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Variations in the male genitalia of *Aedes* (*Stegomyia*) *albopictus* (Skuse) from Chandigarh and its surrounding areas (Diptera: Culicidae)

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Abstract

The Asian tiger mosquito *Aedes albopictus* is the most dominant species of subgenus *Stegomyia* and is medically important from the standpoint of transmitting wide range of human pathogens of deadly diseases like dengue, yellow fever and chikungunya. During present investigations, it has been observed that IX tergum in the male genitalia of *Aedes albopictus* varies greatly. It shows variations with respect to the presence or absence of lateral projections on the IX tergum, as well as in the shape and size of median and lateral projections. The shape of IX tergum in the male genitalia of *Aedes* species is of great taxonomic importance as it is a diagnostic character of the species. These variations have been observed both in natural populations collected from various breeding sites as well as in the adults reared in laboratory. The observed differences have not been noticed by any of the previous workers.

Keywords: *Aedes albopictus*, male genitalia, variations.

1. Introduction

Aedes (Stegomyia) albopictus, a globally invasive species is confined not only to tropical and subtropical regions of the old world, but also to the parts of continental Africa, Southern Europe and America^[14]. It has a high degree of vector potential to transmit greater variety of arboviruses like dengue virus, yellow fever virus in the wild, besides carrying Eastern and Western equine encephalitis virus, West Nile virus, chikungunya and Japanese encephalitis virus under laboratory conditions^[9]. Knudsen^[14] even mentioned the *Aedes albopictus* more dangerous than other species of subgenus *Stegomyia* because of having potential to pick variety of zoonotic viruses from vast menu of hosts.

During present investigations from Chandigarh and its surrounding areas, it has been observed that *Aedes albopictus* is a predominant species over *Aedes aegypti*. Various other workers have observed the same pattern of distribution in other parts of the world and also mentioned that continuous spread of *Aedes albopictus* has displaced the *Aedes aegypti*^[3, 6, 8]. Sagandeep and Monika while describing the seasonal prevalence and relative abundance in and around Chandigarh, also reported the predominance of *Aedes albopictus* and suspected that it might be due to intense competition between the two species for common food, habitat and environment^[15].

During present investigations on the subject, different types of individual variations have been noticed in the IX tergum of male genitalia of *Aedes albopictus*. These variations are found in the presence or absence of lateral projections and shape and size of median and lateral projections of IX tergum.

2. Material and Methods

The adults and immature stages of mosquitoes were collected from Chandigarh, India and its adjoining areas including both urban and rural areas. For the collection of adults, oral aspirators and hand nets were used while, the larvae and pupae were collected with the help of Plastic bowls and then Petri dishes were used to segregate different stages of larvae and pupae. These were collected from various breeding sites like ponds, drains, puddles and water containers and reared in laboratory at 28±1 °C. The adults emerged after 1-2 days or more depending on the weather conditions. The dead mosquitoes were mounted and stored in wooden storage cabinets for further study. For the preparation of slides of genitalia, the procedure given by Siverly and Shroyer^[16] was followed. The terminology advised by Harbach and Knight^[7] was adopted for naming

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various parts of genitalia.

3. Results and Discussion

As far as the morphology of *Aedes albopictus* is concerned, it is a member of *scutellaris* subgroup in having scutum with a long median longitudinal white stripe of narrow scales extending from anterior margin to about the level of wing root and distinguished from all other members of the *scutellaris* subgroup in having a **superalar** white line not clearly defined, presence of narrow scales over wing root, abdominal tergal markings are basal and not connected with lateral markings.

There are several other species belonging to *scutellaris* subgroup which have more or less similar ornamentation to *Aedes albopictus* but correct identification can be made on the basis of male genitalia. Various workers have also mentioned the importance of male genitalia in species identification especially in family Culicidae [2, 5, 16]. In India, not much work has been done on the detailed analysis of male genitalia of mosquito species. Barraud [1] who extensively surveyed all parts of India and also gave genitalic features, while describing species details, did not mention the variability of genitalic characters in *Aedes albopictus*. Kirti and Kaur [12] explored the male genitalic attributes of some species of *Aedes* along with their taxonomic relevance. However, in other parts of the globe, many workers while describing the species details along with their genitalic features have not recorded any kind of variation in the male genitalia of *Aedes albopictus* [4, 5, 9, 10, 11, 13].

In the male genitalia of *Aedes albopictus*, the Gonocoxites (GC) are short and broad with a patch of hairs on the dorsal

surface. *Gonostylus* (GS) are simple, elongate with apex somewhat swollen and having some hairs with a spiniform process. Claspettes (CL) are large with numerous setae. Paraprocts (PPR) are smooth, with a rounded apex and without any kind of teeth. Aedeagus (AE) is represented by several teeth on each side which are widened anteriorly. Tergum (TE) IX with a conspicuous horn like median projection which is about 1/3rd the length of paraprocts and lateral tergal projections on each side. (General view)

Therefore, in the present communication, various variations have been reported on the shape and size of median and lateral projections of IX tergal projection of male genitalia which can further be categorized broadly into 2 groups; one group having prominent lateral projections (LP) which vary in their shape and size while, the other is without prominent lateral projections. In addition to this, variations have also been observed in the shape and size of median apical projection (MP) of IX tergal projection which are described as follows:-

I. Variations in the median projection, where lateral projections are absent or poorly developed.

Ph.1: Median projection is broad, thick, short and becomes narrow towards apex.

Ph.2 Median projection is thin, long and tapering.

Ph.3 Median projection is broad, thick and becomes convex at the apex.

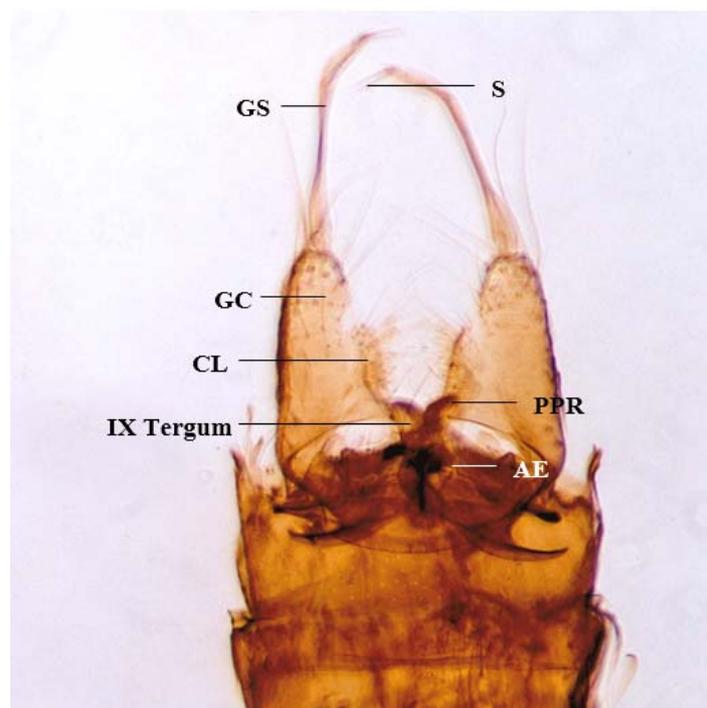
Ph.4 Median projection is narrow, thin & small and shows a kink/ bend towards tapering.

Ph.5 Median projection is broad and thick.

Ph.6 Median projection is thin, small and broad

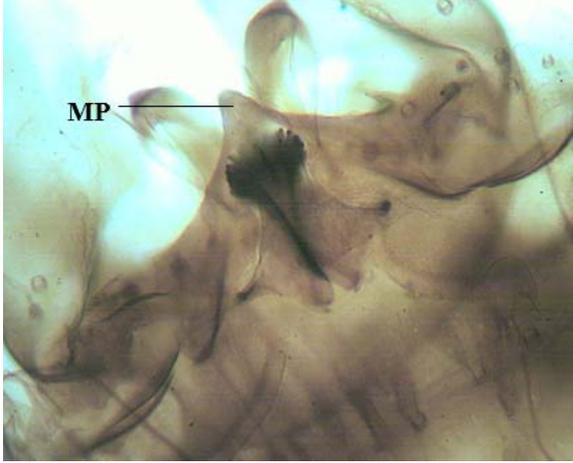
Ph.7 Median projection is thin, short and tapering.

Male Genitalia of *Aedes albopictus*

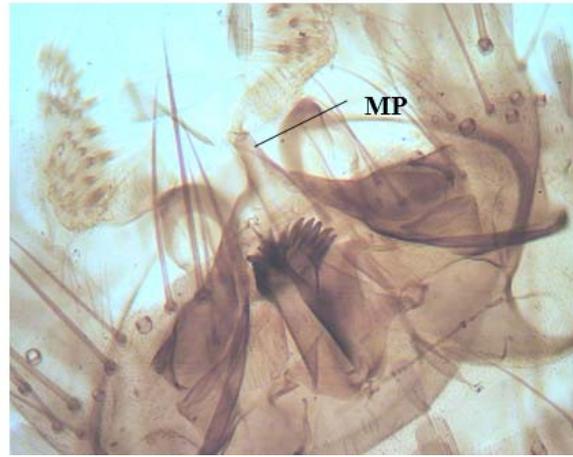


General view

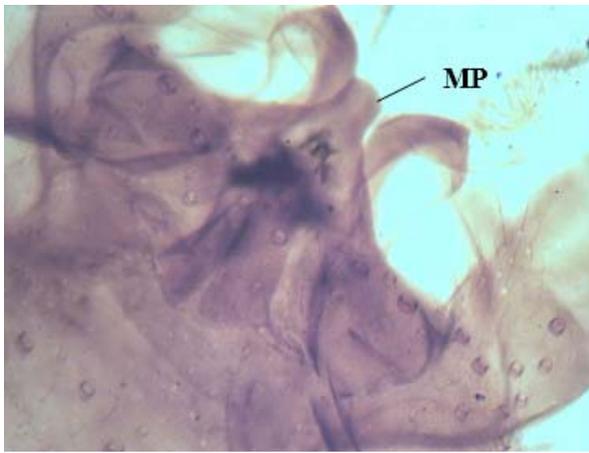
Variations in Median Projection



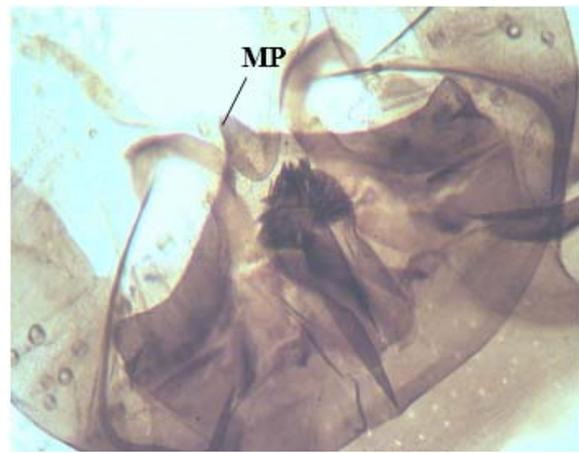
Ph. 1



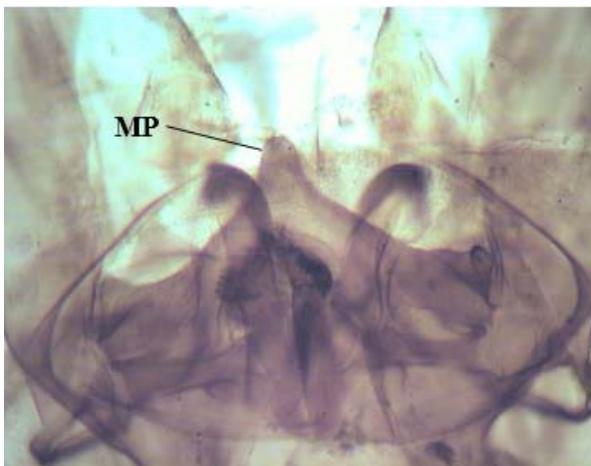
Ph. 2



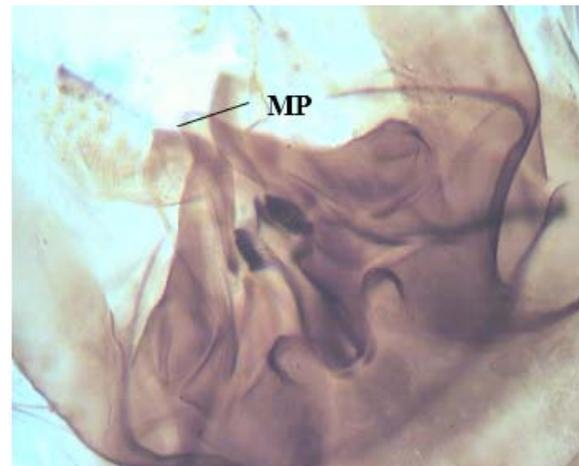
Ph. 3



Ph. 4



Ph. 5



Ph. 6



Ph. 7

II. Variations both in median and lateral projections:

Ph.8: Median projection is thin, long and tapering. Lateral projections are broad and blunt.

Ph.9 Median projection is thick, broad and small. Lateral projections are highly blunt, short as compared to Ph.8.

Ph.10 Median projection is thin, very long, narrow and tapering. Lateral projections are more or less pointed.

Ph.11 Median projection is long, thin and narrow. Lateral projections are highly pointed and long.

Ph.12. Median projection is thick, and broad. Lateral projections are blunt at the tip.

Ph.13 Median projection is thick, broad. Lateral projections are small and thin but, slightly broaden at the end.

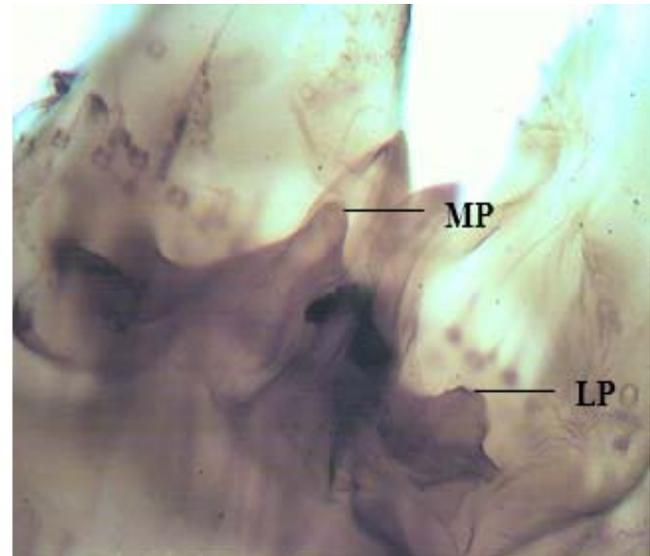
Ph.14. Median projection is thin, narrow and tapering. Lateral projections are swollen and bifurcated at the end.

Ph.15. Median projection is long, very thin, narrow and tapering. Lateral projections are flat with slightly pointed apex.

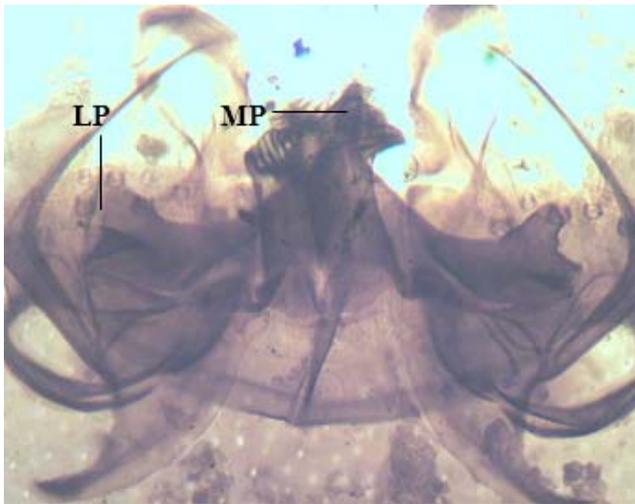
Variations in Median and Lateral Projection



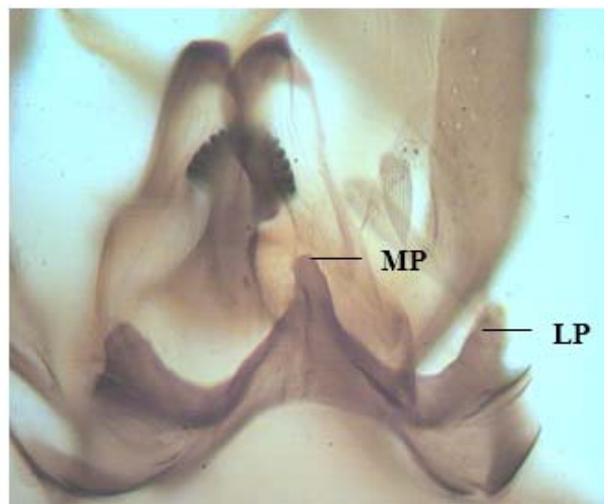
Ph. 8



Ph. 9

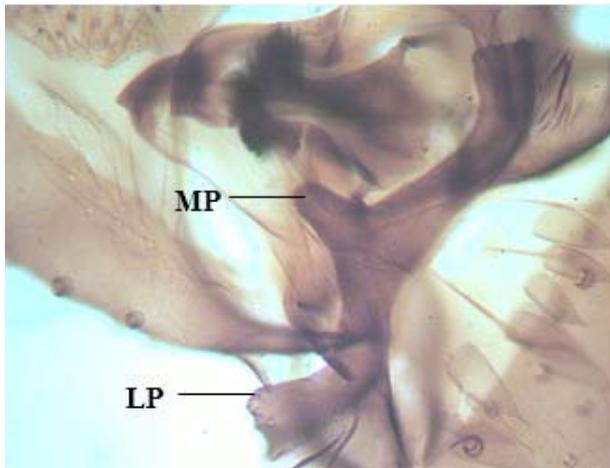


Ph. 10

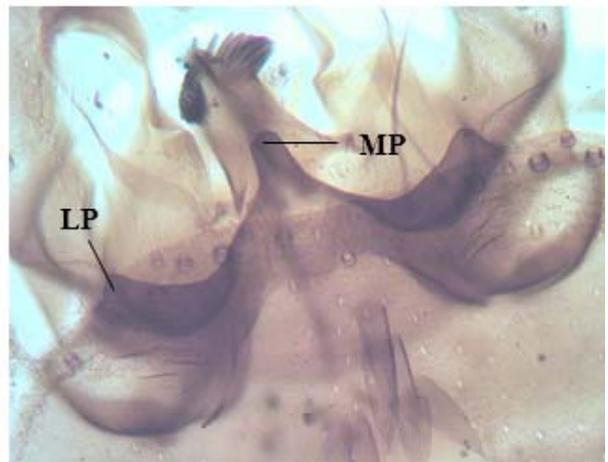


Ph. 11

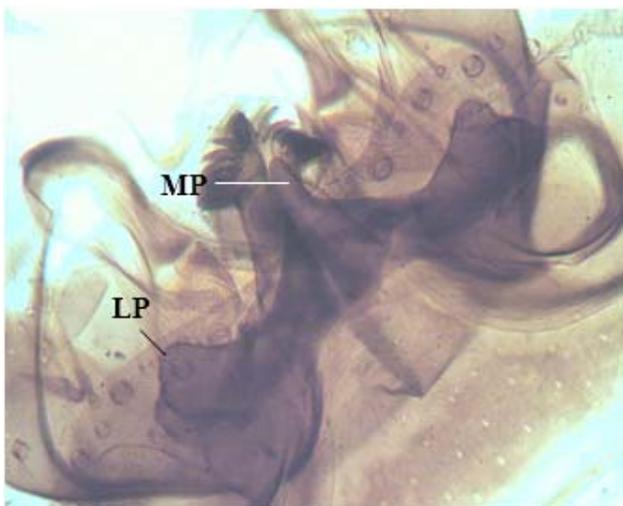
Variations in Median and Lateral Projection



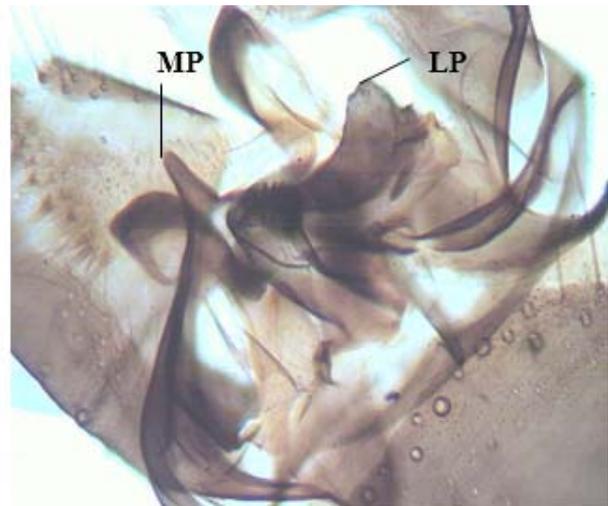
Ph. 12



Ph. 13



Ph. 14



Ph. 15

4. Conclusion

The *scutellaris* subgroup to which *Aedes albopictus* belongs, has many other species which also show close affinity in morphology with *Aedes albopictus*. Hence, keeping in view the significance of male genitalia in correct identification of the species, and potential of this species to transmit plethora of diseases, the present study will be beneficial not only in correct identification, but also for future taxonomic references.

5. Acknowledgements

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