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Scanning electron microscopic studies on cibarium of *Aedes albopictus* (Skuse) & *Aedes aegypti* (Linnaeus)

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Abstract

Studies on cibarium of two species: *Aedes albopictus* (Skuse) and *Aedes aegypti* (Linnaeus) have been conducted using Scanning Electron Microscope (SEM) to explore additional taxonomic attributes. Many new taxonomic characters i.e. width and characteristics of lateral flanges, number and arrangement of cibarial sense organs or papillae viz. palatal papillae, larger dorsal papillae, smaller dorsal papillae, and ventral papillae have come to light.

Keywords: *Aedes*, Cibarial armature, SEM

1. Introduction

Cibarium is an integral part of the alimentary canal and lies within the head of mosquitoes. Cibarium is dorsoventrally flattened structure situated under the clypeus at the proximal end of proboscis. It is located at the base of pharyngeal pump (Lee and Craig 1983) ^[1]. Cibarium is composed of two parts i.e. cibarial armature that includes cibarial teeth in some species and cibarial sense organs. The latter is furnished with palatal papillae, larger dorsal papillae, smaller dorsal papillae and ventral papillae. Formerly the structure was referred as the pharynx, basipharynx, buccal cavity or simply as the food pump. Latter Snodgrass (1935) ^[2] recognized it as the preoral mouth cavity and given the name as "Cibarium".

Cibarium was first pinpointed as a morphological character in the field of taxonomy and identification of many closely related species because of large amount of variations within different taxa by Sinton and Covell (1927) ^[3]; Barraud and Covell (1928) ^[4]; Michener (1944) ^[5]; Chen (1972, 1974) ^[6, 7]; Sirivanakarn (1978) ^[8]; Forattini and Sallum (1992) ^[9]. SEM studies have been made on the cibarium of two medically important species i.e. *Aedes albopictus* (Skuse) and *Aedes aegypti* (Linnaeus) for the first time in this country. Significant differences have been found among two species owing to the width & characteristics of lateral flanges, number and arrangement of cibarial sense organs or papillae viz. palatal papillae, larger dorsal papillae, smaller dorsal papillae, and ventral papillae. These new features can be used to update the status of both the species.

2. Materials and Methods

2.1 Study area: For mosquito collection, several collection-cum-survey tours were conducted at regular intervals in gardens, human dwellings, cattle sheds and paddy fields throughout the Punjab state at dawn and dusk time (between 6:00 A.M. to 10:00 A.M. and 7:00 P.M. to 10:00 P.M.). Specimens were then brought to the laboratory for the proper preservation in collection boxes.

2.2. Identification: Morphological identification was done by following keys of Barraud (1934) ^[10] and Reuben *et al.* (1994) ^[11] upto family and genus level. However, the species were further authentically identified by following the keys of Sirivanakarn (1976) ^[12], Reinert *et al.* (2004) and Rueda (2004) ^[13].

2.3. Preparation of cibarium samples: For Scanning Electron Microscopy, the method given by Lee and Craig (1983) was followed with some modification. Heads of at least five adult female mosquitoes were alienated from their body at a time and boiled in 10% KOH solution till their clearance. These were then washed several times in water. The heads were placed on slide one by one with a drop of water, dissected with the help of dissecting needles, under

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binocular microscope. 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 exposing 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 Technology (IIT), Ropar.

3. Results and Discussion

3.1. *Aedes albopictus* (Skuse):

Cibarium: Length of cibarium twice its width and anterior dorsal hard palate about one third the length of cibarium.

- **Cibarial armature:** Lateral flanges stout, upper ends not curved outwards; width between posterior ends of two lateral flanges ranges approximately 65µm. Cibarial teeth absent. Posterior hard palate quite rough and uneven (Figure: 2).

Cibarial sense organs

- **Palatal papillae:** 4 in number, sparsely and randomly situated at anterior end of anterior hard palate; socket diameter ranges from $1.87 \pm 0.24\mu\text{m}$ (Figure: 3 & 4).
- **Larger dorsal papillae:** 4 in number, forming quadrilateral shape, one pair situated at a short distance apart from each other; socket diameter ranges from $1.9 \pm 0.51\mu\text{m}$ (Figure: 3 & 4).
- **Smaller dorsal papillae:** 4 in number, two on each side of anterior hard palate, linearly placed and equally situated on both sides; socket diameter ranges from $1.32 \pm 0.25\mu\text{m}$ (Figure: 3)



Fig 1: Pharyngeal pump



Fig 2: Cibarial armature

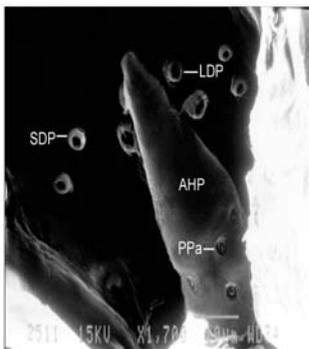


Fig 3: Antero-dorsal membrane

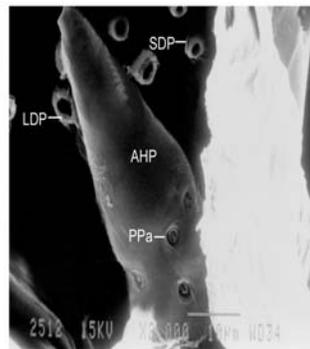


Fig 4: Palatal papillae

3.2. *Aedes aegypti* (Linnaeus)

Cibarium: Length of cibarium ranges 250µm with approximately half the width (Figure: 5).

- **Cibarial armature:** Lateral flanges stout, upper ends not curved outwards; width between posterior ends of two lateral flanges ranges between $71.44 \pm 4.61\mu\text{m}$. Posterior hard palate smooth and even (Figure: 6).

Cibarial sense organs

- **Palatal papillae:** 3 in number, two at periphery and one situated in center of anterior end of anterior hard palate; socket diameter ranges from $2.80 \pm 0.60\mu\text{m}$ (Figure: 9).
- **Larger dorsal papillae:** 4 in number, forming quadrilateral shape, one pair situated at a short distance apart from each other; socket diameter ranges from $2.25 \pm 0.37\mu\text{m}$ (Figure: 8).
- **Smaller dorsal papillae:** 8 in number, five on one side and three on another side of anterior hard palate, asymmetrically arranged on both sides but are equally situated; socket diameter ranges from $1.81 \pm 0.45\mu\text{m}$ (Figure: 8).
- **Ventral papillae:** 4 in number, placed in a group, forming a quadrilateral shape, each papilla with small outgrowth of length ranges from $2.38 \pm 0.33\mu\text{m}$; socket diameter ranges from $3.05 \pm 0.64\mu\text{m}$ (Figure: 6 & 7).

The earlier workers like Dapples and Lea (1974) [14], Uchida (1979) [15] and Lee and Craig (1983) from different parts of the globe mainly emphasized on the functions performed by cibarial sense organs on the bases of force- feeding mechanism using light microscopy in *Aedes albopictus* (Skuse) and *Aedes aegypti* (Linnaeus). It is for the first time the scanning electron microscopy of entire cibarium which is species specific have been done. These features can be incorporated in the revised diagnosis of both the species which are prominent vector of Dengue and Chikungunya.

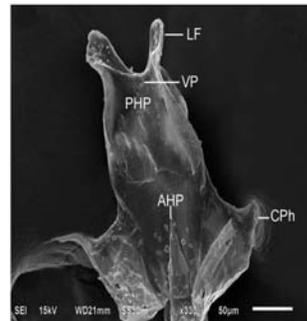


Fig 5: Cibarium

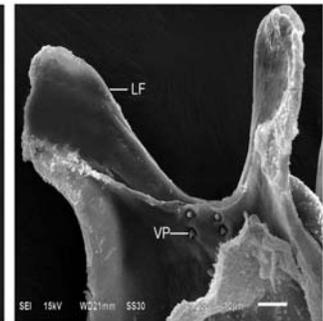


Fig 6: Cibarial armature

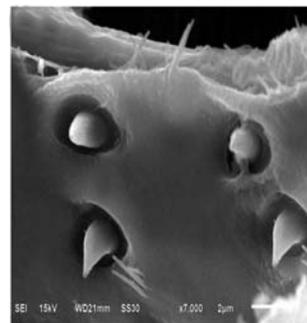


Fig 7: Ventral papillae

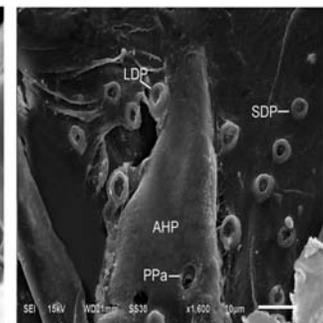


Fig 8: Antero-dorsal membrane

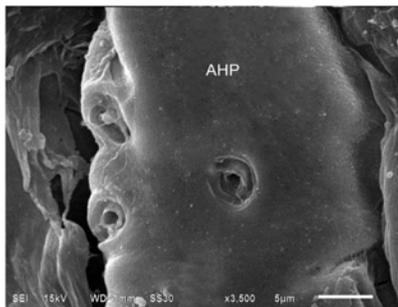


Fig 9: Palatal papillae

4. Abbreviations: AHP- Anterior Hard Palate, CPh- Clypeal Phragma, LDP- Larger Dorsal Papillae, LF- Lateral Flange, PHP- Posterior Hard Palate, PPa- Palatal Papillae, SDP- Smaller Dorsal Papillae, VP- Ventral Papillae

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