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**Kabirul Bashar**  
Department of Zoology,  
Jahangirnagar University  
Savar, Dhaka-1342, Bangladesh

**Faria Farhana Rain**  
Department of Zoology,  
Jahangirnagar University  
Savar, Dhaka-1342, Bangladesh

**Mahmuda Jesmin**  
Department of Zoology,  
Jahangirnagar University  
Savar, Dhaka-1342, Bangladesh

**Asaduzzaman**  
Department of Zoology,  
Jahangirnagar University  
Savar, Dhaka-1342, Bangladesh

## Surveillance of mosquitoes in some selected parks and gardens of Dhaka city, Bangladesh

**Kabirul Bashar, Faria Farhana Rain, Mahmuda Jesmin, Asaduzzaman**

### ABSTRACT

A yearlong (Jul-10 to June-11) intensive survey was conducted to document the diversity and density of different mosquito species, breeding habitats and their status at different park in Dhaka city. A total of 11 species of mosquito were identified from the six study areas. The recorded species were *An. annularis*, *An. culicifacies*, *Ae. albopictus*, *Ae. aegypti*, *Ar. subalbatus*, *Cx. fuscocephala*, *Cx. quinquefasciatus*, *Cx. tritaeniorhynchus*, *Mn. annulifera*, *Mn. uniformis*, *Tx. splendidus*. *Aedes albopictus* (38.18%) and *Ar. subalbatus* (37.47%) were the predominant mosquito species followed by *Cx. quinquefasciatus*. Others species were found in moderate percentage. Lowest density of *Cx. fuscocephala* (0.6%) was recorded among the collected mosquito species from the different study area. The highest percentages of mosquito were found in Botanical garden (28.68%) followed by Ramna park, Zia uddyan, Baldha garden, Suhrawardy uddyan, and Osmani uddyan (6.67%). Fifteen different larval habitats were found in the study areas. Majority of the mosquito species was found to breed in pond. High density of *Ae. albopictus* mosquito were found in all study areas, which is the secondary vector of dengue viruses. Principal dengue vector mosquito, *Ae. aegypti* were found only in Baldha garden. *Ar. subalbatus* was also a dominant mosquito species in the entire site.

**Keywords:** Mosquito, breeding habitat, vector, park, garden, Dhaka city.

### 1. Introduction

According to the statistical yearbook of Bangladesh 2001, it has a population of about 6.9 million in a land area of 590 sq. mile (1528 sq. km.) [15]. In Bangladesh, the percentage of urban population is 20.1 while that of rural 79.9. Due to concentration of development and economic activities in the capital, the rural population, faced with calamities and unemployment, is increasingly moving towards the city. Unofficial sources claim that the population of Dhaka is much higher than 6.9 million and that it would be not less than 12 million. According to available statistics 60 per cent of the total city population lives in the slum areas [4]. There are not enough places for recreation and morning and evening walk. Many people visit and take rest in different park of Dhaka City but they are not safe from vector-borne diseases. Mosquito is a special problem as an ectoparasite because it feeds on both birds and mammals, and thus can harbor and transfer a variety of viruses, nematodes, protozoans, etc., posing a threat to humans and other mammals [5]. Mosquito borne diseases like dengue, malaria, and filariasis are epidemic in some areas of Bangladesh [9]. Dengue attack many people of Dhaka city each and every year. City dwellers were not aware enough about mosquito-borne diseases, its causes, and prevention [1]. Mosquito breed in areas where it can locate temporary pools and stagnant water, such as tree holes, abandoned tires, or leaf clogged gutters. Forested areas, such as along creek banks or where trees are wrapped with leafy vines were the habitat of some mosquito species. It favors pools which contain leaf debris and other organic material to provide food for its larvae. Adults remain in areas near larval habitats throughout their lifespan. Multiple generations may coexist during periods of frequent flooding in the summer, and the last eggs laid during the summer lie dormant through the winter [6, 8]. Male mosquitoes feed on nectar and plant juices. Females may also feed on plant juices, but usually must have a blood meal in order to develop their eggs. These mosquitoes are frequently pests in residential and recreational areas, especially where large numbers of trees are present. Although tree hole mosquitoes can be a severe nuisance, they are not known to transmit any disease to man. They are the main vectors of dog heartworm. The survey was conducted to know the species complex and population density of mosquito in different recreational parks and gardens of Dhaka city.

**For Correspondence:**  
**Kabirul Bashar**  
Department of Zoology,  
Jahangirnagar University  
Savar, Dhaka-1342, Bangladesh  
Email: KB: bkabirul@gmail.com  
Tel: +8801912198089

This study was done because, no survey work about vector or non-vector mosquitoes have been conducted in these areas. These findings will help the visitors to take precautionary measures against mosquito-borne diseases.

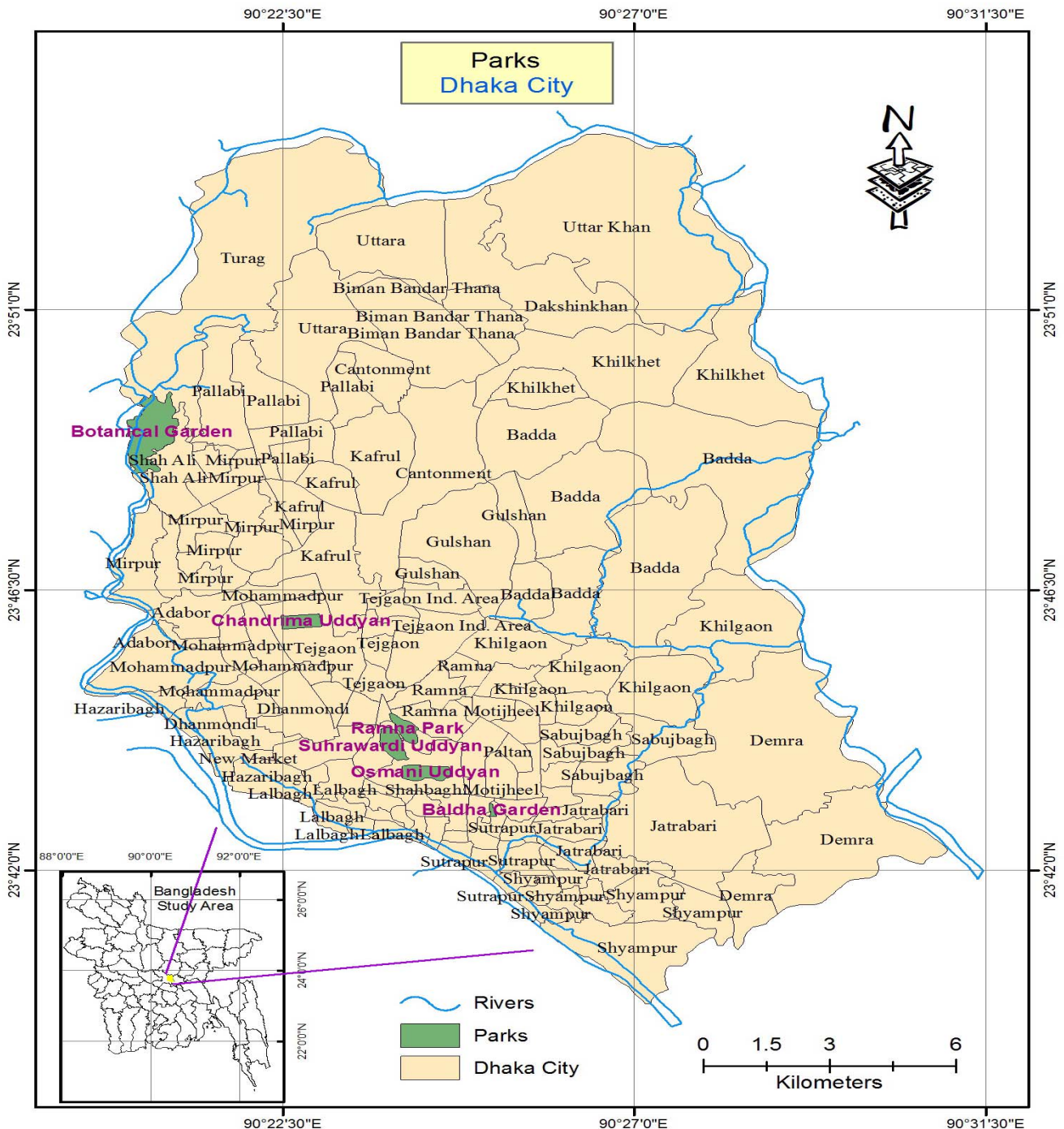
**2. Materials and methods**

**2.1. Study areas**

The present study was conducted in six selected garden and park in Dhaka city viz., National Botanical Garden, Baldha Garden, Osmani Uddyan, Chandrima Uddyan (Zia Uddyan), Ramna Park and Suhrawardi Uddyan.

**2.1.1. Botanical Garden**

National Botanical Garden (Fig.1) was established in 1961 covering an area of about 84 ha of land located at Mirpur adjacent to the National Zoo, about 10 km from the center of Dhaka city; the place is protected from public interference. The garden houses nearly 50,000 species of trees, herbs, and shrubs including a large collection of aquatic plants. The garden is divided into 57 sections, and is managed by the government through the Department of Forestry, Ministry of Environment, and Forests. The geographical location of the garden is 23°49'10.81" N to 90°20'48.92" E.



**Fig 1: Mosquito sampling areas**

### 2.1.2. Baldha Garden

Baldha garden (Fig.1) is one of the oldest gardens located at Wari in the old part of the city of Dhaka. The naturalist, philosopher, and poet Narendra Narayan Roy Chaudhury, landlord of Estate of Baldha, established the garden on his own property in 1909. It is divided into two units, the larger unit; Cybele is roughly rectangular, with the northern side slightly cutting a corner, and measures about 136 meters in length and 76 meters in width. The rose garden in Cybele is famous throughout the subcontinent for its rich collection of roses. One of the two greenhouses has rich collections of orchids, aroids, and conservatory plants. The smaller unit, Psyche is approximately 100 meters long and 45 meters wide which has several varieties of the aquatic plant *Nymphaea pubescens*. The Baldha garden is now managed as a satellite unit of the National Botanical Garden by the Department of Forestry. The geographical location of the garden is 23043°00.21' N to 90025°09.24' E.

### 2.1.3. Osmani Uddyan

Osmani Uddyan is located near the zero point of Dhaka city. The area is surrounded by the Nagarbhaban and Bangabazar to the south, Kurgeon Hall of Dhaka University to the west, the Secretariats and the Education Bhaban to the north, and Gulistan to the east. The uddyan houses several species of trees, herbs, and shrubs. The uddyan loses its glory due to uncontrolled human entrance. At present, a big project was taken to protect the area. The geographical location of the uddyan is 23043°33.34' N to 90024°27.17' E.

### 2.1.4. Chandrima Uddyan

Chandrima Uddyan (also called Zia Uddyan) (Fig.1) is a park situated in the road beside the Jatiyo Sangshad Bhaban, Dhaka. The name literally means "Moonlight Park" in Bengali. The park is notable for being the place where the former Bangladeshi President, Ziaur Rahman was buried. It is connected to the road with a bridge which runs over the Crescent Lake. Due to political reasons, the park was named Zia Uddyan for some time in the past, and this name is still very well known among citizens. The geographical location of the garden is 23046°00.55' N to 90022°22.50' E.

### 2.1.5. Ramna Park

The history of Ramna starts about 1610 AD during Mughal rule and the present shape of Ramna Park (Fig.1) was drawn up in 1952 by C & B Dept. (now PWD) and the lake was excavated and extended. Narrow pathways were built by phases. To water the rare variety of saplings, deep tube well and a bud-shape water tower were built on the northern side. The park now covers an area of 68.50 acres of which the lake takes 8.76 acres. Ramna Park now boasts with 71 species of flowering plant, 36 species of fruit plants, 33 species of medicinal plants, 41 species of forestry and 11 other plant species. Walkways inside park have been widened and five new gates built for entry from different sides. The geographical location of the park is 23044°16.19' N to 90023°59.26' E.

### 2.1.6. Suhrawardi Uddyan

Suhrawardi Uddyan (Fig.1) also known as Ramna Recourse, is located at the heart of Dhaka city. The area is surrounded by the old High Court Building and the mausoleums of the three national leaders Sher-e-Bangla A K Fazlul Huq, K. Nazimuddin and H.S. Suhrawardy to the south, Bangla

Academy, Atomic Energy Commission, Bangladesh National Museum, Public Library and the Teachers Students Centre, Institute of Fine Arts and the main mosque of the University of Dhaka to the west, BIRDEM Hospital, Dhaka Club and Dhaka Tennis Complex to the Supreme Court, the Institute of Engineers and the Ramna Park to the east. The geographical location of the garden is 23043°57.80' N to 90023°59.01' E.

### 2.2. Period of study

The study was carried out from July 2010 to June 2011. All the six study areas were visited once a week for routine collection and observation. So a single area was visited four (4) times a month and total of (4x11) 44 times in the study period.

### 2.3. Procedure of mosquito collection

The larvae of the mosquito were collected from the different areas of the six locations from wet containers available. Larvae were collected using a dipper (14x6 cm) in ground pools and other open sources and Pasteur pipette in tree holes and other container habitats. Eggs were also collected in some instances and brought to the laboratory for rearing and identification. Adult mosquitoes were collected by aspirator and sweeping net. The collected larvae were brought to the entomology laboratory, Department of Zoology, Jahangirnagar University by small plastic jars with water. Larvae were identified in the laboratory and the rest of the larvae were reared in rearing cases for adult identification. Adult mosquitoes were brought to the laboratory by case and cotton bed. Species identification was done following the keys [2, 3, 7, 10, 12, 13, 14].

### 3. Result and Discussion

A total of 11 species of mosquito was identified during the study period from the six selected parks. These were: *Anopheles annularis*, *An. culicifacies*, *Aedes aegypti*, *Ae. albopictus*, *Armigeres subalbatus*, *Culex fuscocephala*, *Cx. quinquefasciatus*, *Cx. tritaeniorhynchus*, *Mansonia annulifera*, *Mn. uniformis*, *Toxorhynchites bengalensis*. *Anopheles* mosquito was found only in Ramna Park and Botanical garden, whereas principal dengue vector mosquito *Ae. aegypti* was found only in Baldha garden. *Armigeres subalbatus* and *Ae. albopictus* mosquito were recorded from the all six study sites because these mosquito breed mainly in tree hole [6].

These mosquitoes are known as wild mosquito. The species *Mn. annulifera* was found in all the study areas except Osmani Uddyan. *Toxorhynchites bengalensis* is the largest in size among the recorded species which was found only in Botanical garden and Ramna park. *Toxorhynchites* larvae are a biological control agent of the other mosquito species [11]. Mosquito diversity is very high in Ramna park and low in Osmani Uddyan because the ecology and biodiversity of the two sites is different (Table 1).

Breeding habitats of the collected mosquito species were recorded during the study period. *Aedes albopictus*, *Ar. subalbatus*, *Cx. fuscocephala*, *Cx. quinquefasciatus*, were found breeding in all the seasons i.e., monsoon, winter and summer. The species recorded in relation to the larval habitats are presented in Table 2. Only two species, *Ae. Aegypti* and *Ae. albopictus* were found in more than five types of larval habitats. A maximum number of six species was found in the pond habitat with lake ranking the next with five species.

*Aedes albopictus* bred most of the recorded breeding habitats except drain, pond, lake and mud pool (Table 2). *Aedes albopictus* (38.18%) and *Ar. subalbatus* (37.47%) showed the highest and *Cx. fuscocephala* (0.6%) the lowest density among the collected mosquito species from the surveyed areas. A moderate (22.59%) of *Cx. quinquefasciatus* was found in all of the surveyed areas. The rest of the mosquito species were

recorded on minimum percentage. The highest and lowest percentages of mosquito were found in Botanical garden (28.68%) and Osmani Uddyan (6.67%), respectively. High density of *Ae. albopictus* mosquito, which is the secondary vector of dengue viruses, was found in all six areas. *Armigeres subalbatus* was also a dominant mosquito species in the surveyed sites.

### 3.1. Tables and Figures

**Table 1:** Density of different mosquito species in different areas of Dhaka city from July 2010 to June 2011

Mosquito species	Survey Areas					
	Ramna Park	Suhrawardi Uddyan	Osmani Uddyan	Chandrima/Zia Uddyan	Botanical Garden	Baldha Garden
<i>Anopheles (Cellia) annularis</i> Vander Wulp, 1884	4.82	0	0	0	2.13	0
<i>Anopheles (Cellia) culicifacies</i> Giles, 1901	2.31	0	0	0	1.52	0
<i>Aedes (Stegomyia) aegypti</i> Linnaeus, 1762	0	0	0	0	0	8.51
<i>Aedes (Stegomyia) albopictus</i> Skuse, 1894	32.61	39.02	41.23	48.08	35.67	32.46
<i>Armigeres (Armigeres) subalbatus</i> Coguillet, 1898	30.06	41.23	38.65	43.62	36.74	34.52
<i>Culex (Culex) fuscocephala</i> Theobald, 1907	1.38	0	0	0	2.21	0
<i>Culex (Culex) quinquefasciatus</i> Say, 1823	12.62	17.26	20.12	7.58	6.34	19.56
<i>Culex (Culex) tritaeniorhynchus</i> Giles, 1901	2.43	1.18	0	0	1.68	0
<i>Mansonia (Mansonioides) annulifera</i> Theobald, 1901	6.92	1.31	0	0.72	5.63	2.64
<i>Mansonia (Mansonioides) uniformis</i> Theobald, 1901	5.32	0	0	0	5.43	2.31
<i>Toxorhynchites (Toxorhynchites) bengalensis</i>	1.53	0	0	0	2.65	0

**Table 2:** Mosquito species of different parks of Dhaka City in relation to larval habitats observed from July 2010 to June 2011

Species \ Habitats	<i>An. annularis</i>	<i>An. culicifacies</i>	<i>Ae. aegypti</i>	<i>Ae. albopictus</i>	<i>Ar. subalbatus</i>	<i>Cx. fuscocephala</i>	<i>Cx. quinquefasciatus</i>	<i>Cx. tritaeniorhynchus</i>	<i>Mn. annulifera</i>	<i>Mn. uniformis</i>	<i>Tx. bengalensis</i>
Tree hole				+	+						+
Bamboo stump				+				+			
Leaf axils				+							
Fruit shell			+	+	+						
Drain					+		+	+			
Pond	+	+				+			+	+	+
Lake	+						+		+	+	+
Rain water pool				+							
Tin pot			+	+							
Coke, water bottles			+	+							
Tyre			+	+			+				
Egg shell				+							
Empty flower pot			+	+							
Flower pot base			+	+							
Mud pool	+	+				+					

+ stands for presence of mosquito.

### 4. Conclusion

The selected park is the recreational and physical exercise spot of the city dwellers. Large numbers of vector mosquito were

found in these places. Out of 11 species recorded in this study, 7 are known to be vectors of different mosquito-borne diseases

in Bangladesh. They are *An. annularis* (malaria), *Ae. aegypti*, *Ae. albopictus* (dengue fever), *Cx. fuscocephala*, *Cx. tritaeniorhynchus*, *Cx. quinquefasciatus* (bancroftian filariasis), *Mn. annulifera* (malayan filariasis). It is well known that some of the female mosquitoes, which were originally zoophilic and sylvatic, have adapted to feeding on human blood and became peridomestic and even per urban due to deforestation. The involvement of man in certain host-parasite cycles will depend on the effect of his activities on the breeding sites of vectors, their capacity to adapt to new ecology and the presence of animal reservoirs as well as human behavior pattern.

It is recommended to stop deforestation in the national park of Bangladesh. Some selected forest (near Dhaka) should be restricted. Recreation spots of Dhaka city should be protected from mosquitoes. Tree holes should be filled with cement. Proper management of the breeding habitats of the mosquitoes in these areas will reduce mosquito population and prevent peoples from vector-borne diseases.

### 5. Acknowledgement

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