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Study of cibarium of *Armigeres (Armigeres) kuchingensis* Edwards with the aid of scanning electron microscope from Punjab

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Abstract

Scanning electron microscopic (SEM) studies have been conducted on cibarium of *Armigeres (Armigeres) kuchingensis* Edwards from Punjab to explore many new taxonomic attributes for the first time. The number and position of papillae of cibarium are highlighted in the manuscript.

Keywords: *Armigeres*, cibarium, SEM.

1. Introduction

Armigeres (Armigeres) kuchingensis was described by Edwards in 1915. This mosquito species is known from throughout India. The adult female representatives of this species are active during daytime in heavily shaded areas. Females readily attack on humans and are vicious biters. *Armigeres (Armigeres) kuchingensis* Edwards is a known vector of *Wuchereria bancrofti* (Tanaka *et al.*)^[1].

The mosquito cibarium is a dorsoventrally flattened, muscular pump situated under clypeus at the proximal end of proboscis. Posteriorly it is connected to pharyngeal pump (Lee and Craig)^[2]. The taxonomic importance of female cibarial armature in the classification of *Anopheles* and *Culex* was first demonstrated by (Sinton & Covell)^[3] and (Barraud & Covell)^[4]. (Christopher)^[5]. and (Barraud)^[6]. provided the figures and descriptions of these structures. Some eminent workers like (Toma and Miyagi)^[7, 8], (Ramalingam)^[9], (Toma *et al.*)^[10, 11], (Darsie)^[12], (Okazawa *et al.*)^[13], (Stone)^[14], (Thurman)^[15], (Basio and Basio)^[16], (Mattingly)^[17], (Mattingly and Qutubbdin)^[18] and (Baisas)^[19] worked on different aspects of various species belonging to genus *Armigeres*. The SEM study on cibarium of a very closely related species i.e. *Armigeres (Armigeres) subalbatus* (Coquillett) was conducted by (Kirti *et al.*)^[20]. But, nobody has attempted SEM studies on the present species, so far. It is for the first time that such studies have been conducted to explore new taxonomic attributes of cibarial armature in the present work.

2. Materials and methods

2.1. Collection and Identification

To optimize the diversity of mosquito fauna, entomological surveys were carried out in different districts of Punjab state during Pre Monsoon, Monsoon and Post monsoon seasons. Adult mosquitoes were collected from indoor and outdoor dwellings, cattle sheds, hay stacks and outdoor bushes with the help of oral aspirators, test tubes and torch light. Collected specimens were identified by using the keys given by (Darsie and Pradhan)^[21], (Sirivanakarn)^[22], (Huang)^[23], (Reinert *et al.*)^[24] and (Reuda)^[25] and terminology given by (Harbach and Knight)^[26]. Followed. Only a limited number of specimens were collected during March 2012- March 2014.

2.2. Sample preparation

For SEM studies of cibarial armature, the method given by (Lee & Craig)^[2] has been adopted. The heads of adult female mosquitoes were snipped off from body and boiled in 10% KOH solution till their clearance. Dissected material was washed several times with water. The head was placed on a slide with a drop of water and dissection was completed with needles under the binocular microscope. Compound eyes were slowly pulled apart in order to

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expose cibarium that is located immediately behind the clypeus. Dissected material was washed several times with water and dehydrated by passing through ascending grades of alcohol. The specimens were placed on stubs in dorsal position after air drying on filter paper and then coated with gold and scanned under JSM- 6100 Scanning Electron Microscope at Indian Institute of Technology (IIT), Ropar.

2.3. Material Examined

Samana: (Shatrana) 25.III.2012, 6 ♀♀; **Patraan:** (Ghaga) 26.III.2012, 4 ♀♀; **Mansa:** (Rakhra) 26.III.2012, 1 ♀; **Anandpur:** (Brahampur) 16.V.2012, 1 ♀; **Nangal:** (Jandala) 17.V.2012, 1 ♂; (Swamipur) 30.VII.2013, 1♀, (Meghpur) 31.VII.2013, 1 ♂, 3 ♀♀, (Patti) 31.VII.2013, 3 ♀♀, (Bahman basti) 4.III.2014, 3 ♀♀; **Malerkotla:** 28.IV.2013, 1 ♀.

3. Results and discussion

3.1. Cibarium (Fig. 1-8): length of cibarium twice its width and anterior dorsal hard palate about one-third length of cibarium.

3.2. Cibarial armature (Fig.1): Lateral flanges rounded, upper ends curved outwards. A horizontal row of projection found posterior to posterior hard palate, projected downward in middle.

3.3. Cibarial sense organs

3.3.1. Palatal papillae (Fig.5): Three in one group (2 are close and 1 apart from others), situated on membranous dorsal wall of hard palate.

3.3.2. Dorsal papillae (Fig.3): A pair of these papillae situated near anterior hard palate on membranous dorsal wall of cibarium.

3.3.3. Campaniform papillae (Fig.3): Single pair (One on either side), situated on posterior half of hard palate, on dorsal membranous wall of cibarium.

3.3.4. Trichoid Papillae (Fig.4): Nine in number, four on one side and five on another side, are socketted at base, situated on anterior membranous dorsal wall of cibarium.

3.3.5. Ventral papillae: Absent.

Taxonomic attributes of cibarium in present species i.e. *Armigeres (Armigeres) kuchingensis* Edwards have been studied and illustrated with the help of scanning electron microscope. These characters can be used for discrimination of the present species from its closely allied species. Such studies have not been conducted on the present species. So far, this is for the first time that cibarium of *Armigeres (Armigeres) kuchingensis* Edwards has been studied in detailed with the help of SEM.

Cibarium of *Armigeres (Armigeres) kuchingensis* Edwards

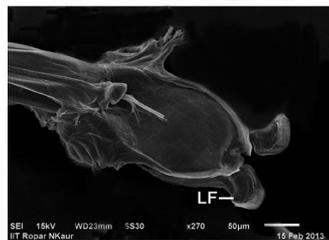


Fig. 1 Cibarial Armature

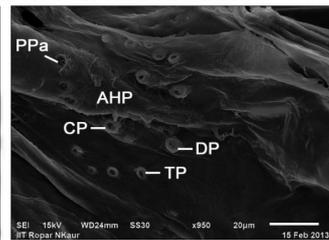


Fig. 2 Antero-dorsal membrane

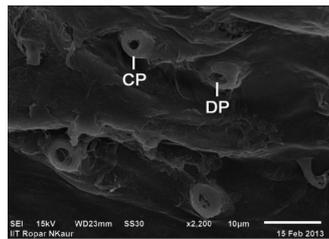


Fig. 3 Dorsal & Campaniform Papillae

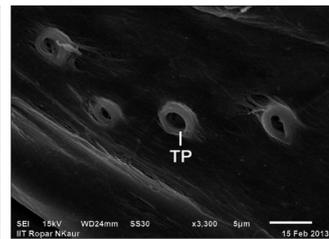


Fig. 4 Trichoid Papillae

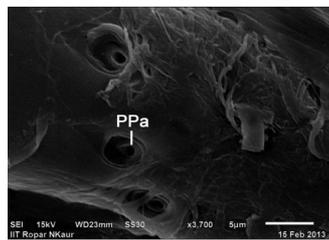


Fig. 5 Palatal Papillae

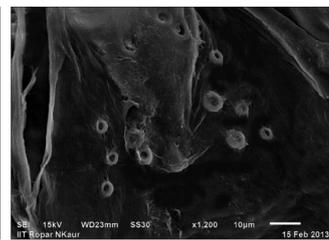


Fig. 6 Antero-dorsal membrane

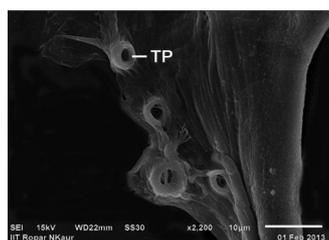


Fig. 7 Trichoid Papillae (Magnified)

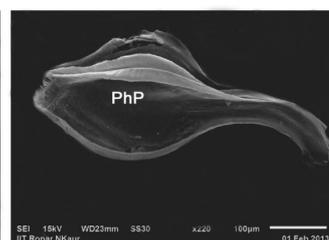


Fig. 8 Pharyngeal Pump

4. Conclusion

Taking in view the different functional and adaptive significance of cibarial armature, the study has been done. The new taxonomic attributes like palatal papillae, dorsal papillae, campaniform papillae and trichoid papillae have been explored and have taxonomic significance. The present species is closely allied to *Armigeres (Armigeres) subalbatus* (Coquillett). It is very difficult to distinguish both the species except sternites V-VI being pale scaled in *Armigeres (Armigeres) kuchingensis* Edwards. However, both the species can be distinguished on the basis of new taxonomic characters very easily. The number of various papillae have been studied and compared with work done by the earlier workers. Palatal papillae are three in number in the present species whereas, four in *Armigeres (Armigeres) subalbatus* (Coquillett). The number of trichoid papillae is nine in present species and eight in *Armigeres (Armigeres) subalbatus* (Coquillett). However, the number of dorsal papillae and campaniform papillae is similar i.e. four (Kirti *et al.*)^[20].

5. Abbreviations

AHP (Anterior hard palate), CP (Campaniform Papillae), DP (Dorsal Papillae), LF (Lateral Flang), PhP (Pharyngeal Pump), PPa (Palatal Papillae) and TP (Trichoid Papillae).

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