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Comparision of Male and Female Genitalia of *Culex* species with Scanning Electron Microscopy (SEM)

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SEM, genitalia, *Culex vishnui* and *Culex pseudovishnui*.

A B S T R A C T

The genitalic structure of male and female mosquitoes of two species belonging to genus *Culex* i.e *Culex (Culex) vishnui* Theobald and *Culex (Culex) pseudovishnui* Colless is studied morphologically and illustrated with the aid of Scanning Electron Microscope (SEM) from Punjab.

Introduction

The species or different forms of it, has a wide distribution throughout African continent including even the Central Sahara and it also occurs in Madagascar. It is widely distributed throughout the Mediterranean region from Punjab (Edwards, 1941; Mattingly, 1954). *Culex vishnui* has been confused with *Culex pseudovishnui* in the past due to their close resemblance; they are definitely distinct species, which are easily distinguished by larval and genitalic characters. The larvae of *Culex vishnui*, *Culex pseudovishnui* and *Culex tritaeniorhynchus* were common in rice fields where they aggregated near the edges of paddy fields during early rice growing season, April to May. In addition to *Culex tritaeniorhynchus*, *Culex vishnui* is possibly one of the important vectors of Japanese Encephalitis virus in Southeast Asia, because of difficulty in separating the adults from sympatric sibling species, *Culex*

pseudovishnui and *Culex tritaeniorhynchus*, its significance in natural transmission of disease has not yet been clearly established Miyagi *et al.* (1992). In Taiwan, (Cates and Detels, 1969) found *vishnui* to be only Japanese Encephalitis virus positive mosquito and concluded that it was the important vector of this disease. Regarding breeding sites both the species having similar habitat like open cultivated lands such as rice fields, stagnant pools, pits and edges of swamps. Their preferred hosts include cows, buffaloes, pigs etc. They also attack on man occasion. These species has been found to be involved in cycle of West Nile virus in Egypt and becoming probably infected from birds (Taylor *et al.*, 1956). The Southeast Asian *Culex vishnui* complex has attracted much attention because of its importance as potential vectors of Japanese Encephalitis virus and related arboviruses (Sirivanakarn, 1976).

Work done on the above said species by Barruad (1934), Bram (1967), Colless (1957), Delfinado (1966), Hara (1957), Jupp and Brown (1967), LaCasse and Yamaguti (1950), Matsuo (1959, 1968 & 1970), Matsuo and Ramalingam (1971& 1972), Matsuo and Iwaki (1972), Miyagi (1971), Miyagi *et al.* (1992), Reuben (1969, 1971a & 1971b), Sagandeeep and Kirti (2006), Sirivanakarn (1975, 1976), Theobald (1901), Yamamoto (1969).

Material and methods

Adult mosquitoes were procured with the help of oral aspirators, test tubes, torch and insect collecting nets from gardens, cattle sheds, hay stacks, nurseries, forests and human dwellings from the different districts of Punjab. For the identification of species keys given by Darsie and Pradhan (1990), Sirivanakarn (1976), Huang (1979), Reinert *et al.* (2004) and Reuda (2004) and terminology given by Harbach and Knight (1980) and for SEM studies protocol given by Chaudhry and Gupta (2004) and Lee and Craig (1983) was followed. For genitalic studies, the last two abdominal segments of adult male and female mosquitoes were snipped off with fine forceps from their body.

These abdominal tips were boiled in 10% KOH solution until their clearance. Dissected material washed several times with water and dehydrated by passing through ascending grades of alcohol. The specimens were placed on stubs in dorsal positions after air drying on filter paper and coated with gold. After that images were observed under JSM-6610LV SEM.

Result and Discussion

Regarding genitalia, several characters i.e. basistyle, dististyle, subapical lobe, paraproct, aedeagus, phallosome etc. are

important for species identification. Female genitalia are important to point out that spermatheca located inside abdomen and its morphological architecture as well as its number is used as taxonomic characters. (Alexander- Pires, 2010).

Male genitalia

***Culex vishnui*:** Dististyle arcuate and flanged laterally along with two minute papillated hair and subapical claw bilobed at apex (Fig. 7); basistyle conical and abruptly tapered beyond the subapical lobe with long setae on lateral side and small setae on dorsal surface (Fig. 1); subapical lobe with (a-h) setae all of varying size and length (Fig. 6).

Seta a very elongated and bent downwardly, b long with sharp apex, d leaf like, e and f rod like, g acuminate apically in the present studies but it is of axe shaped according to Sagandeeep and Kirti (2006) and h small in size; inner division of lateral plate of phallosome having nine finger like projections (Fig. 4). Out of nine projections, five long and well developed, other four short and poorly developed (Sagandeeep and Kirti, 2006).

However, these finger like projections give palmate like appearance with varying length i.e. first two longest, three medium and 4-5 shorter with their apices reaching beyond apical margin of spiculate sternal process; rest four on other side comparatively shorter; inner sternal spiculate process not completely separated from outer division bears numerous spines (Sagandeeep and Kirti, 2006); outer division with strong mesal spine with bifid apex and a strong sternal spine with pointed apex; basal sternal process (Fig. 3) dark, stout, long, curved and well developed; cercal setae (Fig. 2) two in number on proximal region of paraproct.

**Male Genitalia of
Culex (Culex) vishnui Theobald**

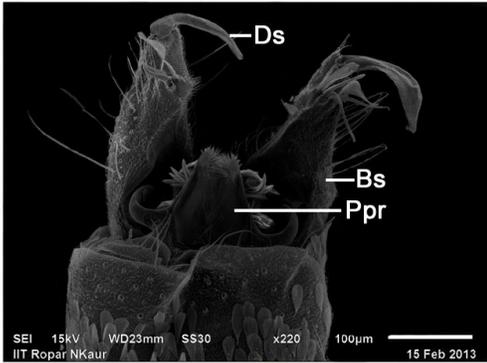


Fig. 1 Male Genitalia

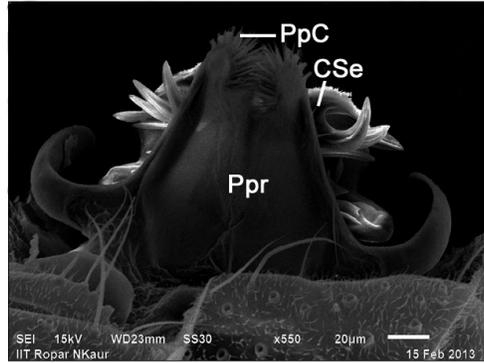


Fig. 2 Paraproct

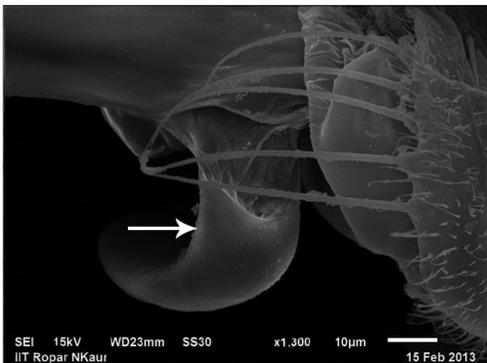


Fig. 3 Basal Sternal Process

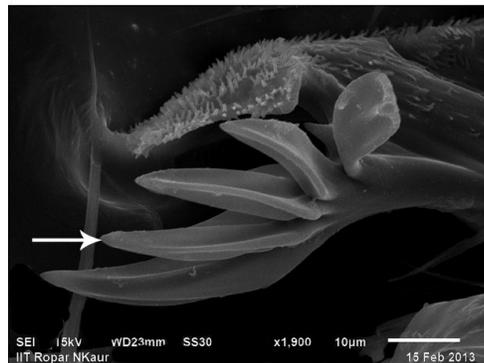


Fig. 4 Finger-like projections

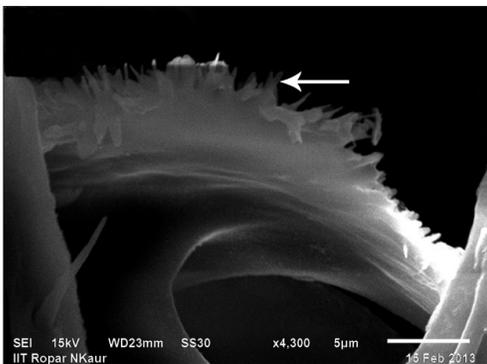


Fig. 5 Spines on Inner Division

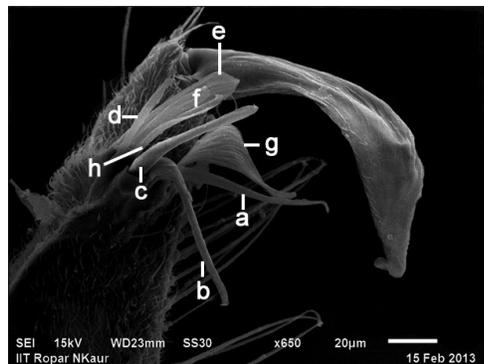


Fig. 6 Subapical Setae

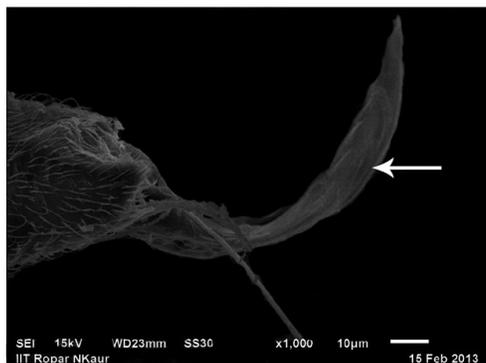


Fig. 7 Dististyle

**Female Genitalia of
Culex (Culex) vishnui Theobald**

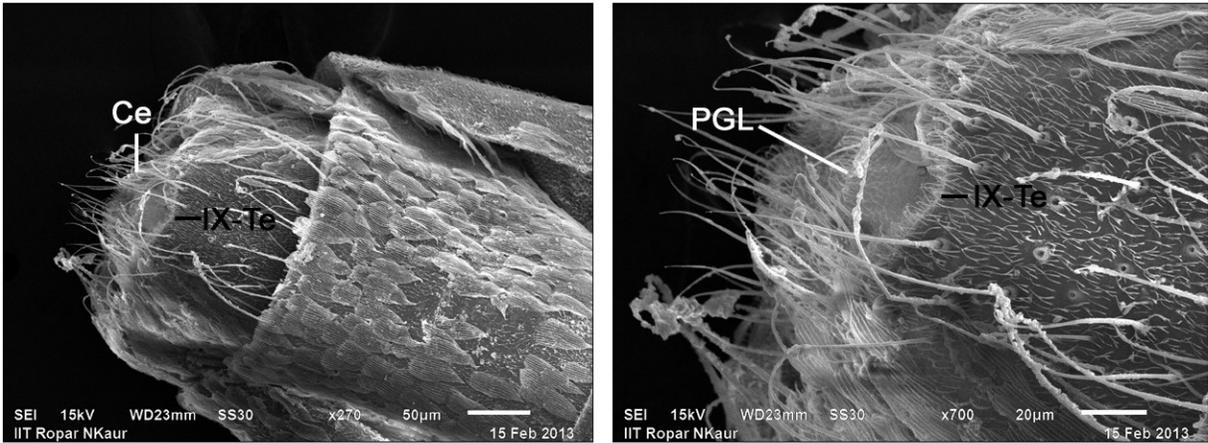


Fig. 8 & 9 Female Genitalia

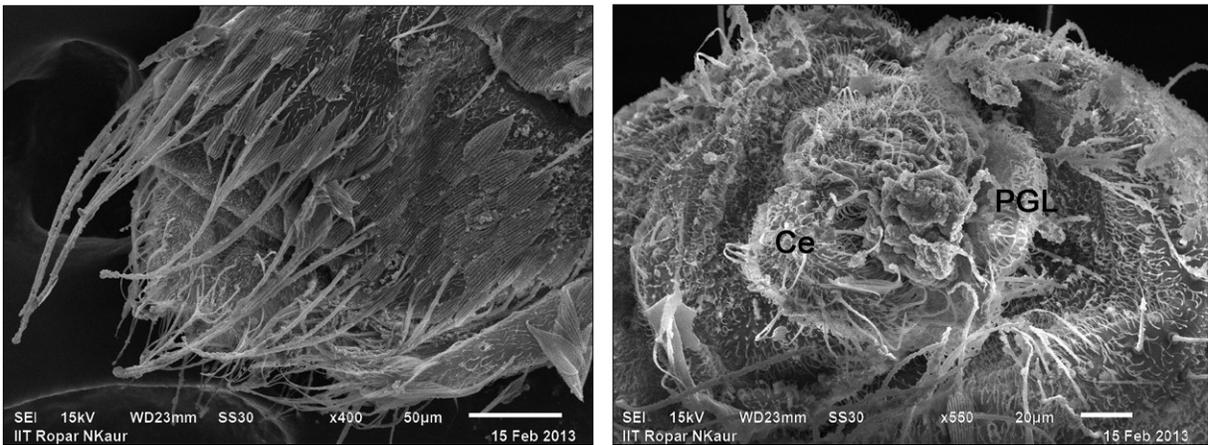


Fig.10 & 11 Female Genitalia (Slightly lateral view)

**Male Genitalia of
Culex (Culex) pseudovishnui Colless**

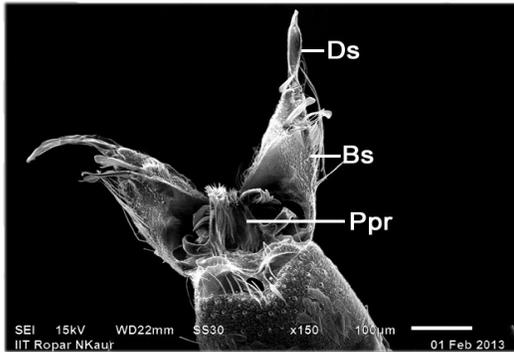


Fig. 12 Male Genitalia

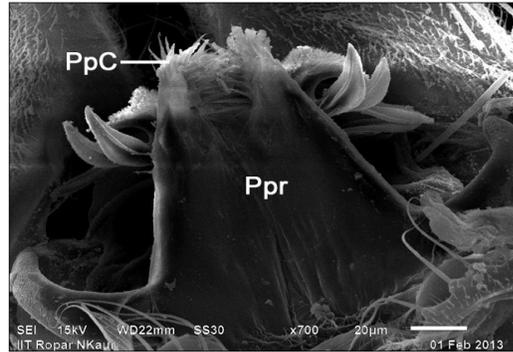


Fig. 13 Paraproct

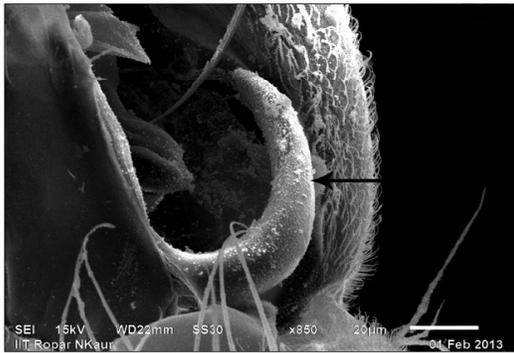


Fig. 14 Basal Sternal Lobe

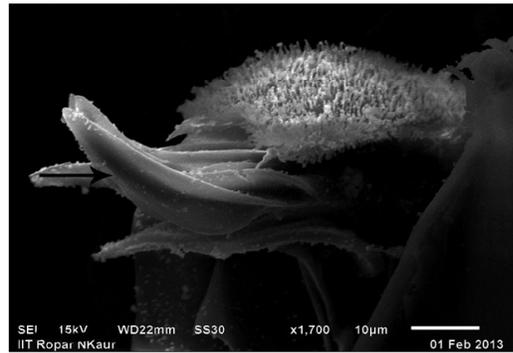


Fig. 15 Finger-like projections

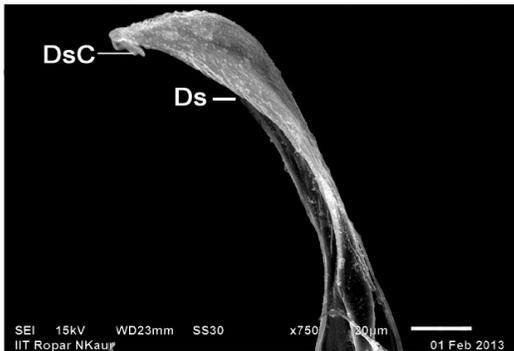


Fig. 16 Dististyle

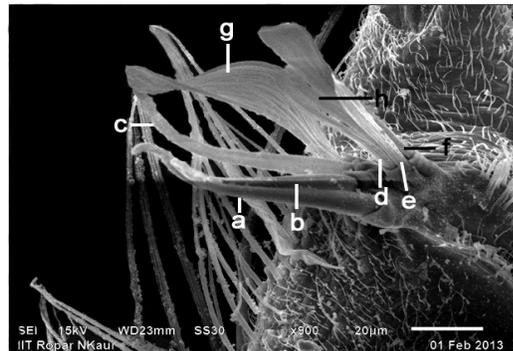
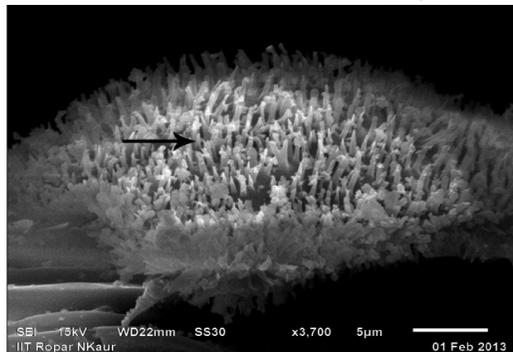


Fig. 17 Subapical Setae



**Fig. 18 Spines on spiculate
portion of inner division**

Female Genitalia of *Culex (Culex) pseudovishnui* Colless

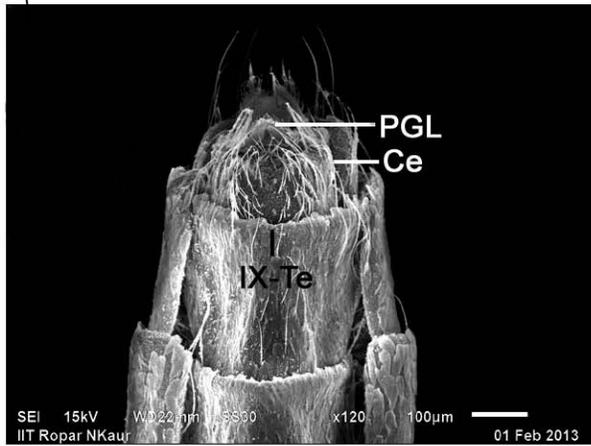


Fig. 19 Female Genitalia

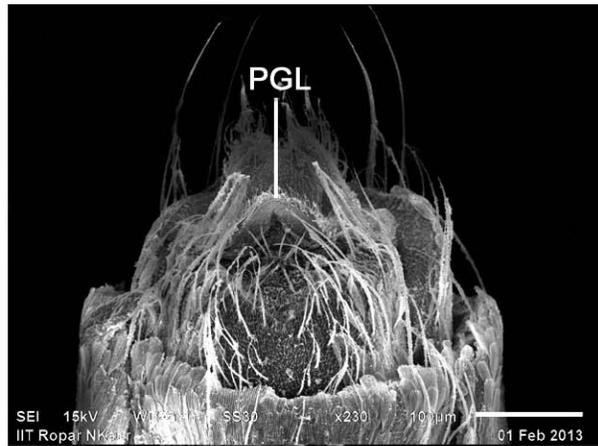


Fig. 20 Postgenital Lobe

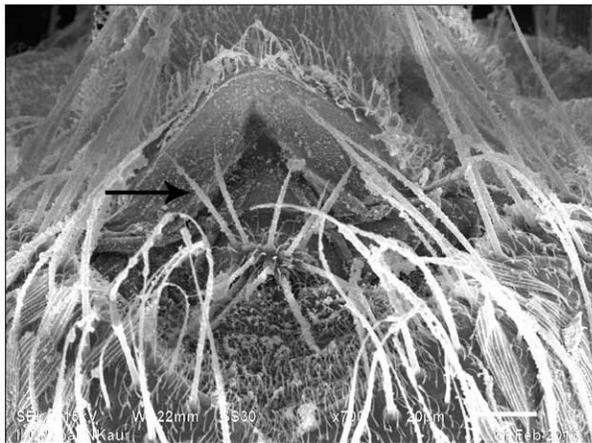


Fig. 21 Postgenital Lobe
(Showing Setae)

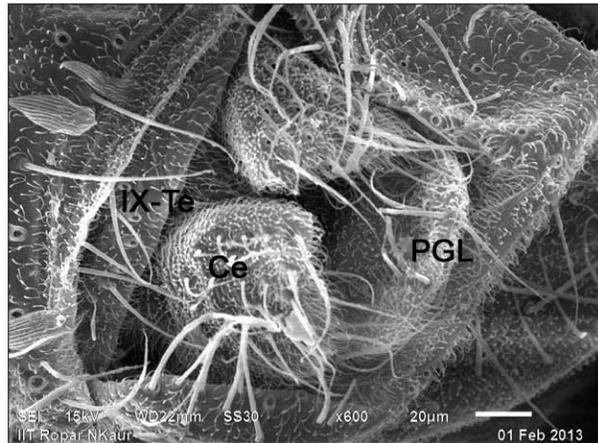


Fig. 22 Female Genitalia
(Slightly Lateral view)

Culex pseudovishnui: Basistyle (Fig. 12) having elongated dististyle (Fig. 16) with bilobed claw at tip; subapical lobe bearing various types of (a–h) setae (Fig. 17). Seta a prominent, b elongated, c flattened at apex and having spatulate appearance, d, e and f long, thin and rod like with curved apices, g broad, acuminate or rounded apically, h hair like in appearance; lateral plate of phallosome has both inner and outer divisions; paraproct bearing numerous

crown of setae at tip (Fig. 13); inner division of lateral plate of phallosome having eight finger like projections (Fig. 15) four on one side and four on the other, giving appearance of palmate process; inner sternal spiculate portion not completely separated from outer division having numerous spines (Fig. 18); 1-2 pair of cercal setae observed at the proximal and distal end of paraproct (Fig. 13); basal sternal process well developed, long and stout (Fig. 14).

Female genitalia

***Culex vishnui*:** Cerci short with numerous setae on the dorsal surface (Fig. 8 & 9); tergum IX slightly curved with minute row of setae (Fig. 10 & 11).

***Culex pseudovishnui*:** Cerci moderately smaller in size with numerous large setae; postgenital lobe (Fig. 20 & 21) bears five pair of setae on its margin; tergum IX forming a U- shaped structure with 6-7 setae (Fig. 22).

Culex pseudovishnui species has been most frequently misidentified as *vishnui*. During this study an attempt was made to correlate the differences between two species with varying genitalic attributes. Although genitalia of *Culex vishnui* was studied earlier by Sagandeeep and Kirti (2006). In the present research work, genitalia of above said species is compared with the previous one and try to find out some new and additional taxonomic attributes. The work on genitalia of *Culex pseudovishnui* of male and female mosquitoes is done for the first time in Punjab.

Abbreviations

Bs (Basistyle), Ce (Cerci), CSe (Cercal Seta), Ds (Dististyle), PGL (Post Genital Lobe), PpC (Paraproct Crown), Ppr (Paraproct) and IX-Te (IX- Tergum).

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