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Ultrastructural studies on cibarium of two species of genus *mansonia* (culicidae: diptera) to explore new & additional taxonomic attributes

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Abstract
Scanning electron microscopy (SEM) studies have been conducted on cibarium of two species of genus *Mansonia* i.e. *Mansonia* (*Mansonioides*) *uniformis* (Theobald) and *Mansonia* (*Mansonioides*) *indiana* Edwards. New and additional taxonomic attributes like lateral flanges, cibarial bar, cibarial teeth; the number, distribution and type of the sense organs have been studied and illustrated. These new and additional characters will be incorporated in the revised diagnosis of both the species.

Keywords: Diptera**,** *Mansonia*, Cibarium, SEM

1. Introduction

Mansonia uniformis (Theobald) is the primary vector of *Wuchereria bancrofti*, Bancroftian *Brugia malayi* (Malayan filariasis) and *Brugia pahangi* (Tropical eosinophilia), Chikungunya virus was also isolated from this species. But the other species *Mansonia indiana* Edwards has been incriminated as a vector of periodic *B. malayi* in Indonesia, Thailand, India and Ceylon (Ramalingam *et al*., 1968). Morphologically, both the species can be distinguished from each other with respect to the pale bands on hind tarsomeres and ill defined spots on scutum. But, sometimes collection and preservation leads to deterioration of important morphological characters employed in taxonomic keys. Therefore, additional and new taxonomic attributes are always beneficial to update the status of various vector species. With this background, an effort has been made to find out some additional and new taxonomic attributes in two species of genus *Mansonia* in the present manuscript.

Various workers like Theobald (1901), Dyar (1925), Gerry (1932), Barraud(1934), Carter (1950), Pratt (1953), Delfinado (1966), Tanaka et al. (1979), Harbach and Knight (1980), Gas *et al*. (1983), Boza *et al*. (2006) and Kirti *et al*. (2014) have done studies on different aspects related to *Mn. uniformis* and *Mn. indiana*. But none of these authors studied the cibarium of the above mentioned medically important species with the aid of SEM and this study has been done for first time to fill this gap. The characteristics like lateral flanges, cibarial bar, cibarial teeth; the number, distribution and type of the sense organs have been described and illustrated in detail.

Material & Method

Several collection-cum-survey tours were conducted at regular intervals throughout the state of Punjab. The adult mosquitoes were collected from gardens, human dwellings, cattle sheds and paddy fields with the help of oral aspirators and torch. The adults caught were killed with ethyl acetate and preserved in collection boxes for further investigation. They were identified with the help of the keys of Barraud (1934) & Sirivanakaran (1976). The method given by Lee and Craig (1983) was followed for studying cibarial armature with certain changes. The heads of the adult female mosquitoes were alienated from their body and boiled in 10% KOH solution till their clearance. These were then washed several times in water. The head was placed on a slide with a drop of water, dissected with the help of dissecting needles, under binocular microscope having as an attachment camera. Compound eyes were slowly pulled apart in order to expose cibarium which is located immediately behind the clypeus. The specimens were washed in several changes of distilled water and dehydrated by passing through ascending grades of alcohol. The specimens were then put on stubs in dorsal position after air drying on

filter paper and coated with gold. After that images were observed under JSM-6610LV Scanning Electron Microscope at Indian Institute of Technologies (IIT), Ropar.

Results and Discussion:

Mansonia (Mansonioides) uniformis (Theobald)

CIBARIUM: Length of cibarium ranges 273.80µm with approximately half width (Fig. 1)

Cibarial armature: (Fig. 2 & 3)

Lateral flanges stout, upper ends slightly curved outwards; width between posterior ends of two lateral flanges ranges 90µm. Cibarial bar having 8-10 teeth, small, about 4.81 ± 0.75µm in length, leaf like structures, placed in a cluster in center of cibarial bar (Fig. 4). Posterior hard palate smooth and even.

Cibarial sense organs:

- Palatal papillae: 4 in number, innervative structures, closely placed in semi-circle and situated at tip of posterior end of anterior hard palate; socket diameter ranges from 1.60 ± 0.25µm (Fig. 5 & 6).
- Larger dorsal papillae: 2 in number, placed on either side, near to center of anterior hard palate; socket diameter ranges from 1.83 ± 0.37µm (Fig. 5).
- Smaller dorsal papillae: 2 in number, placed on either side; socket diameter ranges from 1.75 ± 0.35µm (Fig. 5).

Mansonia (Mansonioides) indiana Edwards

Figure 1. Pharyngeal pump

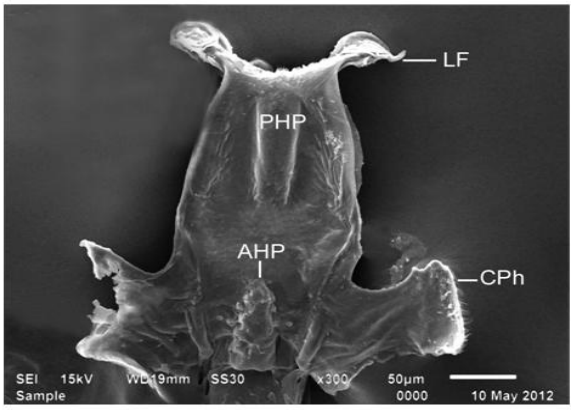

Figure 2. Cibarium

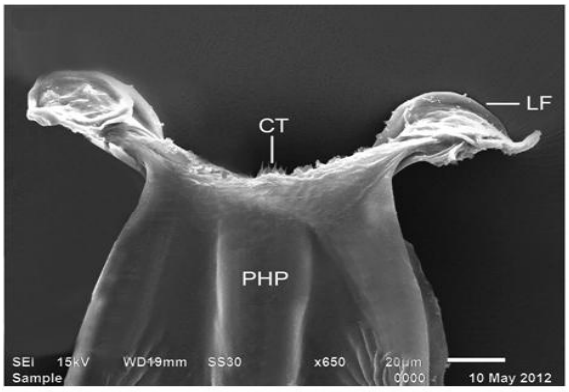

Figure 3. Cibarial armature

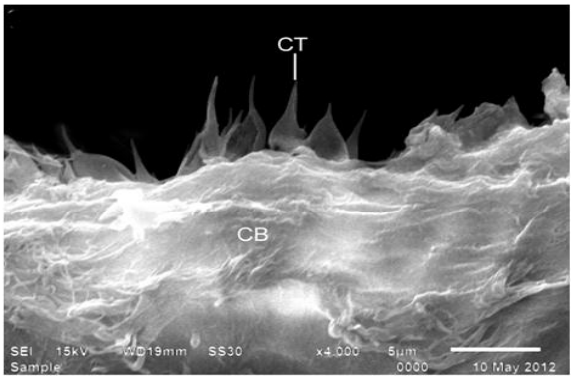

Figure 4. Cibarial teeth

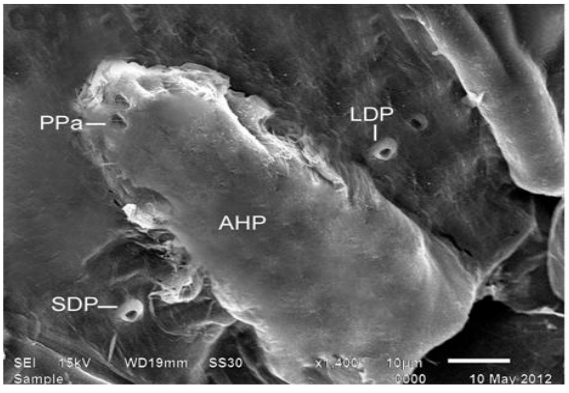

Figure 5. Antero-dorsal membrane

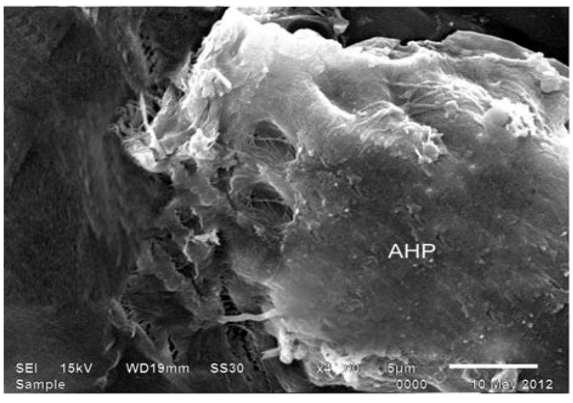

Figure 6. Palatal papillae

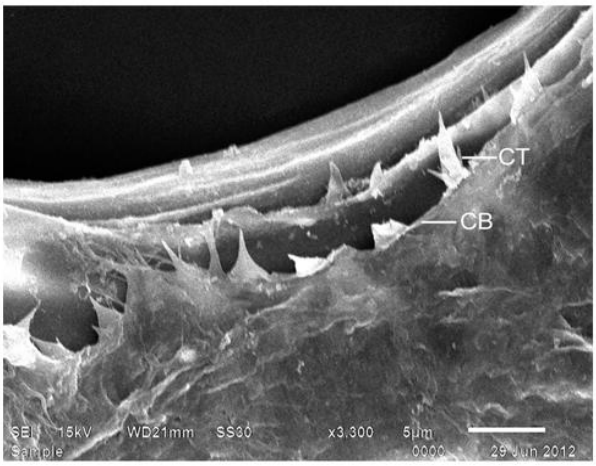

Figure 7. Cibarial armature

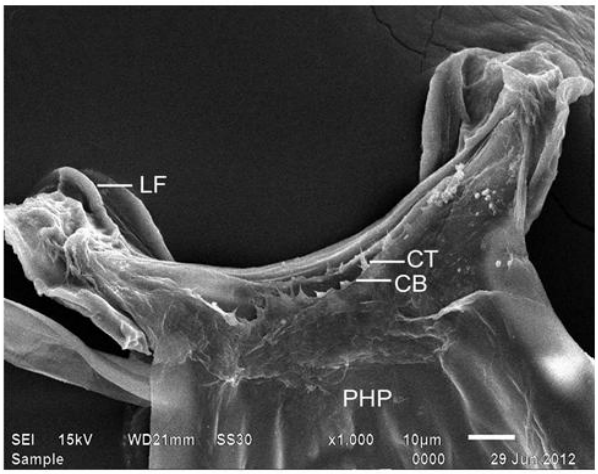

Figure 8. Cibarial teeth

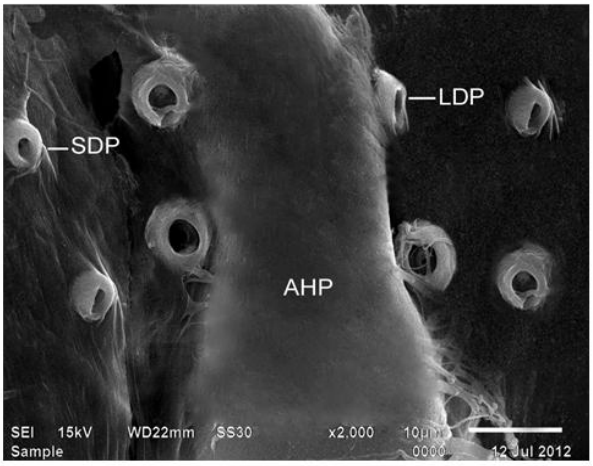

Figure 9. Antero-dorsal membrane

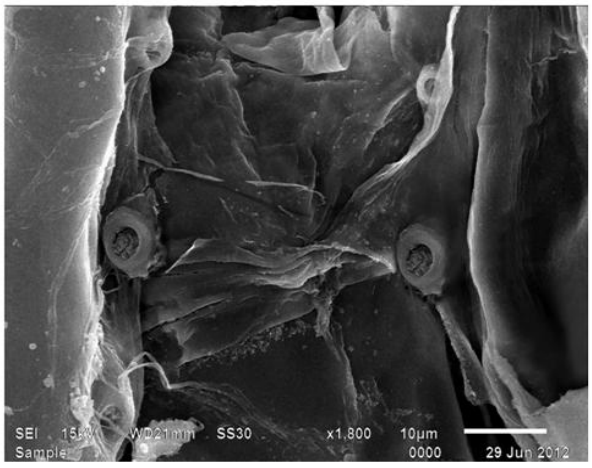

Figure 10. Larger dorsal papillae

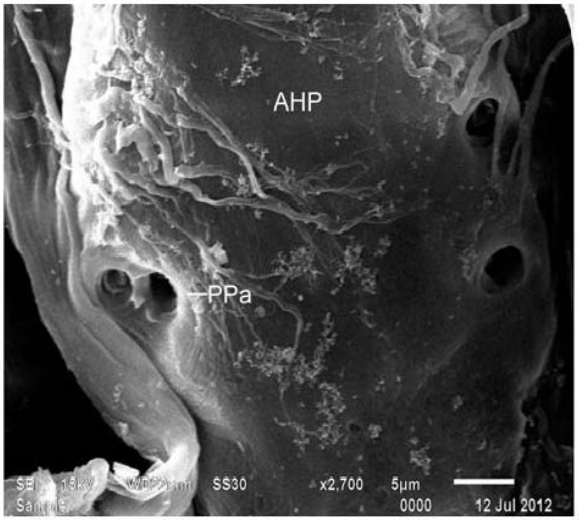

Figure 11. Palatal papillae

Abbreviations: AHP– Anterior Hard Plate, CB– Cibarial bar, CT– Cibarial teeth, CPh– Clypeal phargma, LDP– Larger dorsal papillae, LF– Lateral Flange, PPa– Palatal Papillae, PHP– Posterior Hard Palate, SDP– Smaller Dorsal Papillae

Cibarial armature: (Fig. 7 & 8)
Width between posterior ends of two lateral flanges ranges 95.71µm. Median portion of cibarial armature uneven and rough, in the form of a thin bar or cibarial bar, on which 12-15 cibarial teeth present. Cibarial teeth small, about 4.72 ± 0.9µm in length, spiny leaf like structures and arranged in two rows. Posterior hard palate smooth and even.

Cibarial sense organs:

- Palatal papillae: 4 in number, out of these two making a pair on one side and another two placed near to periphery of anterior end of anterior hard palate; socket diameter ranges from 3.02 ± 1.33µm (Fig. 11).
- Larger dorsal papillae: 4 in number, two placed on either sides to form quadrilateral shape, one pair situated at a

short distance apart from each other; socket diameter ranges from 2.61 ± 0.66µm (Fig 9 & 10).

- Smaller dorsal papillae: 4 in number, two on each side of anterior hard palate, equally situated on both sides; socket diameter ranges from 1.24 ± 0.25µm (Fig. 9).

Taxonomists have always tried to update the diagnosis and status of various taxa of family Culicidae in general and vector species in particular. The present study has proved very useful because characters like lateral flanges, cibarial bar, cibarial teeth; the number, distribution and type of the sense organs have been found to be very relevant. Both the species can be distinguished from each other on basis of number of cibarial teeth (8-10 in *Mn. uniformis* and 12-15 in *Mn. indiana*) present on cibarial bar; arrangement of palatal papillae (semi-circle or sparsely) and number of larger and smaller dorsal papillae (two each in *Mn. uniformis* whereas four each in *Mn. indiana*).

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