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Short communication

Sperm morphology of *Muscidifurax uniraptor* (Hymenoptera: Chalcidoidea: Pteromalidae)

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ABSTRACT

Sperm morphology of the parasitoid *Muscidifurax uniraptor* was investigated under light and transmission electron microscopy. *M. uniraptor* sperm are filiform, spiraled, approximately 150 μm in length, with a distinctive head, hooded by an extracellular sheath and a flagellum. This extracellular layer, from which many filaments radiate, measures approximately 90 nm in thickness and covers a small acrosome and the anterior nuclear region. The acrosome is composed of an acrosomal vesicle and a perforatorium with its base inserted in the nuclear tip. The nucleus is filled with homogeneously compacted chromatin. The centriolar adjunct extends towards the anterior portion in a spiral around the nucleus for 3.5 μm in length. The two mitochondrial derivatives begin exactly at the centriole adjunct base and, in cross-section, have a circular shape with equal areas that are smaller than the axoneme diameter. It is coiled, with 9 + 9 + 2 microtubules and begins from the centriole, just below the nuclear base. The axoneme is connected to the mitochondrial derivatives by two small irregularly shaped masses. Between the derivatives and the axoneme, the 'center-flagellar material' is observed. Overall, these characteristics are recognized in other Chalcidoidea, especially in the eurytomids, but together they form a set of species-specific data.

1. Introduction

The Chalcidoidea are a mega-diverse group of insects including about 500,000 species (Heraty et al., 2013), and may play an important role in the biological control of other arthropods, because most of them are parasitic for other insects. The wasp *Muscidifurax uniraptor* Kogan & Legner (Pteromalidae) is a parasitoid of filth-inhabiting muscoid Diptera, so that it contributes to the reduction of the housefly population in aviaries (Axtell and Arends, 1990).

The structural comparison of the sperm has contributed to studies of systematics in various animal groups (see Jamieson, 1987), and to reach an understanding of insect evolution (see Dallai, 2014). Still, in insects, sperm morphology can also be used for identifying species (Pereira et al., 2008; Barcellos et al., 2015), since this is a cell type with unique features and is almost invariable in the same species, making it a species-specific marker (Phillips, 1970). Therefore, in this study we describe the sperm morphology of the chalcidoid, *M. uniraptor*.

2. Materials and methods

Eight adult male *M. uniraptor* were obtained from a laboratory culture that was being maintained in the Entomology Department of the Escola Superior de Agricultura Luiz Queiroz – ESALQ/USP, Piracicaba, São Paulo, Brazil. Of these, three specimens were used for light microscopy and five for transmission electron microscopy.

2.1. Light microscopy

For sperm measurement: the seminal vesicles were dissected and squashed on clean glass microscope slides, followed by spreading, then fixed with 4% paraformaldehyde in 0.1 M phosphate buffer at pH 7.2. After drying at room temperature, the slides were observed under an Olympus BX41 photomicroscope equipped with a phase contrast lens to enable measurement of the sperm.

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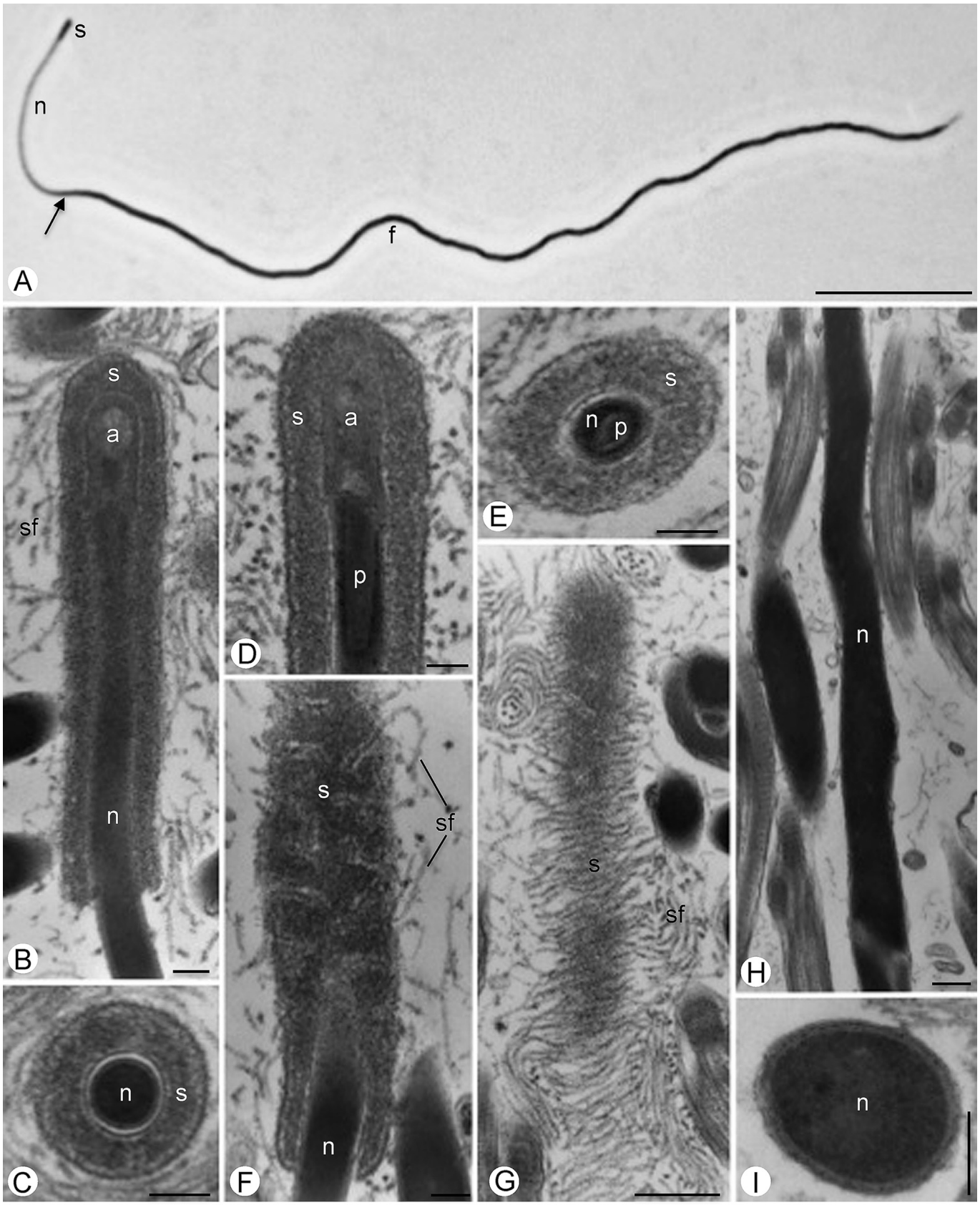

Fig. 1. Light (A) and transmission electron (B–I) micrographs of *M. uniraptor* sperm in longitudinal (B, D, F–H) and transverse (C, E, I) sections. (**A**) Phase contrast of sperm showing the extracellular sheath region (s). The arrow indicates the limit of head (h) and flagellum (f). (**B**) Section of the head region showing the acrosome (a), the nucleus (n) and the filaments (sf) of the extracellular sheath (s). (**C**) Cross section of the nucleus (n) and the thick extracellular sheath (s). (**D**, **E**) Sections of the head region showing the acrosomal vesicle (a) and the perforatorium (p) inserted in a deep cavity of the nucleus (n) and filaments (sf) radiating from the extracellular sheath. (**F**, **G**) Superficial section of the extracellular sheath showing the filaments irradiating from it. (**H**, **I**) Sections of the nuclear region. Notice the coiled nucleus in H. Scale bars: 20 μm (A); 0.1 μm (B, C, D, E, F and I); 0.3 μm (G, H).