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Studies on morphological variations of *Aedes albopictus* in some areas of South 24 Parganas, West Bengal

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Abstract
Dengue is an enigmatic vector-borne disease and is transmitted by the day feeding *Aedes* mosquitoes (*Aedes albopictus* and *Aedes aegypti*). *Ae. albopictus is* closely associated with human habitations and is adapted to feed on humans. The larvae of *Ae. albopictus* were collected from all kind of water filled container in and around the houses in two areas (Diamond Harbour and Canning) in South 24 Parganas, West Bengal. Larvae were taken to the laboratory and reared in colony culture cage. Morphological variations (maxillary palp, proboscis and wings) are observed from the emerged adults. These morphological variations may help to identify the vectors and its sibling species. The prevalence of such vectors may indicate the diseases (Dengue and Chikungunya) load present in that area. Re-emergence of Dengue, Dengue hemorrhagic fever (DHF) and Chikungunya in South 24 Parganas areas along with population abundance of *Ae. albopictus* has become a major health problem. Therefore, a preliminary attempt has been made to study the breeding habitat preference of *Ae. albopictus* along with its morphological variations in South 24 Parganas (Diamond Harbour, Canning).In our present study morphological variations such as cup shaped proboscis, white palp, mosaic palp etc. are observed. The frequency of variation in *Ae. albopictus* is 1.2%.

Keywords: *Ae. albopictus*, dengue, breeding habitat, morphological variation

1. Introduction
Mosquitoes are one of the most medically significant vectors of several diseases like Dengue, Malaria, Chikungunya, Filaria etc., affecting both human and domestic animals worldwide. Dengue and Dengue hemorrhagic fever (DHF) have become important health problems. About 50 million dengue infection occurs annually [1].Dengue is an enigmatic disease which is transmitted by the day feeding *Ae. albopictus mosquitoes*. India is first leading country in representing a significantly larger dengue burden both in urban and rural environments. Resurgence of Dengue and DHF along with the population abundance of *Ae. albopictus* in some areas of West Bengal serve as an indicator point to know the population abundance and morphological variation of *Ae. albopictus*. Various lines of data [2, 3] indicated that the breeding habitat is crucial for the study of population dynamics as well as morphological variation of *Ae. albopictus*. Several studies highlighted that the rapid urbanization with unplanned town expansion, construction sites in city and excessive usage of water cooler in summer which led to creation of temporary and permanent water bodies highly conducive to mosquito to breed [3, 4, 5]. *Aedes* is a container breeder and breeds in a variety of natural and manmade container. *Ae. albopictus* female preferably lay eggs in artificial collection of water. The hatched larvae undergo growth and metamorphosis and attain adult stage. The economic importance of this group seems to rest not only for their role as vector of dengue but also for their morphological variation in natural as well as laboratory population. Various lines of data [6, 7, 8] indicated that climatic variables such as high temperature, rainfall, humidity (Fig -7) have a significant impact in the development and survivorship of mosquitoes. However, a very little attention has been paid to study the variation in breeding habitat and morphogenetic diversities of *Ae. albopictus* in South 24 Parganas, West Bengal. In view of this reason, we have undertaken a preliminary investigation to know different types of breeding habitat as well as the morphological variations of *Ae. albopictus* in some areas (Diamond Harbour & Canning) of South 24 Parganas, West Bengal.

2. Materials and Methods

In present study, two areas (Diamond Harbour and Canning) in South 24 Parganas were selected on the basis of outbreak of dengue fever in the last two years. The larvae of *Ae. albopictus were* sampled from August 2015 to July 2016. Larval stages of *Ae. albopictus* (field generation, Fo) were collected from domestic container (tank) and peri domestic containers (plastic container, plastic bucket, plastic tub & food container of cow) and brought to the laboratory. Larvae were taken to the laboratory and their development (Larva-pupa- adult) occurs in the colony culture cage. The emerged adults were killed with ether and were identified by using the key of Leslie Rios et al, 2004 [9]. The morphology of male and female *Ae. albopictus* was observed under Digital Binocular Microscope. The morphological variations (mouth parts & wings) along with its images have been taken by using Dewinter stereo macroscope.

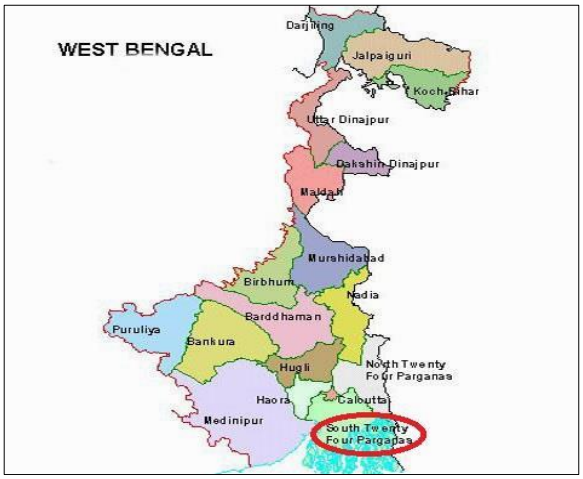


Fig 1: Map showing the collection site of *Ae. albopictus* larvae.

3. Results & Observation

The Fig 1 indicates the collection site (on the map) of *Ae. albopictus* larvae. The wild type adult (female), wing and head of wild type (male and female) *Ae. albopictus* are shown in Fig 2 and Fig 3 respectively. *Ae. albopictus* are identified on the basis of thoracic characteristics. Both male and female of *Ae. albopictus* are almost similar in appearance except for the differences in size of antennae, maxillary palp, abdomen, claws and in scale markings. In female proboscis is long, straight and dark in colour without any white scale patches and it is longer in male. In male maxillary palp is long with five white scale bands and in female maxillary palp is very short with white scales at the top. The antennae have 13 flagellar segments and from the inter-segmental region antennal hairs are arranged in a whorl fashion. The antennal hairs are bushy and plumose in male whereas in female, they are smaller and less dense. In *Ae. albopictus*, thorax (dorsum) is black coloured with a single silver line (white striped).The wings in *Ae. albopictus* are flat, narrow and membranous which is larger in female than male. They have three pairs of legs having coxa, trochanter, femur, tibia and the tarsal segments. The last tarsal segment carries claws. Table 1 reveal the breeding habitat preferences of *Ae. albopictus* (Fig 4). The place, date of collection, types of habitat, number of sampled larvae, and number of emerged adult, description of variation, number and sex of the variant is presented in Table 2. The data in table 3 reveal the morphological variations in emerged adult (Fig 5) and its frequency. The diversity of variations such as proboscis, palp and wing are presented through pie chart in Fig 6.During the time of collection the average temperature, rain fall and humidity are recorded (Fig 7).

(A) (B)

Fig 2: *Wild* type *Ae. albopictus* (Female) Wing of wild type adult *Ae. albopictus*

(A) **(B)**

Fig 3: Head of wild type male (A) and female (B) adult *Ae. albopictus*

Table 1: Breeding habitat of *Ae. albopictus*

Place (South 24 Parganas)	Plastic container	Plastic bucket	Plastic tub	Food container of cow
Diamond Harbour	+	+	+	-
Canning	-	+	+	+

(A) (B)

Fig 4: Breeding habitat: Food container of cow (A & B)

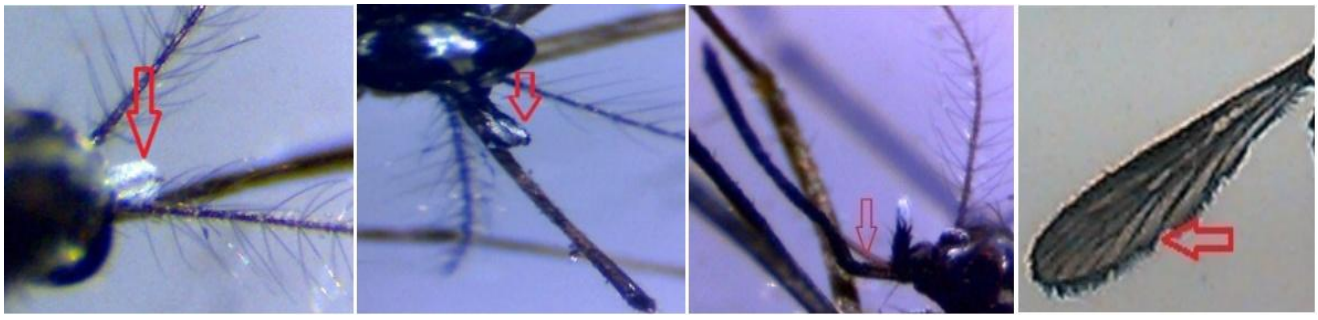
Table 2: Larvae Collected from rural areas of South 24 Parganas (Diamond Harbour & Canning)

S. No.	Place	Date	Types of habitat	No. of sampled larva	Total no. of emerged adult			Description of variation	No. & sex of the variant
1	Diamond Harbour	04.08.15	Plastic container	73	25	43	68	Cup shaped proboscis	1F
2	Diamond Harbour	09.08.15	Plastic tub	86	22	50	72	No variation found	
3	Diamond Harbour	17.09.15	Plastic container	146	46	93	139	Cup shaped proboscis	1F
4	Canning	23.09.15	Food container of cow	119	31	73	104	Cup shaped proboscis	2F
5	Canning	08.10.15	Food container of cow	43	7	21	28	White maxillary palp, mosaic palp,	2F
6	Diamond Harbour	09.11.15	Plastic container	59	12	32	44	Cup shaped proboscis	1F
7	Diamond Harbour	19.11.15	Plastic tub	48	14	20	34	No variation found	
8	Diamond Harbour	27.11.15	Plastic container	46	6	23	29	Cup shaped proboscis	1F
9	Canning	16.12.15	Food container of cow	27	6	12	18	Cup shaped proboscis	2F
10	Canning	10.01.16	Food container of cow	33	7	21	28	Cup shaped proboscis	1F
11	Canning	02.05.16	Plastic tub	76	17	48	65	No variation found	
12	Diamond Harbour	16.05.16	Plastic tub	92	22	50	72	No variation found	
13	Canning	07.06.16	Plastic bucket	159	26	101	127	Cup shaped proboscis	1F
14	Diamond Harbour	13.06.16	Plastic tub	132	39	77	116	No variation found	
15	Diamond Horbour	21.07.16	Plastic bucket	167	52	99	151	fringe spot	1F

Table 3: Morphological Variations of *Ae. albopictus*

S. No.	Location	Total No. of Sampled larva	Total No. of emerged adult	Variation			No. of variation (%)
				Wing	Palp	Proboscis	
1.	South 24 Parganas (Diamond Harbour, Canning)	1306	1095	Fringe spot 5.2(1)	White maxillary palp, mosaic palp(2)	Cup Shaped(10)	13(1.19)

3.1 Morphological Variations



(A) (B) (C) (D)

Fig 5: Showing Palp (A- white & B-mosaic), Proboscis (C-cup shaped) and Wing (D- Fringe spot) Variations in *Ae. albopictus*

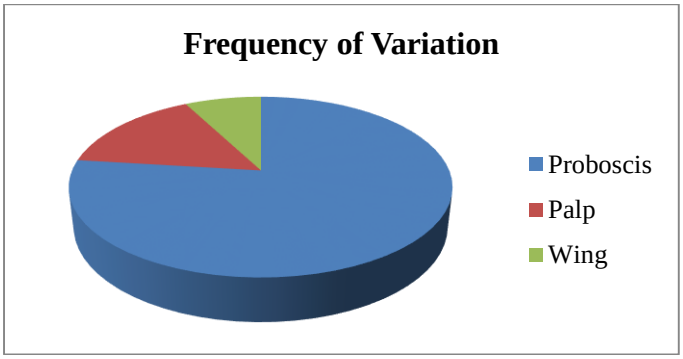
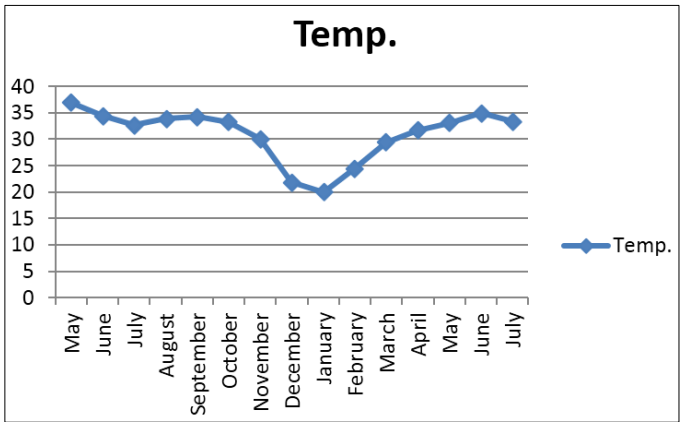
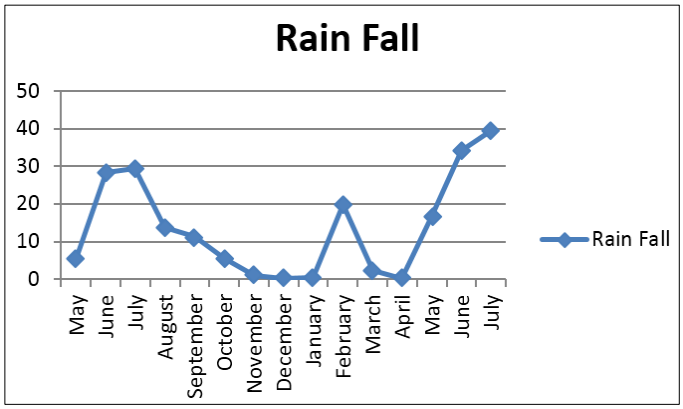


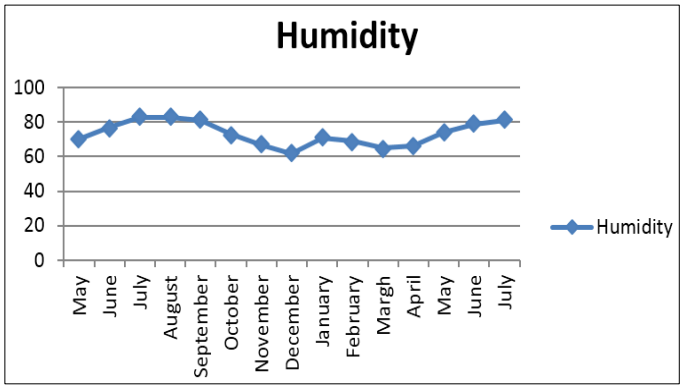
Fig 6: Pie chart showing Frequency of variation



(A)



(B)



(C)

Fig 7: Showing A- average temperature (°C), B- Rainfall (mm) and C- humidity (%), from May, 2015- July, 2016

4. Discussion

In the present study it was observed that *Ae. albopictus* preferred to lay eggs in different plastic container(table- 1). Present study provides information regarding the breeding habitat preference as well as morphological variation of *Ae. albopictus*. They prefer to breed both in the standing and slowly running water bodies. The availability of these water bodies play an important role in maintaining the density and diversity of *Ae. albopictus* population [10]. *Aedes* is a container breeder which breeds in domiciliary and extra domiciliary containers. The wide range of breeding choice (Table 1) of *Ae. albopictus* makes its control a tedious task. *Ae. albopictus* ex hibit strong physiological plasticity, allowing it to thrive in a wide range of climates (Fig-7) and habitat. Population of *Ae. albopictus* fluctuate with rain fall and water storage [11]. Relative humidity plays an important role in the population abundance of *Ae. albopictus* (Fig-7). Morphological variations provide an essential tool for genetic analysis and for establishment of formal genetics [14]. Studies on morphological variation are important not only for species identification but also to understand the process of speciation. Variation in morphological characters of mosquitoes is usually based on the ornamentation of maxillary palp, proboscis and wings. Various lines of data [12, 13, 14, 15] indicated that morphological variation in *Anopheles* mosquitoes varies from 3.2-4.5%. In our present observation morphological variation (Fig-5&6) in *Ae. albopictus* is very low (1.2%). Our observation reveals that palp and proboscis variations are well manifested in *Ae. albopictus*. Earlier several scientists [12, 15, 16] recorded such type of variations (Cup shaped proboscis) in *Anopheles vagus* and *Anopheles subpictus.*

Our data (Table- 2 & 3) indicates that the cup shaped proboscis is well marked in the species *Ae. albopictus*. A population may increase rapidly and positively from its small size depending upon its struggle with the environment. At that time some of its non-adaptive characters (fringe spot on wing) present in the original gene pool may have the chance to increase in proportion. Simultaneously, some other adaptive characters (Variation palp and proboscis) are also favoured and encouraged by selection during population expansion. Furthermore, environmental factors may favour certain variation having higher adaptive value. In our investigation cup shaped proboscis, white and mosaic maxillary palp variation seems to have some adaptive advantage in this environment. These adaptive characters, in due course increase in number, get established in the population and prove more competitive in the environmental struggle [12, 17].

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6. References

1. WHO, Dengue guidelines for diagnosis, treatment, prevention and control.2009.
2. Overgaard HJ, Tsuda Y, Suwonkerd W, Takagi M. Characteristics of *Anopheles minimus* (Diptera: Culicidae) larval habitats in northern Thailand. Environ Entomol.

2002; 31(1):134-141.
3. Singh NP, Kaushik R and Yadav M. Population dynamics and breeding habitat diversity of vector mosquitoes in selected urban and sub urban areas of Jaipur, India: 12th Int. Conf. Vect. and Vect. Bro. Dis. 2013; 3:56-63.
4. Das PK. Vector borne diseases & their control in relation to Developmental activities, Proc. 2nd Sym. Vect. And Vect. Bro. Dis. 1997, 45-55.
5. Tyagi BK. Climate change and emergence of Dengue and Chikungunya in Kerala state, India, 12th Int. Conf. Vect. And Vect. Bro. Dis. 2013; 3:16-28.
6. Focksd A, Haile DG, Daniels E and Mount GA. Dynamic life table model for *Aedes aegypti* (Diptera: Culicidae): analysis of the literature and model development. J. of Med. Ento. 1993a; 30:1003-1017.
7. Kumawat R, Karam Vir Singh. Effect of Relative humidity on breeding of *Aedes aegypti* with respect to container positivity, 12th Int. Conf. Vector and Vect. And Vect. Bro. Dis. 2007, 132-139.
8. Paingankar MS, Gokhale MD, Vaishnav KG and Shah PS. Monitoring of Dengue & Chikungunya viruses in field-caught *Aedes aegypti* (Diptera: Culicidae) in Surat city, India: Cur. Sc. 2014; 106(11):1559-1567.
9. Leslie Rios, James E. Maruniak. Asian tiger mosquito, *Aedes albopictus*, University of Florida 2004.
10. Pandian R, Vanita Valli R, Selven T and Charles MA. Proc. 2nd. Sym. 1997, 194-201.
11. Kalra NL, Wattalb L and Raghvan NGS. Distribution pattern of *Aedes aegypti*. Bull. Ind. Malaria. 1918.
12. Banerjee PK, Chatterjee RN. Study of biology of *Anopheles subpictus* in West Bengal with reference to its intra specific variation between urban, pre urban and rural population: Trans. Zool. Soc. India. 1997; 1(1):86-92.
13. Nagpal BN, Sharma VP. Morphological variation in natural population of *A. vagus* Donitz, 1902, collected from Andaman Island, Ind. Jour of Malar. 1983; 20:35-44.
14. Gunashekharan K, Sahu SS, Sadanandane C, Parida SK, Patra KP, Jambulingam P. morphological variations in some Indian Anophelines from Koraput district Orissa, India Ind.Jour of Malar. 1990; 27:127-138.
15. Nagpal BN. Morphological variation in natural population of *Anopheles stephensi*, Liston, 1901 collected fron Kach Gujrat, Ind. Jour of Malar. 1990; 27:25-35.
16. Pal S, Chattopadhay A, Banerjee PK. Anopheline diversity: Morphological and Molecular variation of an *An. subpictus* in rural and urban areas of West Bengal. Jour. Ento & Zoo. Stu. 2013; 2:35-40.
17. Barett SCH, Charles worth D. Effect of change in the level of inbreeding on the genetic load: Nature (London). 1991; 352(6335):522-524.