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ORIGINAL ARTICLE

Morphological characterization of the antennal sensilla of the earwig *Anisolabis maritima* (Dermaptera: Carcinophoridae) with reference to their probable functions

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KEYWORDS

Earwig;
Anisolabis maritima;
Sensilla;
Antennae;
Scanning electron microscopy

Abstract The earwig, *Anisolabis maritima* (Dermaptera: Carcinophoridae), is one of the most significant insects in KSA because, it was recorded in Saudi Arabia as a beneficial predator on eggs and newly hatched larvae of the red palm weevil, *Rhyncophorus ferrugineus*. We examined the external morphology of the antennal sensilla of males and females of *A. maritima* using scanning electron microscopy (SEM). The filiform antennae of *A. maritima* were of the conventional type comprising a basal scape, pedicle and a long, thread-like flagellum, which was composed of 12 flagellomeres of males and 16 flagellomeres of females. Six morphologically unique sensillar types were found and described on the antennae of males and females of *A. maritima*. Of those identified, there were three types of porous trichoid sensilla (long, curved and arcuate), and two types of basiconic sensilla (short and curved), and one type of aporous trichoid sensilla. The shape, external morphology and array of sensilla on the antennae of males and females of *A. maritima* were similar.

1. Introduction

Anisolabis maritima is a cosmopolitan insect worldwide in distribution (Arnett, 1993). Most stages have been found throughout the year, males seemed more prevalent from late spring through autumn. Eggs were found during the warmer months, and were guarded by the females (Nishida, 2002). Zimmerman (2001) stated that *A. maritima* is found only along the seashore. It is an endemic species in order Dermaptera and represents an adaptive radiation from a marine littoral ancestor which is indigenous to Hawaii. It is frequent in winter beneath the piles of seaweed, boards, and debris just above high tide make, and is also recorded from Jacksonville for key west on east coast (Brindle, 1981). The earwigs are not considered as pests, although they are elsewhere in the world. These can be found in a variety of habitats including caves, coastal and marine littoral areas, mesic and sometimes wet forests, and possibly in the recent lava flows (Nishida, 2002). Earwigs are significant generalist predators of a range of orchard pests (Suckling, 2006). The *A. maritima* earwig was recorded in KSA as a predator for the eggs of the red palm weevil *Rhynchophorus ferrugineus* (2002, القمة و القعيط).

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The aim of the present work is to identify and investigate the different sensilla that are distributed on the legs and anal cerci of *A. maritima* adults with discussion of their possible function in the behavior of host location and oviposition of the insect, which could facilitate future studies on neurobiology of olfaction and gestation. *A. maritima* may be used as a beneficial predator for the eggs of *R. ferrugineus* in future and as a tool in integrated pest management program (IPM).

2. Materials and methods

2.1. Scanning electron microscopy

Experimental adult individuals, males and females, of *A. maritima* were obtained from the Ministry of Agriculture and Water in El-Kharj, Riyadh, KSA. The morphological characters and location of different sensilla distributed on the antennae of the earwig *A. maritima* were examined using scanning electron microscopy. The insects were soaked in 70% ethanolic alchohol for 24 h, then the antennae were separated from the bodies of the insects. The specimens were rinsed thoroughly in distilled water and were fixed in 4% glutaraldehyde for 24 h at 5 °C, these were then dehydrated in conceding series concentration of acetone, individually for 1 h, and air dried. The specimens were mounted individually on stubs, then coated with gold and were examined using scanning electron microscopy (SEM) (JEOL-JSM b36 OLV); the observations were obtained and recorded from 10 males and 10 females.

3. Results

3.1. General description of A. maritima antennae

The filiform antennae of both sexes were of the conventional type comprising basal scape, pedicel and flagellum, which was composed of 12 flagellomeres of males and 16 flagellomeres of females. The long antenna of males was 1812.5 μm, and that of females was 2078.12 μm. The scape, pedicel and flagellum of males constituted 156.2, 78.1 and 1437.5 μm, and that of females constituted 1906.2 μm of the entire antennal length, respectively (Fig. 1A). On the surface of the entire antennae numerous sensilla were distributed (Fig. 1B and C), which were equal in both sexes but were different in the number of hair: females had 855 hair and males had 635 hair. The flagellomeres of females consisted 811 hair and those of males consisted 590 hair (Table 1).

4. Terminology

Antennal sensilla have been named differently by various authors despite similarity in their external morphology and positions on the antennae (Moran and Brown, 1973; Singleton-Smith et al., 1978; Ossiannilsson, 1992; van Baaren et al., 1996; Sorker et al., 2004; Kristoffersen et al., 2006; Onagbola and Fadamiro, in press). To avoid this inconsistency in terminology, we classified and named the various sensilla observed on the antennae of *A. maritima* based on their mor-

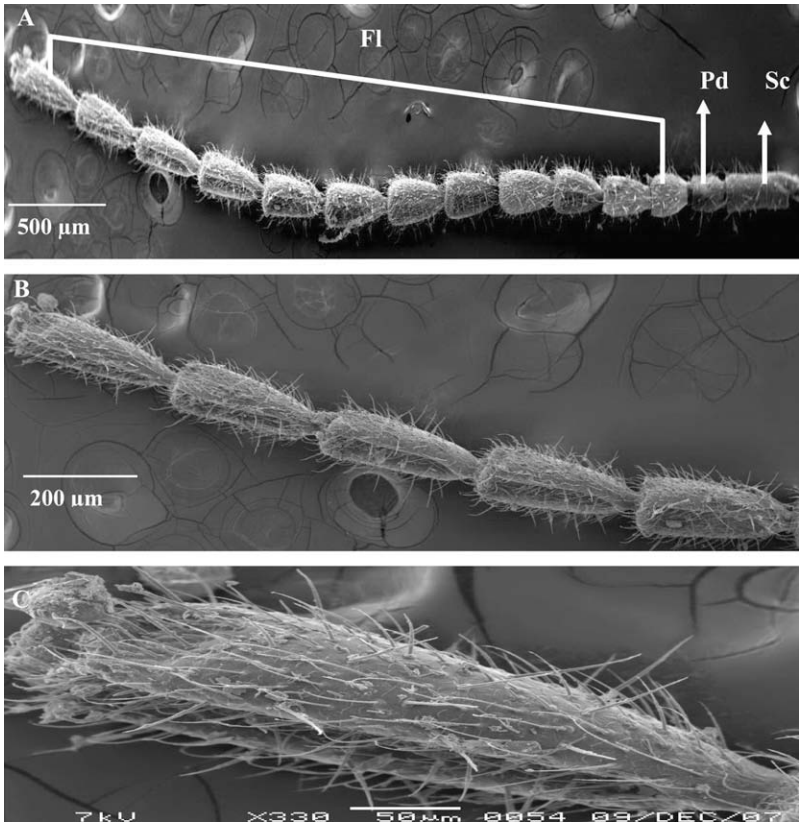

Figure 1 (A) Scanning electron micrograph (SEM) of an antenna of a male *A. maritima* showing the scape (Sc), pedicel (Pd) and flagellum (Fl). The antenna of a female *A. maritima* is similar in shape and morphology, but is slightly longer. (B) Magnified part of the antenna showing many hair surface cover. (C) Lateral flagellomeres showing numerous cover with sensilla.