

“STUDIES ON TAXONOMY AND OCCURRENCE OF GENUS AEDES (L.) (DIPTERA: CULICIDAE) AT AURANGABAD, (M.S.), INDIA”

Entomology

Sule S. R.	Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra. India.
Chavan R. J.*	Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra. India. *Corresponding Author
Shinde L.V.	Department of Zoology, J.E.S. College Jalana M.S.

ABSTRACT

The taxonomic study of mosquito is helpful for the correct identification up to species level. The present study deals with the taxonomy and occurrence of the mosquito genus *Aedes* from different habitats of Aurangabad city of Maharashtra, India. Total three species of Genus *Aedes* such as *Aedes aegypti*, *Aedes albopictus*, *Aedes vittatus* were recorded during the present study. Species were identified as per the standard methodology suggested by Christopher (1933), Barraud, P. J. (1934), Chester J. Stojanovich (1994), Leopoldo M. Rueda (2004), Nagpal and Tingare (2010). This type of taxonomic study helps for effective management of mosquito borne diseases like dengue, yellow fever, chikungunya etc.

KEYWORDS

Taxonomy, *Aedes albopictus*, *Aedes vittatus*, *Aedes aegypti*, Aurangabad.

INTRODUCTION

Mosquitoes are medically most important Arthropod vectors that affect the well-being of human life. The mosquitoes belong to the phylum Arthropoda order Diptera sub order Nematocera and family Culicidae. A total of 3,556 species of family Culicidae comprising of two subfamilies *Culicinae* and *Anophelinae* (Harbach, 2003)⁽¹⁾. India ranks fifth in terms of mosquito biodiversity after Brazil, Indonesia, Malaysia, and Thailand (Foley *et al.*, 2007)⁽²⁾. Indian mosquito fauna includes 393 species divided among 49 genera and 41 subgenera among which subfamily *Anophelinae* contains 61 species in one genus followed by subfamily *Culicinae* with 332 species in 11 tribes and 48 genera (Battacharyya *et al.*, 2014)⁽³⁾. Around 10 % of female mosquito species act as vectors of different pathogen that causes various diseases like malaria, dengue fever, chikungunya, yellow fever, lymphatic filariasis, Japanese encephalitis and other serious diseases. In India mainly four genera of mosquito like *Culex*, *Anophelines*, *Mansonia*, and *Aedes* are commonly occurring but out of these four *Aedes* species are important from a medical point of view two species of *Aedes* especially *A.aegypti* and *A.albopictus* are vectors of arbo-viruses that infect various vertebrates and humans.

The most common arboviruses spread by *Aedes* species causes diseases like dengue fever, yellow fever, and chikungunya (Masroor *et al.*, 2015)⁽⁴⁾. *Aedes* is a genus of mosquitoes originally found in tropical and subtropical zones of the globe. *A. aegypti* is a much more variable mosquito, but it has been possible to recognize three forms which are easily distinguishable on color characters, at least in the female, and which show associated behavior characters of considerable importance (Mattingly, 1957)⁽⁵⁾. *A.aegypti* is a key vector of dengue, is widely distributed in the tropical and subtropical zones. About two-thirds of the world's population lives in areas infested with dengue vectors, mainly *A.aegypti*. Dengue viruses infect over 100 million people every year (Hahn *et al.*, 2001)⁽¹¹⁾. It is considered highly invasive in nature and can carry a variety of pathogens that can be transmitted to humans. The species *A.aegypti* and *A. albopictus* (Skuse) are the primary vectors of concern worldwide. *A.aegypti* mosquito is the main vector that transmits the viruses that cause dengue. It is also known to transmit filarial infections of *Wuchereria bancrofti* and *Dirofilaria immitis* and avian parasite *Plasmodium gallinaceum*. *A. egypti*, *A. albopictus* this species act as vector species (Karlekar *et al.*, 2015)⁽¹³⁾. In India, dengue and chikungunya are the most important arboviral diseases that are transmitted mainly by *A. aegypti* and *A.albopictus* and have caused massive and unprecedented outbreaks in recent times, thereby causing big loss of lives and economic burden to the nation (Lahariya 2006 and Das *et al.* , 2013)⁽⁹⁻¹⁰⁾.

It is necessary to gain knowledge about morphology, taxonomy and occurrence of this genus to decide the management strategy for the vector mosquito species.

MATERIAL AND METHODS

Mosquito larvae were collected from Aurangabad city of Maharashtra from different habitats Like residential area, gardens, ditches, shelter area, vacant place, washroom, plastic vessels, metal vessels, small ponds in rainy seasons, ceramic vessels, barrels, a tucker box, tires, coconut shell, temporary pools, ditches and drainage (gutters), water storage tanks etc. Adult Mosquito were collected during June 2018 to May 2019 from the study area, by carbon dioxide trap, mouth aspirator methods. Collected mosquitos were brought to the laboratory for identification. Mosquito were preserved in separate cork and tube with dry preservation method and larval collection was stored in 70% alcohol. Whether identification is done with the help of larvae and adult, Photography was done under microscope, the identification is made with the help stereoscope binocular microscope and mosquito were identified based on standard taxonomic key suggested by Christopher (1933), Barraud, P. J. (1934) Chester J. Stojanovich (1994), Leopoldo M. Rueda (2004), Nagpal and Tingare (2010).

RESULT AND DISCUSSION

During the present study three species belonging to genus *Aedes* of subfamily *Culicinidae* were reported as shown in the table no. I.

Larval identification key of genus *Aedes*:

Head seta 4-c small variously branched, less than 0.5 length of 7-c; 6-c, single or with two equal Branches; Seta 4-c closer to 6-c than to 5-c.....*Aedes* Ventral brush (4-x) with five pairs of setae each with two branches; pecten scales usually 8-20, each scale with 1-4 basal denticle; comb scales with distinct large median spine with strong and stout lateral densital.....*Aedes*.

Key to the Adult *aedes*:

- 1) Small or medium size mosquito, palpi are one fourth length of proboscis comb scales with fi, leg show black and white patches, proboscis not curved downward or if slightly so, not laterally compressed, Scutum have different pattern. Post spiracular setae present proboscis slender and usually straight, never laterally compressed.
- 2) Mesonotum marked with a pair of lateral curved white lines, and usually as a sub-median yellowish line; tibiae without white rings two dots of white scales on clypeus.

Keys to the species of genus: *Aedes*: (Barraud, P.J.1934)

- 1) All tibia with white rings2.
Tibiae without white rings3.
- 2) Mesonotum marked with 4-6 small white spots; femora with preapical white rings; proboscis with scattered yellow scaling.....*A. vittatus*
- 3) Mesonotum marked with a pair of lateral curved white lines, and usually also with a pair of sub-median yellowish lines; two dots of white scales on clypeus...*A.aegypti*.

4) A narrow silver mid line present in mesonotum.....*A. albopictus*.

Description:

Aedes aegypti (Linnaeus, 1762)

Family: Culicidae

Subfamily: Culicinae

Genus: *Aedes*

Species: *Aedes aegypti*

Diagnostic character:

This species resembles the Asian tiger mosquito with a slight difference in size thorax pattern. The adult mosquito is small to medium -sized approximately 4 to 7 millimeters. These adults have white scales on the dorsal (top) surface of the thorax that form the shape of a violin. Each tarsal segment of the legs possesses white basal bands, forming what appear to be stripes. Silver white flat scales in middle of vertex, continued downwards between eyes; similar scales on tori; two small silvery white dots on clypeus tips of palpi conspicuously white. Thorax: flat silvery white scales on all lobes of scutellum.

Legs: mid femur, when viewed from the front, with a white longitudinal line running from the base for nearly whole length, but not continued quite to knee; anterior surface of hind femur pale on basal 1, or more, the pale scaling continued as a thin longitudinal line nearly to knee. Similar character reported (Masroor et al.,2015) ⁽⁴⁾. The abdomen is generally dark brown to black, but also may possess white scales.

Occurrence: Mainly in rainy seasons, present in clean water, pot, small rock hole, small rainy ditches, tank, etc.

Aedes vittatus (Bigot, 1861)

Family: Culicidae

Subfamily: Culicinae

Genus: *Aedes*

Species: *Aedes vittatus*

Diagnostic Character:

This species shown silvery white scales on the narrow vertex. Clypeus with white silvery scales. Palpi with silvery white tips, wings with mainly narrow scales on all veins. scutum with three pairs of small round silvery white spots. Tibiae are dark in color each with white spots and white sub basal white band. Tarsomeres 1-4 with white bands; fifth tarsomere is fully white. Similar character shown (Masroor et al.,2015) ⁽⁴⁾.

Occurrence: Mainly in rainy seasons, pot, small rainy ditches, tank, tyre, dumps, coconut shell, manmade artificial containers etc.

Aedes albopictus (Skuse,1894)

Family: Culicidae

Subfamily: Culicinae

Genus: *Aedes*

Species: *Aedes albopictus*

Diagnostic character:

This species shows a narrow silver (white) line present in median of mesonotum. Broad white rings on all segments of mesonotum. Broad white rings on all segments of tarsi. Scutum without patch of white

scales at scutal angle. Mid femur without scattered pale scales on anterior surface *Aedes albopictus*. This is less than 10 mm long from end to end with a striking white and black pattern. *Aedes albopictus* adults have a white stripe down the middle of the top of the thorax. The antennae of male are bushier in comparison to the female are noticeably bushier and contain auditory receptors. The maxillary palps of the males are also longer than their proboscis, whereas the female maxillary palps are much shorter. The tarsus of the hind legs of the males is more silver. The proboscis is dark colored, the upper surface of the end segment of the palps is covered in silvery scales. They have compound eyes and one separated to another eyes. Compound eye is distinctly separated from one another. The scute, the dorsal portion of thoracic segment, is black along side the characteristic white midline. Similar results have reported (Masroor et al.,2015) ⁽⁴⁾.

Occurrence: Mainly in rainy season, small ditches, pots, tires, tress hole, small house pot, etc.

The studies on monthly occurrence of various species of *Aedes* shows that *A. egypti* occurs in the month of June to December at all localities. In month of January, March its occurrence not seen in all localities. In month February, April and may occurrence have seen in sampling site. Similar results were reported by another worker (Amruthraj et al.,2019) ⁽¹²⁾. *A. albopictus* was reported in all location in the month of April to December continuously but after the month December this species occurrence is less in month of February to April. The species *A. vittatus* shows occurrence in all location in month of July to December. But in month of January to May they show less occurrence. Similar results for monthly variation of *Aedes* mosquito occurrence were reported by (Amruthraj et al.,2019) ⁽¹²⁾. The occurrence of genus *Aedes* study is important for taxonomical aspect (Gradoni et al., 2021) ⁽¹⁷⁾.

Sampling site wise and Monthly occurrence

The species of genus *Aedes* are vectors of different diseases hence they determine the course of diseases transmission and the ecological status of the native environment. Chikungunya and dengue are the common diseases that are prevalent in the local public and the disease spread is associated with the abundance of vector mosquitos. During the present study three species of genus *Aedes* such as *A. egypti*, *A. albopictus* and *A.vittatus* were reported with variation in their monthly occurrence at sampling site such as Mukundwadi, Nakshatrawadi, Kanchanwadi, Waluj, Pandharpur, Bhimnagar, Begumpura, Rajabazar, Bhoiwada, Paithan gate, Railway station, and Parvati Nagar etc.

The overall population of *Aedes* was high from May to December, with peaks between June to December, followed by a decline to December that persisted to March of the next year. During June to September high populations of *Aedes* were recorded. For most of the mosquito species, more individuals were collected during March to October than during January to Mid-March. Our findings are similar to (Akram et al., 2009) ⁽¹⁶⁾ who reported that the *Aedes* was high from May to September.

Table I Showing the taxonomic diagram of mosquito Genus *Aedes* from Aurangabad.

Subfamily	Genus	Species
Culicinae	<i>Aedes</i>	<i>Aedes aegypti</i>
		<i>Aedes albopictus</i>
		<i>Aedes vittatus</i>

Table II Showing distribution of Genus *Aedes* in sampling site of Aurangabad.

Location	Species	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Mukundwadi	<i>A.egypti</i>	+	+	+	+	+	+	-	-	+	-	+	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	-	+	+	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	-	-	-	-	-
Nakshatrawadi	<i>A.egypti</i>	+	+	+	+	+	+	+	-	+	-	+	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	-	-	-	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	-	-	-	-	-
Kanchanwadi	<i>A.egypti</i>	+	+	+	+	+	+	+	-	+	-	-	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	-	-	+	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	-	-	-	-	-
Waluj	<i>A.egypti</i>	+	+	+	+	+	+	+	-	-	-	-	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	-	-	-	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	-	-	-	-	-
Pandharpur	<i>A.egypti</i>	+	+	+	+	+	+	+	-	+	-	+	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	-	-	-	+	+

	<i>A.vittatus</i>	-	+	+	+	+	+	+	+	-	-	+	-	-
Bhīm Nagar	<i>A.egypti</i>	+	+	+	+	+	+	+	+	-	-	-	-	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	+	-	-	-	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	+	-	-	-	-	-
Begumpura	<i>A.egypti</i>	+	+	+	+	+	+	+	+	-	-	-	-	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	+	-	-	-	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	+	-	-	-	-	-
Rajabazar	<i>A.egypti</i>	+	+	+	+	+	+	+	+	-	+	-	-	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	+	-	-	+	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	+	-	-	-	-	-
Bhoiwada	<i>A.egypti</i>	+	+	+	+	+	+	+	+	-	+	-	-	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	+	-	-	-	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	+	-	-	-	-	-
Paithan gate	<i>A.egypti</i>	+	+	+	+	+	+	+	+	-	-	-	-	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	+	-	-	-	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	+	-	-	-	-	-
Railway station	<i>A.egypti</i>	+	+	+	+	+	+	+	+	-	+	-	-	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	+	-	-	-	+	+
	<i>A.vittatus</i>	-	+	+	+	+	+	+	+	-	-	-	-	-
Parvati Nagar	<i>A.egypti</i>	+	+	+	+	+	+	+	+	-	-	-	+	+
	<i>A.albopictus</i>	+	+	+	+	+	+	+	+	-	-	+	+	+
	<i>A.vittatus</i>	+	+	+	+	+	+	+	+	-	-	-	-	-

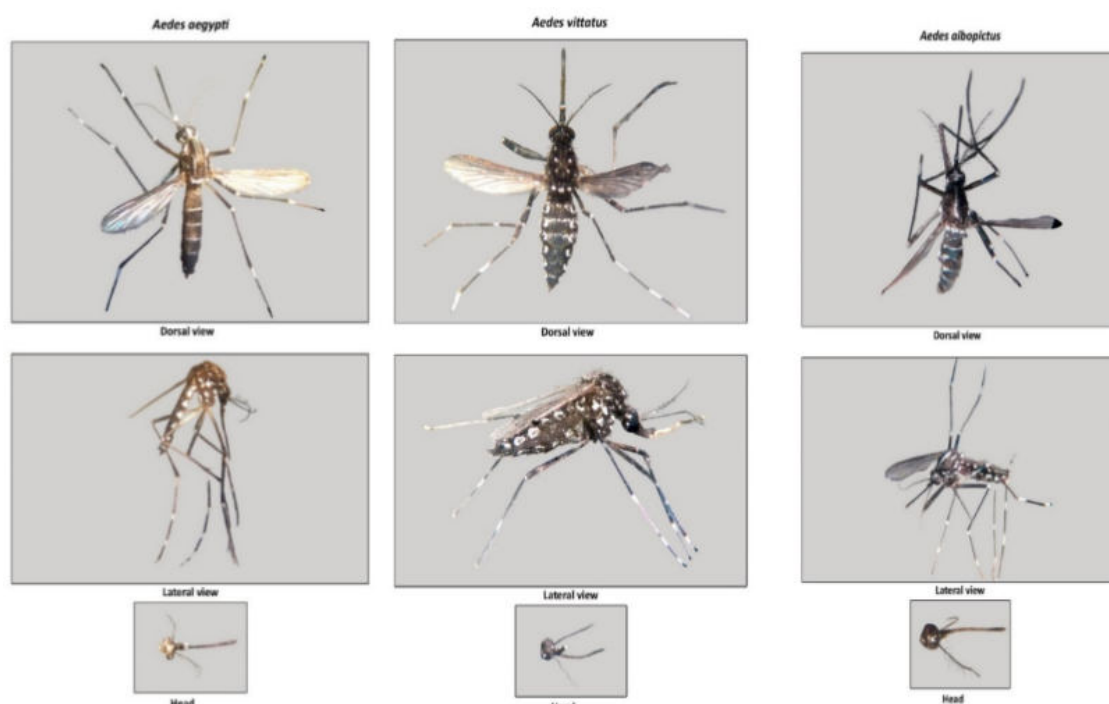


Plate: 1, 2 & 3
Photographs of *Aedes aegypti*, *Aedes vittatus* & *Aedes albopictus* showing dorsal view, lateral view and Head.

CONCLUSION

During present study of taxonomy and distribution of three species belonging to genus *Aedes* such as *Aedes aegypti*, *Aedes albopictus* and *Aedes vittatus* is studied at Aurangabad.

REFERENCES:

- Harbach RE. Identification of sibling species of *Anopheles fluviatilis* (Diptera: Culicidae). *Bulletin of Entomological Research* 2003; 93:169-171.
- Foley DH, Rueda LM, Wilkerson RC. Insight into mosquito biogeography from country species records. *Journal of Medical Entomology*. 2007; 44(4):554-567.
- P. F. Mattingly (1957) Genetical Aspects of the *Aedes Aegypti* Problem, *Annals of Tropical Medicine & Parasitology*, 51:4, 392-408.
- Masroor Alikhan I, Khalid Al Ghamdi, and Jazem Abdullah Mahyoub (2015) *Aedes* mosquito species in western Saudi Arabia. *Journal of Insect Science: Vol. 14, Article 69*.
- Bhattacharyya DR, Rajavel AR, Natarajan R, Mohapatra PK, Jambulingam P, Mahanta J, Faunal richness and the checklist of Indian mosquitoes (Diptera: Culicidae). *Journal of species lists and distribution* 2014; 10(6):1342-1358. 202.
- Barraud, P. J. 1934. The fauna of British India, including Ceylon and Burma. Diptera. Vol. V. Family Culicidae. Tribes Megarhinini and Culicini. Taylor and Francis, London. 463 p., 8 pl., 1 map.
- Rueda LM. 2004. Pictorial keys for the identification of mosquitoes (Diptera: Culicidae) associated with Dengue virus transmission. *Zoo taxa* 589: 1-60.
- Knight KL, Stone A. 1977. A catalogue of the mosquitoes of the world (Diptera: Culicidae). The Thomas Say Foundation, Entomological Society of America.
- Lahariya C, Pradhan SK. Emergence of chikungunya virus in Indian subcontinent after 32 years: A review. *Journal of Vector Borne Diseases*. 2006; 43:151-160.
- Das B, Das M, Dwivedi B, Kar SK, Hazra RK. Molecular investigations of dengue virus during outbreaks in Orissa state, eastern India from 2010-2011. *Infection, Genetics and Evolution*. 2013; 16:401-41.
- Hahn CS, French OG, Foley P, Martin EN, Taylor RP. Bispecific monoclonal antibodies mediate binding of dengue virus to erythrocytes in a monkey model of passive viremia. *J Immunol* 2001; 166:1057-65.
- Amruthraj Radhakrishnan. Study on mosquito (Diptera: Culicidae) diversity in Ernakulam district of The Kerala state, South India. *International Journal of Mosquito Research* 2019; 6(1): 01-05.
- Karlekar S, Andrew R. Mosquito diversity and vector species status in and around Nagpur city of Maharashtra state, India. *International Journal of Mosquito Research* 2015; 2(2):19-23.
- Rohinaz, Afsheen Maryam, Shabnam. Population Dynamics of Mosquitoes in Various Breeding Habitats at University of Peshawar Campus, Khyber Pukhtunkhwa Pakistan. *Journal of Entomology and Zoology Studies* 2014; 2(2): 189-195.
- Pawar RG, Thete KD, Shinde LV. Distribution and Diversity of Mosquito Larvae from Kopargao Teshil, Dist. Ahmednagar (M.S.) India. *International journal of life science. scientific research*, 3(5): 1305-1310.
- Akram, W., Hafeez, F., Ullah, U. N., Kim, Y. K., Hussain, A., & LEE, J. J. (2009). Seasonal distribution and species composition of daytime biting mosquitoes. *Entomological Research*, 39(2), 107-113.
- Gradoni, F., Bertola, M., Carlin, S., Accordi, S., Toniolo, F., Visentin, P., & Michelutti, A. (2021). Geographical data on the occurrence and spreading of invasive *Aedes* mosquito species in Northeast Italy. *Data in Brief*, 36, 107047.