale *bar* 0.5 μm. (e) Cross-section of Region I at the level of the centriole (C) showing the first crest-like body (CB). Scale bar = 0.3 μm. (f) Cross-sections of Region I showing anterior areas with one crest-like body (CB) and the posterior area (*) with two crest-like bodies. CM, cortical microtubules. Scale bar = 0.3 μm. (g and h) Consecutive cross-sections of Region II showing the periaxonemal sheath (PS). CM, cortical microtubules. Scale bars = 0.3 μm.