Journal of Global Biosciences
Vol. 3(4), 2014, pp. 787-791
Date of Online: 30, Sept.- 2014

ISSN 2320-1355
http://mutagens.co.in

BIODIVERSITY IN CAVITY-NESTING HONEY BEES *APIS CERANA* F. AND *APIS MELLIFERA* L. (HYMENOPTERA: APIDAE): ULTRASTRUCTURE OF MOUTH-PARTS

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Abstract

Tongue of honey bees is modified for collecting nectar. Hudson (1970) identified the mouth parts as an important morphological character offering itself for beneficial exploitation under the electron microscope. It presents a high geographic variability related with the floral resources visited by the bees (Padilla *et al*., 2001). Scanning of tongue offers one such advanced diagnostic tool to study honey bee biogeography and determine adaptive variations to native flora. However this aspect has not been sufficiently exploited. The present studies were therefore planned to determine differences by scanning electron microscopy in the tongue of cavity-nesting bees *A. cerana* and *A. mellifera*.
Key words: *Apis cerana*, *Apis mellifera*, tongue, SEM.

INTRODUCTION

The mouth parts of honey bees are of chewing and lapping type. They can manipulate solid material as well as lap up liquids. The mandible and labium are of chewing type. Mandibles are attached on the sides of the head and the proboscis or tongue, made up of the maxillae and the labium. The mandibles are used in molding the wax. The maxillae and labium are developed into a series of flattened elongate structures to form a proboscis (Winston, 1987). The glossa of labium is greatly elongated, covered with hair and ends in a small rounded lobe, the flabellum forming a flexible tongue (Michener and Brooks, 1984). The glossa, which is a muscular tube is covered with short hair and on coming in contact with the nectar at the bottom of a corolla tube, capillary action draws nectar up to its base (Knutz, 1906). The glossa is also important for pollen collection (Michener *et al.* 1978). Liquids are absorbed by the flabellum which is present at the tip, into the mouth by a narrow channel (Michener and Brooks, 1984).

MATERIAL AND METHODS

Two cavity-dwelling species- *A. cerana* F. and *A. mellifera* L. were taken for the present study. *A.cerana* and *Apis mellifera* was collected from maintained apiaries in Chandigarh. The collected material of *A.cerana* and *A. mellifera* was preserved in 5% gluteraldehyde and the protocol of Bozolla and Russell (1999) was followed for electron microscopy.

Preparation of material for scanning electron microscopy

The tongue was carefully excised from the freshly collected worker bees of *Apis cerana* and *Apis mellifera*. These were then washed with phosphate buffer 2 to 3 times and then dehydrated through graded series of acetone and dried in a critical point drier. Dehydrated samples were mounted on slides in the desired orientation with the help of double side adhesive tape under binocular microscope. The samples were attached in such a way that they became visible from all sides. The stubs were placed inside the sputter for gold coating to overcome the problem of “charging” and “beam damage”. The sputtered specimens were examined in Jeol JS-6100 scanning electron microscope operated at an acceleration voltage of 10KV at Regional sophisticated instrumentation centre, Panjab University, Chandigarh.

The results of scanning were preserved as photographs used in this presentation.

RESULTS

The tongue of honey bees showed 3 regions- proximal, middle grooved region and distal spoon shaped flabellum. (**Fig. 1 and 2**).

Fig. 1. Tongue of *Apis cerana*

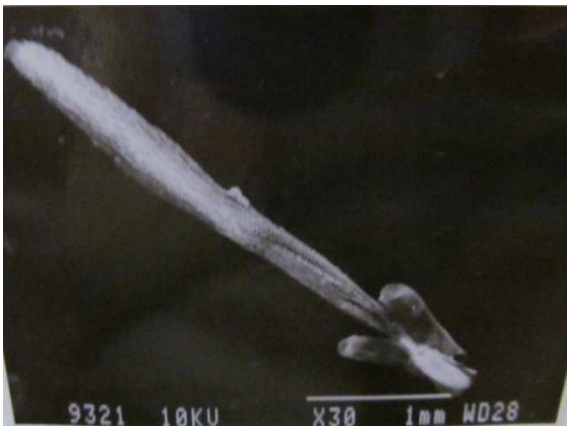

Fig 2. Tongue of *Apis mellifera*

Apis cerana

The proximal region presented a distinct pattern of ridges bearing short and spinous structures. The ridges showed an uneven and irregular arrangement giving a rough surface to the basilateral region of the tongue. The spines were present on the top of ridges **(Fig. 3)**. The middle grooved region formed the sucking siphon. It was converted into an imperfect tube by means of two rows of hair which converged towards the centre. The hairs were long, stiff and unbranched **(Fig. 4 and 5)**. The flabellum which is the liquid absorbing organ of the tongue was distinctly rhomboidal in shape. The distal margin of the flabellum was fringed with a row of distinct branched processes. The proximal end of these processes were long and straight. They became arborescent at the distal end **(Fig. 6 and 7)**.

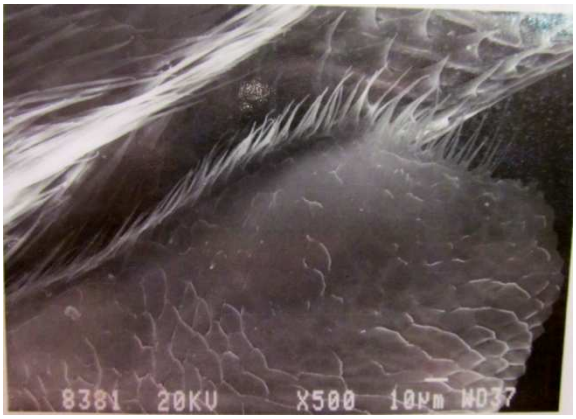

Fig. 3. SEM of proximal region of tongue

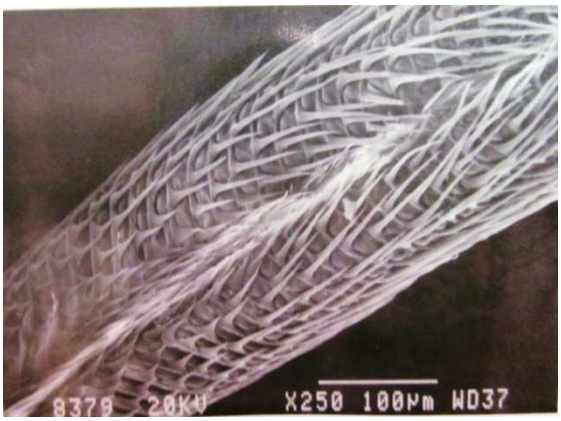

Fig. 4. SEM of middle part of the tongue

Fig. 5. Higher magnification of middle part

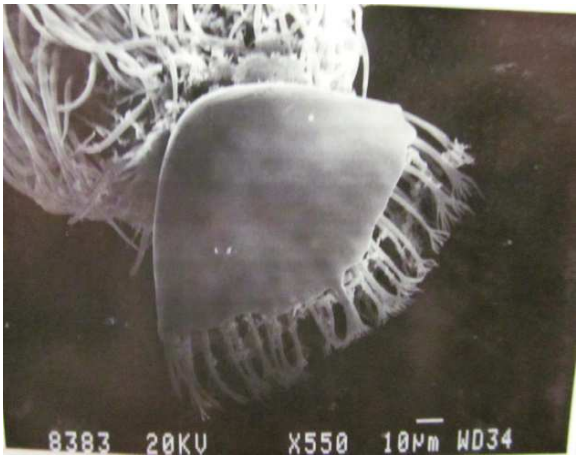

Fig. 6. SEM of distal part showing flabellum

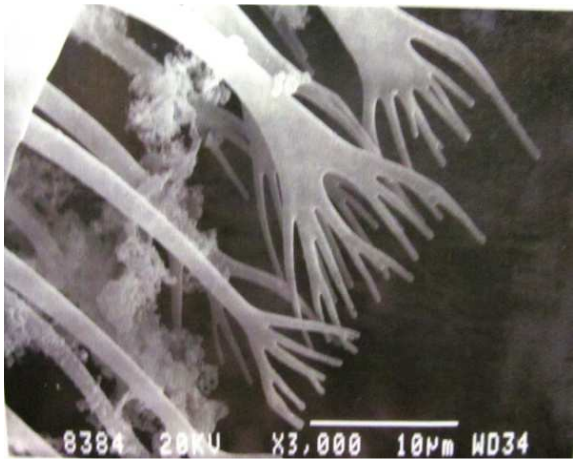

Fig. 7. Higher magnification of the branched structures present on flabellum

Apis mellifera

The proximal region of *Apis mellifera* showed a regular pattern of ridges that possessed one short and spinous structures. **(Fig. 8).** The spines were much shorter than there observed in *A.cerana*. The middle part exhibited irregularly arranged rows of hair along the grooved region. The hairs were longer and thinner than *A.cerana.* There were straight and almost of equal length. A few hair were however seen to possess bifurcated tips **(Fig. 9 and 10).** The distal region forming the flabellum was roughly triangular in shape **(Fig. 11)**. The distal margin of the flabellum possessed the characteristic long, distinct processes branched at the tips **(Fig. 12).**

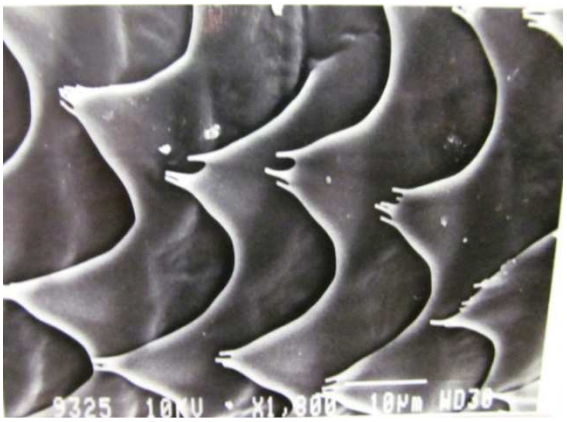

Fig. 8. SEM of proximal part of tongue

Fig. 9. SEM of middle part of the tongue

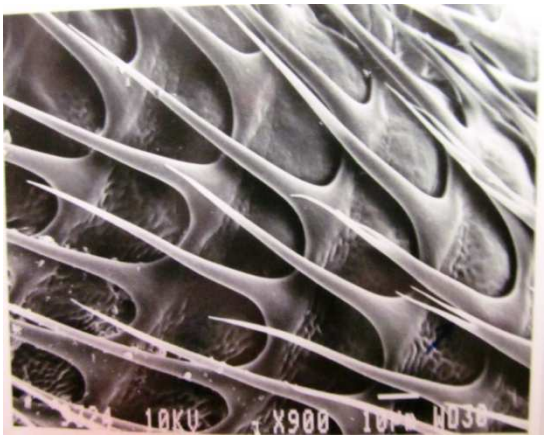

Fig. 10. Higher magnification of middle part

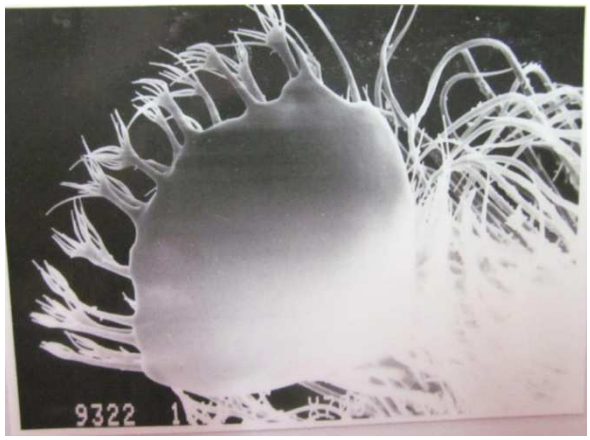

Fig. 11. SEM of flabellum

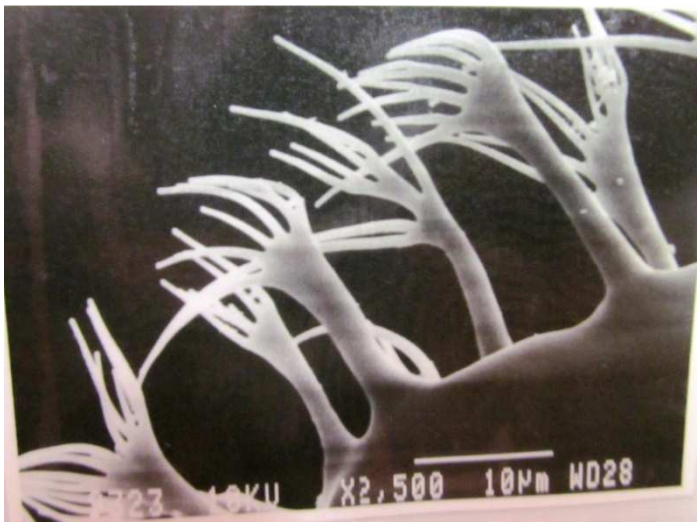

Fig. 12. Higher magnification of the distal end of flabellum showing branched processses

DISCUSSION

The ultrastructure of mouth parts in honey bee has been poorly studied. Very few workers have worked on this technique for differentiation of species. SEM revealed gustatory sensilla in the form of hair (chaetic sensilla) or pegs (basiconic sensilla) on *Apis mellifera* L. (Esslen and Kaissling, 1976). Erickson *et al.* (1986) performed the SEM studies on the mouth parts of worker *Apis mellifera* and reported the sensilla and their distribution on the labrum, mandibles and maxillae. Differences in the shape of the sensory structures of tongue of *Apis dorsata* F. from Nurpur and Jaipur have been reported by Anudeep and Kumar (2012 b). They reported different types of sensilla found on prementum, labial palps, galeae and glossa. During the present investigations, these findings are interesting in the respect that these perhaps reflect the similarity in the habits of the cavity-nesting bees *viz.*, *A.cerana* and *A.mellifera*. The two bees showed distinct morphological variations with respect to the lapping and sucking apparatus. The chaetic sensilla of previous workers correspond to the long hair observed during the present study and showed distinct differences with respect to shape and size. The shape of flabellum differed in the two species reason being the influence of native flora. Present SEM studies helped to identify characteristic ultrastructural variations observed in different parts of the tongue of the 2 cavity-nesting species.

ACKNOWLEDGEMENTS

We are grateful to UGC (BSR), New Delhi for providing financial assistance.

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