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Faunnastic Studies On Vector And Non-Vector Mosquitoes In JU,Savar, Dhaka.

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Abstract: An entomological surveillance carried out (March-12 to July-12) to record the mosquito species and their status in Jahangirnagar University (JU) campus. A total 14 species under 6 different species identified. The recorded genera were *Anopheles (An), Culex (Cx), Aedes (Ae), Armigeres (Ar), Mansonia (Mn) and Toxorhynchites (Tx).*The collected species were *Cx. quinquefasciatus, Cx. tritaeniorhynchus, Cx. fuscocephala, Cx. vishnui, Cx. gelidus, Cx*. *hasensoni, An. annularies, An. vagus, Ae. aegypti, Ae. albopictus, Ar. subalbatus, Tx*. *splendens, Mn. annulifera, Mn. uniformis*. Among the adult mosquitoes *Cx. tritaeniorhynchus* showed the highest density and *Tx. splendens* showed the lowest density .High number of *Ae. Albopictus* were recorded from study area, which is the secondary vector of dengue viruses.

Key words: *Culex, Anopheles, Aedes, Armigeres, Toxorhynchites , Mnsonia*, Mosquito Jahangirnagar University

Introduction

Mosquitoes are well known groups of insects belonging to the family Culicidae of the order Diptera and well-known group of insect, consisting of more than 85,000 species (Tembhare, 1997). The numbers of this order are commonly called as true flies and are abundance in individuals and species almost everywhere. They are highly evolved and indirectly affect the health of humans, animals and plants. Others are important natural enemies of insects and some are considered beneficial as plant pollinators. They occur every conceivable terrestrial and freshwater habitat (Pedigo, 1996). Mosquitoes have been some of the most significant pest in the history of mankind (Pedigo, 1996). The mosquito has four stages in its life cycle: egg, larvae, pupae and adult. The adult is an active flying insect, while the larvae and pupae are aquatic and occur only in water. Depending on the species, eggs are laid on the surface of the water or are deposited on moist soil or other object that will be flooded. Eggs are white when first deposited, darkens to black within 12-24 hours. Eggs are laid by singly by some species and others lay eggs together to form rafts. The larvae (wrigglers or wigglers) of all mosquitoes live in water and four development periods of instar. These are called 1^{st}, 2^{nd}, 3^{rd}, 4^{th} instars. Upon maturity the 4^{th} instar larvae molt to pupal stage, which are also aquatic called tumblers (Borror, 1981). Adult mosquito has slender body, globular head, large compound eyes and elongated dimorphic antennae (Tembhare, 1997). They are tiny creatures have the potential and lethal capacity to kill more than a million victims a year around the world (vatandoost and vaziril, 2001) and are considered as an assasins and nuisance. Many infect micro-organisms and thus transmit disease. Report on such diseases, particularly on those dengue, malaria, filaria, Japanese encephalitis have been published by Ahmed *et al* (1986). Apart from these, they cause biting annoyance and irritation through sucking blood (Goma, 1966). Mosquitoes are cosmopolitan in distribution. There are many types of mosquitoes living in the tropical and sub-tropical regions of the world (Mortimer, 1998). The mosquitoes occupy a wide variety habitat in rural, urban and sylvan situations enhance their probability to be true vector species (Omeara *et al*., 1993). Except Antarctica mosquitoes are worldwide distributed. They found from the tropic to the Arctic circle and from lowlands to the peaks of high mountains. In the distribution patterns, some species are cosmotropical and some have restricted distribution and they may be confined to particular areas in the globe (Service, 1980), and the greatest variety being found in tropical rain forest regions (Knight and Stone, 1977). Mosquitoes make up the family Culicidae of the order Diptera, which is divided into three subfamilies: (1) Toxorhynchitinae (Megarhininae), adults large with metallic scales, proboscis strongly bent downward, flower-feeding, and larvae predacious, for example, *Toxorhynchites rutilus; (2)* Culicinae, adults with palpi of the female less than half length of proboscis, scutellum trilobed, females hematophagous, for example, *Culex pipiens* and *Aedes aegypti;* (3) Anophelinae, adults with palpi of both sexes nearly or as long as proboscis, scutellum with exceptional band like, females hematophagous, for example, *Anopheles maculipennis* (Kettle, 1995). There are more than 2500 species of Culicinae of which, *Culex* genera with nearly 750 species and the genus *Aedes* contains more than 500 species (WHO review paper, 1972). There are more than 3000 mosquito species of the world grouped in 39 genera and 135 sub genera of which 100 are vector of human diseases (Clement, 1992; Reinert, 2001). In Bangladesh, altogether 113 species of mosquitoes, including 34 Anophelines and 79 Culicines, have so far been recorded (Ahmed, 1987). Recently Kabirul Bashar, assistant professor. Department of Zoology, Jahangirnagar University, Savar, Dhaka, Bangladesh introduced a new species under the genus *Culex.* Among the genus, *Culex quinquefasciatus* Say (= *Culex fatigans)* is widely distributed in urban and rural areas in Bangladesh (Aslamkhan and Wolfe, 1972; Hossain *et al.,* 1998), and are predominant throughout the year. They grow abundantly in dump and marshy places all over the country. Mosquitoes exploit almost all types of lentic aquatic habitats for breeding. The immature stages of mosquitoes thrive in the aquatic bodies along with conspecifics and heterospecifics forming the larval mosquito community. The resources in terms of food, predators and competitors present in the habitat determine the population status of larval mosquitoes, both qualitatively and quantitatively (Sunahara *et al.,* 2002; Carlson *et al.,* 2004). Mosquitoes larvae breed in different type of wet container. Larval breeding habits include a wide variety of ground water accumulation as well as tree–holes, bamboo stumps, internodes, leaf axils, picher plants and varieties of container, both indoor and outdoor. The diversity among insects has always been of keen interest, not only to entomologists dealing with structure and function, but also

to those who are engaged in different environmental programs. Mosquitoes distributed worldwide and practically no part of the globe that can serve for human existence is free from mosquitoes. (O'Meara, 1976). They are also important nuisance pests. Mosquito born diseases are also public health problem of Bangladesh. The Mosquitoes are known to be the vectors of many dreadful human diseases like malaria, filariasis, encephalitis, dengue fever etc. (Bang, 1985; Halstead, 1966). Many species bite man and they serve as vectors in the transmission of several human disease (Borror *et al*., 1981). All mosquitoes are not capable to transmitting diseases, although they may harbor pathogens. There are some factors, which determine Victoria capability. A species that normal lives near man, feeds readily or preferably on man and lives for several weeks or longer is more likely to be a major vector than a species that lives away from human habitation, feeds by preference on non-human hosts and dies within a relatively short time. Besides these, temperature is the most important factor, because it affects the speed of development of the parasite within the mosquito and the rate of metabolism itself (Ahmed, 1996). Moreover, vector density is also important in process of diseases transmission. When a good vector occur in high density, diseases transmission will be intense. Such situation have also been noticed in Bangladesh. Several outbreaks occurred by such mosquitoes whose density become high in some particular year due to favourable climatic condition (Ahmed, 1996). Vector-borne diseases remain a major deterrent to human settlement and agricultural development in many areas of Africa and Asia (NAS, 1975). Mosquitoes transmit harmful pathogen to men, causes severe and fatal diseases which create health problem of man and animals in tropics (WHO, 1997). Mosquito-borne diseases have been a major problem in almost all tropical and subtropical countries, and currently there are no successful vaccines against most such diseases. Taubes (1977) pointed out that mosquito borne diseases of man occur worldwide in more than 700,000,000 people annually and will be responsible for the deaths of 1 of every 17 people alive. According to Hill (1997), mosquito borne disease attacks 100 million people per year and more than 1 million die. *Anopheles* (60 sp.) causes malaria in tropic and sub-tropic by transmitting the pathogen Plasmodium sp., *Culex quinquefasciatus* causes filariasis, *Culex triteaniorynchus* causes encephalitis and *Aedes aegypti* causes yellow fever in humid Africa, Central and southern America by transmitting the pathogen (Tembhare, 1997). Recently it is noticed that mosquitoes can transmit hepatitis B-virus (Siemens, 1987). The filariasis is such a disease causing swelling of the limbs, urogenital organs, breast etc. with long-term disability. Recent estimates suggest that in 73 countries some 120 million people are infected (WHO, 1997a). Among them 107 million people are infected by filaria in the tropical areas of Africa, South-East Asia, the Pacific Islands, and South and Central America. In Bangladesh filariasis is present now in 23 endemic districts, mostly bordering India. About 20 million is already infected, most of which are incapacitated and another 30 million are at risk of infection (WHO review paper, 2008). High prevalence rate is found in northern districts, such as Thakurgaon, Dinajpur, Rangpur and Nilphamari (Banglapedia, 2008). The cycles of mosquito-borne viral encephalitis and meningitis diseases are similar. Most involve various bird species that are said to be ***reservoirs***. Once infected by a mosquito bite, the reservoir species are usually not seriously affected. They will, at least for a time, produce enough viruses in their bodies to infect mosquitoes. In this manner, mosquitoes pick up the virus and may become ***vectors***, or organisms that transmit the disease to other animals, such as birds, horses or humans. Horses and humans are generally thought of as “dead-end” hosts because they do not produce enough virus to infect mosquitoes. Thus, dead-end hosts are not involved in the spread of disease. (Illinois Department of Public Health, 2007). According to World Health Organization the virus for Dengue is the most arbovirus to man in the world, and since *Aedes aegypti* has been found to transmit this virus, it has been widely studied and blamed as the vector (Mortimer, 1998). The *Aedes* group of mosquitoes includes many nuisance mosquitoes, as well as species that transmit disease to humans. This is a diverse group that includes the inland floodwater mosquito (*Aedes vexans*), the Asian tiger mosquito (*Aedes albopictus*) and the tree hole mosquito (*Ochlerotatus triseriatus******) – all of which prefer to feed on the blood of mammals. Floodwater mosquitoes lay their eggs on soil that becomes flooded, allowing the eggs to hatch and larvae to develop in temporary pools. Asian tiger and tree hole mosquitoes are container-breeding mosquitoes, laying their eggs in small, water-filled cavities, including tree holes, stumps, logs, and artificial containers. (Illinois Department of Public Health, 2007). They mainly spread dengue fever. Dengue was reported in Dhaka long time ago (Aziz, et al.,1967) but it intensity increasing day by day. At present the dengue has become a serious problem in our country specially in Dhaka city. WHO currently estimates there may be 50 million new dengue infections every year (Chowdhury *et al*., 2000). Malaria is a parasitic disease transmitted through mosquito bites. It is serious and sometimes fatal tropical disease. Four kinds of malaria parasites can infect humans: *Plasmodium falciparum, P. vivax, P. ovale*, and P. malariae; infection with *P. falciparum,* if not promptly and correctly treated, can be fatal in as little as one or two days. The vectors of these parasites are: *Anopheles minimus*, *An*. *dirus, An. Maculatus.* The symptoms of malaria can resemble symptoms of influenza. They include fever, chills, nausea, headache, and fatigue. (www.wrongdiagnosis.com, 2010). These trouble ensued a battle in between man and mosquitoes. These battles have resulted into research work to enable man to know of mosquito, so they can be controlled. Evaluation of mosquito habitats in terms of species composition and resources help to understand the bio-ecology and related control measures of pests and vector mosquitoes is more appropriable. The present study was conducted to record the status of vectors and other Mosquito species in Jahangirnagar University (JU) campus, Savar, Dhaka, Bangladesh. These have been done because little known about the vector mosquito fauna in JU campus. Only a study was conducted. (k.Bashar, 2001). This study will be help the physician and the campus dwellers to take precautionary activities against vector born diseases.

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Result and Discussion

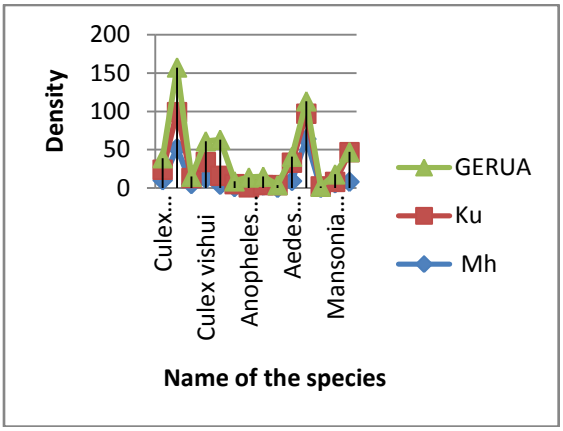
Present study was undertaken to survey the mosquito species in Jahanrirnagar University campus by collecting and identifying the species. Mainly the adult mosquito are collected by using aspirator and spray sheet. The study was carried out each month from 21 to 30 during five month. (Table.1

Table 1: Abundance of different species found in study area during

Name of the species	Mir Mosharrof Hossain Hall (Teachers quarter)			A.F.M Kamaluddin hall (student residential)			Gerua Residential Region		
	Aspirator catch	Spray sheet	Total	Aspirator catah	Spray sheet	Total	Aspirator catch	Spray sheet	Total
Culex quinquefascitus	2	8	10	3	11	14	4	11	15
Culex tritaeniorhynchus	9	43	52	8	36	47	10	48	58
Culex fuscocephala	2	3	5	2	6	8	0	2	2
Culex vishnui	1	11	12	5	17	22	6	21	27
Culex gelidus	1	3	4	3	9	12	8	39	47
Culex hasensoni	0	1	1	1	3	4	1	3	4
Anopheles annularies	0	1	1	0	0	0	2	11	13
Anopheles vagus	1	2	3	0	1	1	2	9	11
Aedes aegypti	0	0	0	1	3	4	0	0	0
Aedes albopictus	2	7	9	7	17	24	2	6	8
Armigeres subalbatus	11	53	64	9	24	33	3	13	16
Toxorhynchites splendens	0	0	0	1	1	2	0	0	0
Mansonia annulifera	1	5	6	0	2	2	2	8	10
Mansonia uniformis	2	6	8	8	31	39	0	0	0
Total	32	143	175	48	164	212	40	171	211
	Grand total								598

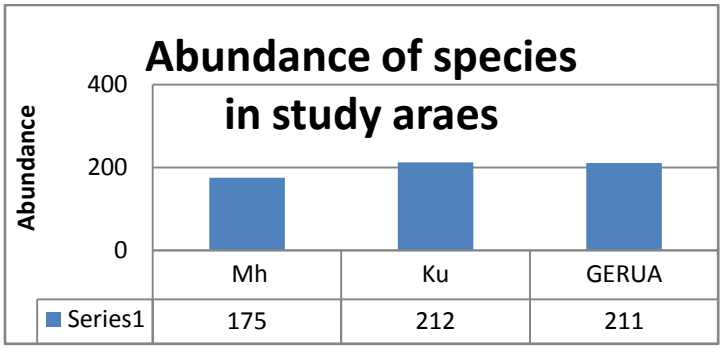
After collecting from different places the species were identified and recorded. During study period about 598 female mosquitoes were identified and male are discarded. About 14 species of mosquito under 6 genera identified . The collected 6 genera were *Culex (Cx), Anopheles (An), Aedes (Ae), Armigeres (Ar), Toxorhynchiten (Tx), and Mansonia (Mn). The species were Cx. quinquefasciatus, Cx. triteaniorhynchus, Cx. fuscocephala, Cx. vishnui, Cx. gelidus, Cx. hasensoni, An. annuliries, An. vagus, Ae. aegypti, Ae. albopictus, Ar. subalbatus, Tx. splendens, Mn. Annulifera,* and *Mn. Uniformis.*(Table.1) Among the 14 species the density and abundance were varied due to different study areas. The study were Jahangirnagar University and it was sub divided into three places- Mir Mosharrof Hossain Hall (MH), A.F.M Kamal Uddin Hall (KU), Gerua residential area (GERUA). The highest dominant species was *Cx.triteaniorhynchus*(157) and 2nd dominant species was *Ar. subalbatus* (113)

Graph.1. Density of species in three different different areas.



But density of the species as varied in different places. The dominant species in MH Hall was *Ar. subalbatus* and lowest dominant species were, *Cx. hasensoni, An. annuliries*. In KU Hall the dominant and lowest dominant species were *Cx. triteaniorhynchus* and *An. vagus* respectively. In GERUA the highest and lowest density of the species were, *Cx. triteaniorhynchus* and *Cx. fuscocephala* respectively.(Graph.1). The abundance of the species were varied in different places. Among the species the most abundances found in the KU Hall and the lowest abundance found in Mh Hall.

Graph.2. Abundance of mosquito species in three places of JU.



*Series 1=total number of species
*Mh=Mir Mosharrof Hossain Hall, ku=kamaluddin Hall and GERUA=Gerua residential area.

Total 175 species found in Mh Hall, total 212 species found in KU Hall and 211 species found in GERUA. (Graph.2) During identifying it was recorded the nature of the mosquito. Mainly the mosquitoes were remain in four natures. These are unfed, fed, half gravid and gravid.

Nature of the mosquito species

There are various type of mosquitoes found in the study area, they were as unfed, fed, half-gravid and gravid. The total collection from various places, the species showed different nature. (Table: 3, 4 and 5). The mosquitoes are collected and identified with its nature.

Table.3: Collection of mosquito by Aspirator and spray sheet during five Month study from Mir Mosharrof Hossain Hall

Table.3.1: Different type of mosquito found in Mir Mosharrof Hossain Hall during March

Name of the species	Non-fed	fed	Half-gravid	Gravid	Total
Culex quinquefasciatus	2	1	0	0	3
Culex tritaeorynchus	4	2	0	1	7
Culex fuscocephala	1	0	0	0	1
Culex vishnui	4	0	1	0	5
Culex gelidus	0	0	0	0	0
Culex hasensoni	0	0	0	0	0
Anopheles annularies	1	0	0	0	1
Anopheles vagus	0	0	0	0	0
Aedes aegypti	0	0	0	0	0
Aedes albopictus	1	1	0	0	2
Armigeres subalbatus	10	3	1	1	15
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	2	0	0	0	2
Mansonia uniformis	1	0	0	0	1
Grand Total					37

Table.3.2: Different type of mosquito found in Mir Mosharrof Hossain Hall during April

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	1	0	0	0	1
Culex tritaeniorhynchus	12	0	0	0	12
Culex fuscocephala	0	0	0	0	0
Culex vishnui	2	1	0	0	3
Culex gelidus	1	0	0	0	1
Culex hasensoni	0	1	0	0	1
Anopheles annularies	0	0	0	0	0
Anopheles vagus	1	0	0	0	1
Aedes aegypti	0	0	0	0	0
Aedes albopictus	3	0	0	0	3
Armigeres subalbatus	5	2	1	0	8
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	1	0	0	0	1
Mansonia uniformis	1	0	0	0	1
Grand Total					32

Table.3.3: Different type of mosquito found in Mir Mosharrof Hossain Hall during May

Name of the specie	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	3	0	0	0	3
Culex tritaeniorhynchus	12	0	1	0	13
Culex fuscocephala	2	1	0	0	3
Culex vishnui	2	0	0	0	2
Culex gelidus	1	1	0	0	2
Culex hasensoni	0	0	0	0	0
Anopheles annularies	0	0	0	0	0
Anopheles vagus	1	0	0	0	1
Aedes aegypti	0	0	0	0	0
Aedes albopictus	1	0	0	0	1
Armigeres subalbatus	11	2	2	0	15
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	0	0	0	0	0
Mansonia uniformis	0	0	0	0	0
Grand Total					40

Table.3.4: Different type of mosquito found in Mir Mosharrof Hossain Hall during June

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	1	0	0	0	1
Culex tritaeniorhynchus	5	4	1	0	10
Culex fuscocephala	1	0	0	0	1
Culex vishnui	0	1	0	0	1
Culex gelidus	0	0	0	0	0
Culex hasensoni	0	0	0	0	0
Anopheles annularies	0	0	0	0	0
Anopheles vagus	1	0	0	0	1
Aedes aegypti	0	0	0	0	0
Aedes albopictus	1	0	1	0	2
Armigeres subalbatus	8	3	1	1	13
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	2	0	1	0	3
Mansonia uniformis	3	1	0	0	4
Grand Total					36

Table.3.5: Different type of mosquito found in Mir Mosharrof Hossain Hall during July

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	2	0	0	0	2
Culex tritaeniorhynchus	8	2	0	0	10
Culex fuscocephala	0	0	0	0	0
Culex vishnui	1	0	0	0	1
Culex gelidus	1	0	0	0	1
Culex hasensoni	0	0	0	0	0
Anopheles annularies	0	0	0	0	0
Anopheles vagus	0	0	0	0	0
Aedes aegypti	0	0	0	0	0
Aedes albopictus	1	0	0	0	1
Armigeres subalbatus	11	0	1	1	13
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	0	0	0	0	0
Mansonia uniformis	1	1	0	0	2
Grand Total					30

Table.4: Collection of mosquito by Aspirator and spray sheet during five month study from A.F.M. Kamal Uddin Hall.

Table.4.1: Different type of mosquito found in A.F.M Kamal Uddin Hall during March

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	2	1	1	0	4
Culex tritaeniorhynchus	8	2	0	0	10
Culex fuscocephala	1	1	0	0	2
Culex vishnui	5	1	0	0	6
Culex gelidus	2	1	0	0	3
Culex hasensoni	1	0	0	0	1
Anopheles annularies	0	0	0	0	0
Anopheles vagus	0	0	0	0	0
Aedes aegypti	3	0	0	0	3
Aedes albopictus	4	0	1	0	5
Armigeres subalbatus	5	1	1	0	7
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	0	0	0	0	0
Mansonia uniformis	6	2	0	0	8
					49

Table.4.2: Different type of mosquito found in A.F.M Kamal-uddin Hall during April

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	1	1	0	0	2
Culex tritaeniorhynchus	7	1	0	0	8
Culex fuscocephala	1	0	0	0	1
Culex vishnui	2	1	0	0	3
Culex gelidus	2	1	1	0	4
Culex hasensoni	0	0	0	0	0
Anopheles annularies	0	0	0	0	0
Anopheles vagus	0	0	0	0	0
Aedes aegypti	0	0	0	0	0
Aedes albopictus	3	1	1	1	6
Armigeres subalbatus	4	2	1	0	7
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	1	0	0	0	1
Mansonia uniformis	2	1	0	0	3
Grand total					35

Table.4.3: Different type of mosquito found in A.F.M Kamaluddin Hall during May

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	3	2	0	0	5
Culex tritaeniorhynchus	12	4	1	0	17
Culex fuscocephala	1	0	0	0	1
Culex vishnui	4	2	0	1	7
Culex gelidus	1	0	0	0	1
Culex hasensoni	0	0	0	0	0
Anopheles annularies	0	0	0	0	0
Anopheles vagus	0	0	0	0	0
Aedes aegypti	1	0	0	0	1
Aedes albopictus	3	1	0	0	4
Armigeres subalbatus	11	0	0	0	11
Toxorhynchites splendens	1	0	0	0	1
Mansonia annulifera	1	0	0	0	1
Mansonia uniformis	7	1	1	0	9
Grand Total					58

Table.4.4: Different type of mosquito found in A.F.M Kamaluddin Hall during June

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	2	0	0	0	2
Culex tritaeniorhynchus	4	1	1	0	6
Culex fuscocephala	1	1	0	0	2
Culex vishnui	2	1	0	0	3
Culex gelidus	3	1	0	0	4
Culex hasensoni	1	0	0	0	1
Anopheles annularies	0	0	0	0	0
Anopheles vagus	1	0	0	0	1
Aedes aegypti	0	0	0	0	0
Aedes albopictus	5	0	0	0	5
Armigeres subalbatus	3	0	1	0	4
Toxorhynchites splendens	1	0	0	0	1
Mansonia annulifera	0	0	0	0	0
Mansonia uniformis	12	1	0	0	13
Grand total					42

Table.4.5: Different type of mosquito found in A.F.M Kamaluddin Hall during July

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	1	0	0	0	1
Culex tritaeniorhynchus	4	2	0	0	6
Culex fuscocephala	2	0	0	0	2
Culex vishnui	2	1	0	0	3
Culex gelidus	0	0	0	0	0
Culex hasensoni	2	0	0	0	2
Anopheles annularies	0	0	0	0	0
Anopheles vagus	0	0	0	0	0
Aedes aegypti	0	0	0	0	0
Aedes albopictus	3	1	0	0	4
Armigeres subalbatus	6	0	0	0	6
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	0	0	0	0	0
Mansonia uniformis	3	1	0	0	4
Grand Total					28

Table.5: Collection of mosquito by Aspirator and spray sheet during five month study from Gerua residential area.

Table.5.1: Different type of mosquito found in Gerua residential area during March

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	3	1	0	0	4
Culex tritaeniorhynchus	7	1	0	0	8
Culex fuscocephala	0	0	0	0	0
Culex vishnui	6	1	1	0	8
Culex gelidus	5	1	0	0	6
Culex hasensoni	1	0	0	0	1
Anopheles annularies	1	1	0	0	2
Anopheles vagus	0	0	0	0	0
Aedes aegypti	0	0	0	0	0
Aedes albopictus	0	0	0	0	0
Armigeres subalbatus	1	1	0	0	2
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	1	0	0	0	1
Mansonia uniformis	0	0	0	0	0
Grand Total					32

Table.5.2: Different type of mosquito found in Gerua residential area during April

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	5	1	0	0	6
Culex tritaeniorhynchus	7	2	1	0	10
Culex fuscocephala	1	0	0	0	1
Culex vishnui	5	0	1	1	7
Culex gelidus	6	3	0	0	9
Culex hasensoni	0	0	0	0	0
Anopheles annularies	0	0	0	0	0
Anopheles vagus	2	1	0	0	3
Aedes aegypti	0	0	0	0	0
Aedes albopictus	2	0	0	0	2
Armigeres subalbatus	0	0	0	0	0
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	2	0	0	0	2
Mansonia uniformis	0	0	0	0	0
Grand Total					40

Table.5.3: Different type of mosquito found in during Gerua residential area during May

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	2	1	0	0	3
Culex tritaeniorhynchus	9	3	0	0	12
Culex fuscocephala	0	0	0	0	0
Culex vishnui	2	2	1	0	5
Culex gelidus	7	3	1	0	11
Culex hasensoni	0	1	1	0	2
Anopheles annularies	2	1	0	0	3
Anopheles vagus	1	0	0	0	1
Aedes aegypti	0	0	0	0	0
Aedes albopictus	1	0	0	0	1
Armigeres subalbatus	5	1	0	0	6
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	3	1	0	0	4
Mansonia uniformis	0	0	0	0	0
Grand Total					48

Table.5.4: Different type of mosquito found in Gerua residential area during June

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	2	0	0	0	2
Culex tritaeniorhynchus	5	3	2	1	11
Culex fuscocephala	0	0	0	0	0
Culex vishnui	4	0	0	0	4
Culex gelidus	5	2	1	0	8
Culex hasensoni	0	0	0	0	0
Anopheles annularies	7	1	0	0	8
Anopheles vagus	4	1	0	0	5
Aedes aegypti	0	0	0	0	0
Aedes albopictus	3	0	1	0	4
Armigeres subalbatus	4	1	0	0	5
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	0	0	0	0	0
Mansonia uniformis	0	0	0	0	0
Grand Total					47

Table.5.5: Different type of mosquito found in Gerua residential area during July

Name of the species	Unfed	Fed	Half-Gravid	Gravid	Total
Culex quinquefasciatus	0	0	0	0	0
Culex tritaeniorhynchus	12	2	2	1	17
Culex fuscocephala	0	1	0	0	1
Culex vishnui	2	1	0	0	3
Culex gelidus	10	2	1	0	13
Culex hasensoni	1	0	0	0	1
Anopheles annularies	0	0	0	0	0
Anopheles vagus	1	1	0	0	2
Aedes aegypti	0	0	0	0	0
Aedes albopictus	1	0	0	0	1
Armigeres subalbatus	3	0	0	0	3
Toxorhynchites splendens	0	0	0	0	0
Mansonia annulifera	3	0	0	0	3
Mansonia uniformis	0	0	0	0	0
Grand Total					44

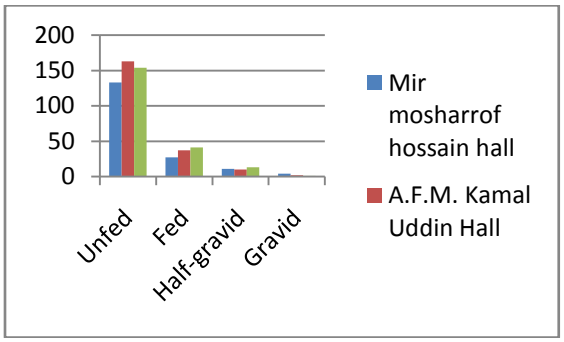
The unfed species were highest dominant and the the gravid species were lowest dominant species in three study period.

Table.6: Different species found from three study area

Name of the study area	Unfed	Fed	Half-Gravid	Gravid	Total
Mir Mosharrof Hossain Hall	133	27	11	4	175
A.F.M Kamal Uddin Hall	163	37	10	2	212
Gerua residential area	156	41	13	1	211

About 452 species were unfed, 105 species were fed, 34 species were half gravid while only 7 species were gravid.(Table.6). In Mh Hall unfed, fed, haif-gravid and gravid were 133, 27 ,11, 4 respectively. In KU Hall unfed, fed, half-gravid, gravid were 163, 37, 10, 2 respectively and In Gerua unfed, fed, half-gravid and gravid 156, 41, 13 and 1 respectively.The density of the different species showed in Graph.2.

Graph.3: Different species found in three study area.



The density of different species (fed, unfed, half-gravid and gravid) found in study area.(Graph.2)

Seasonal prevalence of Mosquito species in JU campus

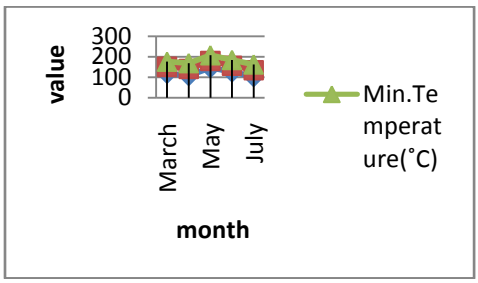
The density of mosquito species were greatly affected by temperature, humidity and rainfall.

Table.7. Relation of mosquito species with humidity and temperature and rainfall.

Month	Total species number	Humidity	Rainfall	Max. Temperature (˚C)	Min.Temperature (˚C)
March	118	73.20 %	11mm	32.9	25
April	107	79.90 %	47mm	33.3	28
May	146	81.51 %	159 mm	33.3	28.4
June	125	88.12 %	232 mm	31.3	27.8
July	102	87.58 %	78.5 mm	32.7	27.6

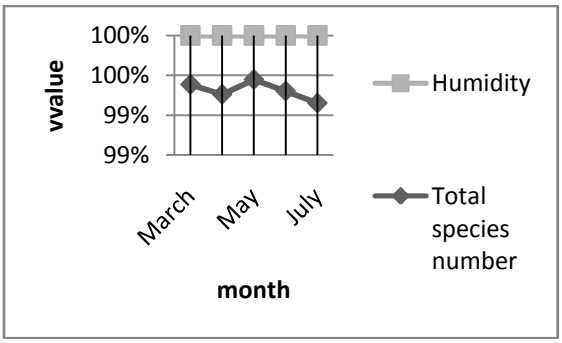
Source: Jahangirnagar University weather division, Dept. of Geography and environment.

Graph.4: Relation of mosquito species with temperature.



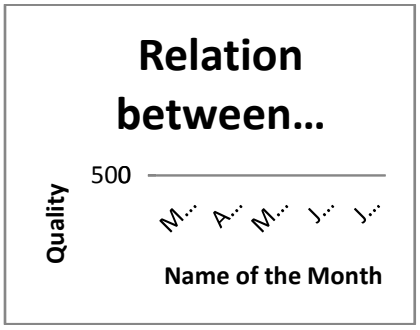
During the study period the highest temperature found in May about maximum 33.3˚C and minimum28.4 C and the lowest temperature was found in March about maximum 32.9˚C and minimum 25˚C. When temperature is highest mosquito density is relatively higher (146) and when temperature is lower mosquito density is lower . In March, April, May, June, July the Maximum and minimum temperature were 32.9-25C, 33.3-28C, 28.4-33.3C, 27.8-31.3C and 17.6-32.6C. In March, April, May, June, July the mosquito species were found 118, 107, 146, 125, 102 respectively.The highest amount of mosquito was collected in May. So, it seems to be temperature and mosquito are positively co-related. The temperature and total mosquito species correlation is calculated and it is 0.125881.(Graph.4)

Graph: 5. Relation between species and humidity

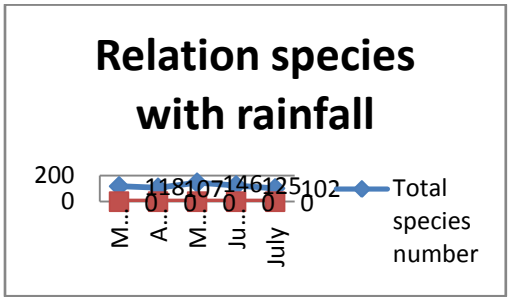


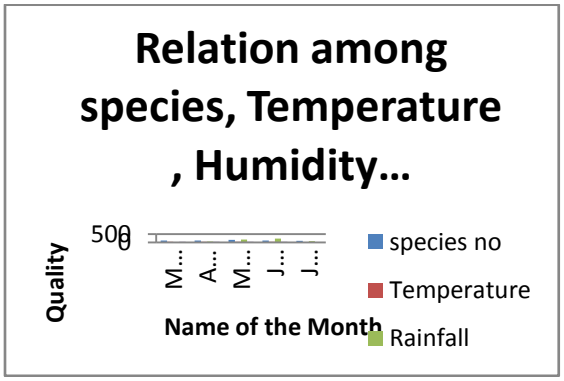
Humidity also great effect in mosquito species abundance. In March, April, May, June and July the total mosquito species were identified about 118, 107, 146, 125, 102. In these month the humidity were

Graph.4: Relation between species with temperature, Humidity and Rainfall



73.20, 79.9, 81.51, 88.12, 87.58 respectively. The increase of mosquito species due to decrease of humidity.The humidity was negatively correlated. The humidity and total mosquito species correlation is calculated and it is about -0.08843.(Graph.5)





Rainfall also have great effect in mosquito species abundance. In March, April, May, June and July the total mosquito species were identified about 118, 107, 146, 125, 102.

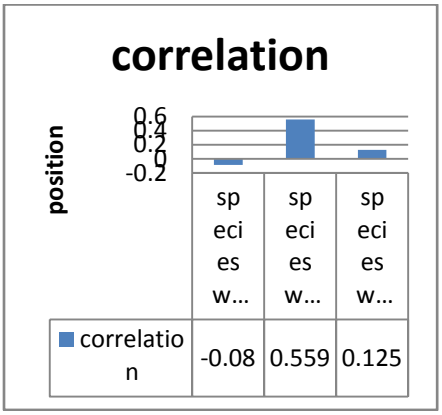
Graph: 6. Relation between mosquitoes species and rainfall.

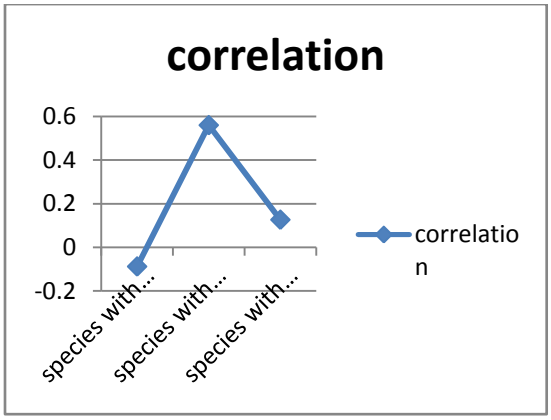
In March, April, May, June, July the rainfall were 11, 47, 159, 232 and 78.5 respectively. The species density relatively increases due to sudden rainfall. The rainfall and total mosquito specie are correlated. The correlation is 0.559318.(Graph.6)

Graph:7. Effect of temperature, humidity and rainfall on mosquito species abundance.

Species abundance and density depen on the temperature, rainfall and humidy.Temperature and rainfall when increase the mosquito species increase. But when the humidity increase the the density and abundance of species decrease. (Graph.7) The species abundance and density of mosquito species were direcly correlated to temperature, humidity and rainfall.

Graph.8: Correlation with species abundance, humidity, rainfall and temperature.





In our study we found that temperature and rainfall were positively correlated where the humidity was negatively correlated to mosquito species density and abundance. (Graph.8).

Discussion

A total 598 female mosquitoes identified and male are discarded that are collected from different places (3 places) of Jahangirnagar University (JU) during the study period (March-10 to July-10). Altogather 14 species under 6 genera were identified. The collected 6 genera were Culex (Cx), Anopheles (An), Aedes (Ae), Armigeres (Ar), Toxorhynchites (Tx), and Mansonia (Mn). The species were Cx. quinquefasciatus, Cx. triteaniorhynchus, Cx. fuscocephala, Cx. vishnui, Cx. gelidus, Cx. hasensoni, An. annuliries, An. vaguss , Ae. aegypti, Ae. albopictus, Ar. subalbatus, Tx. splendens, Mn. annulifera, and Mn. uniformis. The present study record only the three sub families Anophelinae Culicinae and Toxorhynchitenae.

Among the 14 species of adult mosquitoes, Cx. triteaniorhynchus (157), were dominant species followed by Ar. subalbatus (113), Cx. gelidus (63), Cx. vishnui (61), Mn. uniformis (47), Ae. albopictus (41), Cx. quinquefasciatus (41), Mn. Annulifera (18), Cx. fuscocephala(15)), An. vagus (15), An. annuliries (14), Cx. hasensoni (9) Ae. Aegypti (4) Tx. Splendens (2). The cause of the dominace species Cx. quinquefasciatus in the Dhaka city is the presence of polluted water breeding places. But the picture is different in JU campus, where the polluted water breeding places comparatively less than Dhaka city. As clear water breeder mosquitoes were more in the study area. It is the reason of high density of Cx.tritaeniorhynchus, Cx. vishnui than Cx.quiquefasciatus in JU campus. The study area were sub-divided into following 3 sub areas , Mir Mosharrof Hossain Hall (Mh), A.F.M. Kamal-Uddin Hall (Ku) and Gerua residential area (Gerua). In Mh Hall the dominant species is Ar. subalbatus and 2nd dominant species is Cx. teitaeniorhynchus, and the lowest density is Cx. hasensoni. In KU the dominant species is Cx. teitaeniorhynchus. In Gerua the dominant species is Cx. triteaorinhynus and Cx. gelidus and the lowest density is Cx. fuscocephala. In three sub area the highest density is Cx. triteaoniorhynchuus and 2nd highest Ar. subalbatus and the lowest is Toxorhynchites splendens. Adult collection showed that the most (11) species were distributed in all sub areas of the campus. Aedes aegypti and Toxorhyncites splendes found only in KU hall. The highest dominant species were collected and identified from KU hall (212). Ku Hall confined to forest area and lake and Aedes albopictus and Toxorhynchites splendes species were found in there. In Ku Hall 13 species were dominant among the identified 14 species and only 1 species (An. annuliries) was not found. The 2nd dominant species were found in GERUA (211). The habitat of Gerua was confined with cattle field and rice field. There the abundance was found Anopheles spp. There the 11 species were dominant among the identified 14 species. Mn. Uniformis, Ae. Aegypti, Toxorhynchites splendens were not found. The third collected species were from Mh Hall that was 175. There the 12 species were dominant and only Toxorhynchites splendens, Ae. Aegypti were absent. In OUR study we found that the highest density of unfed mosquitoes and lowest is gravid. In study period we observed that the humidity, temperature and rainfall have direct effect on species density. Humidity are negatively correlated where the rainfall and temperature are positively correlated. The highest humidity was found in June (88.12%) and lowest humidity was found in March (73.20%).When humidity increases mosquitoes density decreases. The lowest humidity was found in March but the mosquito density found in March is moderate in number (118).So, it can be concluded that when humidity is increases mosquito decreases. The relation between mosquito and humidity is negatively correlated and the negative correlation is –0.08843. But when the temperature and rainfall increase the mosquitoes density increase. These were positively correlated to mosquitoes density. The correlation between mosquito species and temperature was 0.125881 and between mosquito species and rainfall was 0.8559318.

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