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Sensilla of the antenna and palp of *Hydrotaea chalcogaster* (Diptera: Muscidae)

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Abstract

Hydrotaea chalcogaster is a fly species of medical and forensic importance in many parts of the world. In this study, we investigated the sensilla of the antenna and palp of the adult female fly using scanning electron microscopy. The antennal scape has one type of sensillum, the sharp-tipped sensillum trichodeum; whereas, the antennal pedicel also possessed this type of sensillum in addition to an unidentified type. Three types of sensilla were found on the flagellum: (1) sensilla basiconica, with both large and small sensilla basiconica showing wall pores, (2) sensilla coeloconica, with a smooth surface, and (3) sensory pits, with wall pores of pegs. The arista is located dorso-laterally on the flagellum and has three segments. Short microtrichia are located around the distal end of its second segment and on the proximal half of the third segment. Both large sharp-tipped sensilla chaetica and small sensilla basiconica with wall pores were observed on the palps. Results of this study contribute to our overall understanding of the ultrastructural morphology of sensilla on the antenna and palp of *H. chalcogaster*.

Keywords: *Hydrotaea chalcogaster*; Antenna; Palp; Sensilla: Scanning electron microscopy

1. Introduction

Hydrotaea (= *Ophyra*) *chalcogaster* is a fly species of medical and forensic importance in many parts of the world. This fly is widely distributed in the Oriental, Australasian and Ethiopian regions (Shinonaga, 2002). It is claimed to have an important role in the dispersal of fecal pathogens similar to that of *Musca sorbens*, a putative vector of trachoma (Bohart and Gressitt, 1951). The bacterium, *Mucor ambiguous*, has been found to associate with this species, a finding supported by Usui (1960). In regard to forensic importance, specimens of *Hydrotaea chalcogaster* were found in human corpses and pig carcasses by Carvalho et al. (2000).

In insects, olfactory receptor neurons are located in cuticular sensilla that exist on the antenna and palps (Anton et al., 2003). For example, this was demonstrated in the adult mosquito, *Anopheles gambiae* (Diptera: Culicidae) by Anton et al. (2003), and the pomace fly, *Drosophila* (Diptera: Drosophilidae) by Stocker (1994), de Bruyne et al. (1999), and Shanbhag et al. (1999). Evidence from works by Kelling et al. (2002) and Wasserman and Itagaki (2003) using electrophysiological analyses to assess olfactory receptors in the antenna and palps of adult flies (Diptera: Muscidae and Sarcophagidae) indicated that both organs respond to various odors. As for flies associated with corpses (particularly in the families Calliphoridae, Muscidae and Sarcophagidae), few studies have examined the sensilla on antennae and/or palps (Fernandes et al., 2004; Sukontason et al., 2004). To help increase the anatomical database on flies of medical and/or forensic importance, we describe the morphology of the sensilla on the antenna and palp of adult female *H. chalcogaster* using scanning electron microscopy (SEM).

2. Materials and methods

Adult females of *H. chalcogaster* were obtained using a bait-trap from a fly survey in Chiang Mai, northern Thailand (17–21°N and 98–99°E), in February 2003. After identification, they

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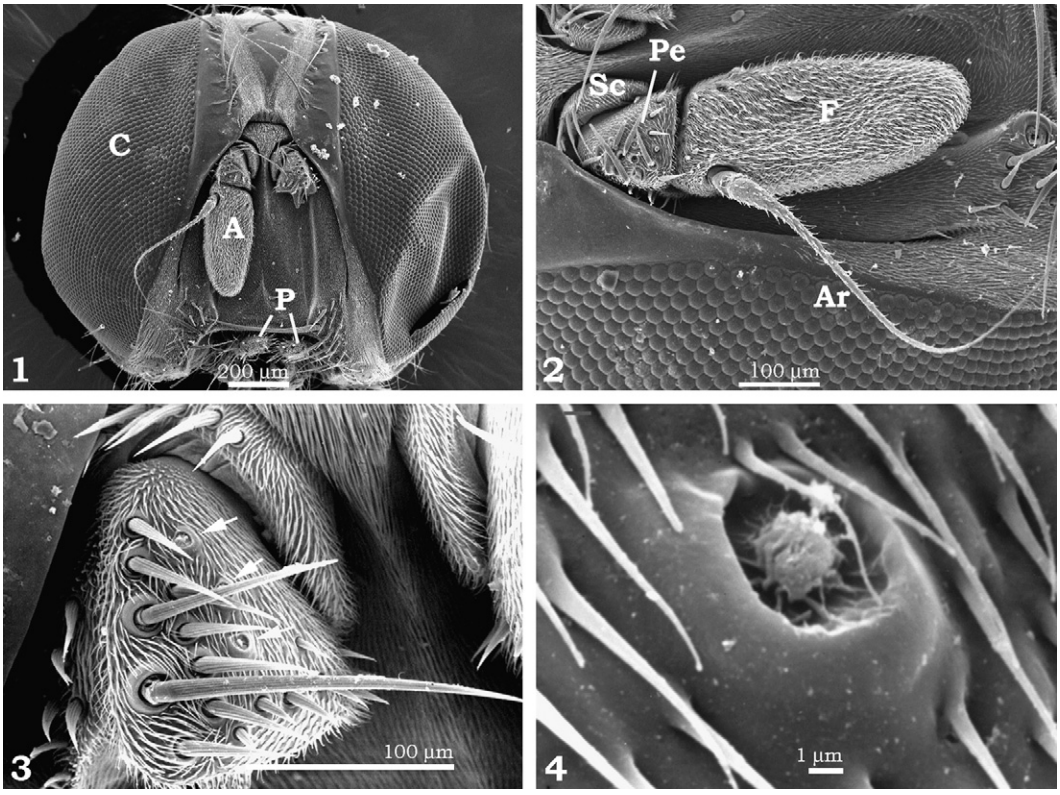
were kept in 70% alcohol for about a year before being prepared for the scanning electron microscopy (SEM) process. Since only females were collected, males were not examined in this study but only females were. The heads of all flies were removed under a dissecting microscope using a sharp blade. Five specimens were fixed in 2.5% glutaraldehyde mixed with phosphate buffer solution at a pH of 7.4 at 4 °C for 24 h, then subjected to postfixation in 1% osmium tetroxide and dehydrated in a graded alcohol series. This was followed by treatment in acetone and critical-point drying. Finally, the heads were mounted on stubs, sputter-coated with gold, and viewed with a JEOL JSM-5910LV SEM (Tokyo, Japan). The terminologies of adult flies used in this study followed McAlpine (1981) and classification of sensilla follows that of Zacharuk (1985).

3. Results

SEM observations of the head of female *H. chalcogaster* revealed a pair of antennae located frontally between the large compound eyes; whereas, a pair of palps arose at the distal end of the rostrum, a part of the proboscis (Fig. 1). Each antenna consists of three segments: a proximal scape, pedicel, and distal flagellum (or funiculus) that bears a slender seta called the arista laterally (Fig. 2). All antennal segments in this species possess sensilla.

Only one type of sensilla was observed on the scape, namely the sensilla trichodea. Approximately six sensilla of similar length were seen on the scape arranged in a single row (Fig. 3). The sensilla trichodea are curved and tapered distally along their longitudinal axis. The surface of the scape is densely covered by small spinules of microtrichia. In addition to presence of sensilla trichodea, the pedicel also contained an unidentified type of sensilla. The sensilla trichodea on the pedicel are morphologically similar to those found on the scape, with exceptions of being more numerous and being variable in length (Fig. 3). Approximately four to five of the unidentified type of sensillum were observed (Fig. 3, arrows) and were characterized by having a small dome (≈2.7 μm in diameter, $n = 3$) in the middle of radiating folds encircled by a low round cuticular ring (≈10.8 μm in diameter, $n = 3$) (Fig. 4).

The flagellum is the most prominent part of the fly antenna. The arista is located dorso-laterally on the flagellum and is comprised of three segments (Figs. 2 and 5). Short microtrichia are located around the distal end of the second segment of the arista and on the proximal half of the third segment (Fig. 5). The entire surface of the flagellum is densely covered with microtrichia that taper to their tips (Fig. 6). Types of sensilla clearly observed on the flagellum include sensilla basiconica, sensilla coeloconica and sensory pits. Sensilla basiconica were classified into two types, large and small. A large sensillum basiconicum was characterized by having a



Figs. 1–4. Scanning electron micrographs of adult female *H. chalcogaster*. (1) Head bearing pair of large compound eyes (C), antenna (A) and palps (P). (2) Antenna (oriented on its side in micrograph) comprised of three segments: scape (Sc), pedicel (Pe) and flagellum or funiculus (F). Arista (Ar) is located dorso-laterally on the flagellum. (3) Enlarged view of scape and pedicel highlighting variable size of the sensilla trichodea. Arrows indicate unidentified type of sensilla on the pedicel. (4) Higher magnification of the unidentified type of sensilla characterized by bearing a small dome in the middle of radiating folds encircled by a round cuticular ring.