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RESEARCH ARTICLE

SEASONAL VARIATION OF MOSQUITOES IN RELATION TO ABIOTIC ENVIRONMENTAL FACTORS IN BEED DISTRICT OF MAHARASHTRA, INDIA

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ABSTRACT

The present study gives an overview of data on the biodiversity of mosquitoes. The distribution pattern of mosquitoes is related to habitat preference. These habitats may be natural or man-made. Mosquitoes are carriers of number of diseases. The study was carried out for one year during August 2019 to July 2020. Collection of mosquito species from different nine geographical regions of Ashti tehsil, District Beed (M.S.). Mosquitoes were collected at different habitats. A total number of 3274 mosquitoes were collected from nine different localities. A diverse collection of Mosquitos reveals the presence of Seventeen species belonging to five genera i.e. *Anopheles, Aedes, Culex Armigeres* and *Mansonia*. *Anopheles* genus dominated with seven species. The highest population of mosquito species observed in the rainy season in the month of September. Whereas density of mosquito species was observed least in the summer, in the month of February. Genus wise Contribution (percentage) of Mosquitos was dominated by *Anopheles sp.* (33.87%), followed by *Aedes sp*. (28.68%) ,*Culex sp*. (26.66%), *Armigeres s*p. (8.77%) and *Mansonia Sp* (2.02%). The most dominant species collected from study areas was *Culex quinquefasciatus* (18.7%) followed by *An. subpictus* (9.8%) , *Aedes aegypti* (9.32%) and *An. culicifacies (8.86 %) and* the least collected species was *Anopheles gigas (1.68%).*

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INTRODUCTION

Now a day's mosquito **is** most problematic arthropod regarding human health. It is not only nuisance but also vector parasites for number of diseases. So for the better and healthy human health worldwide number of workers are working on "mosquito and mosquito borne diseases" but till today we are not got satisfaction. More than half of the world's population live in areas where this mosquito species is present. Globally mosquito borne diseases causes 2.5 million deaths per year viz. Malaria, Dengue, Yellow fever, Elephantiasis etc. Sustained mosquito control efforts are important to prevent outbreaks from these diseases. There are several different types of mosquitoes and some have the ability to carry many different diseases'. The distribution pattern of adult mosquitoes is related to habitat preference of the immature stages. These habitats may be natural or man-made, temporary or permanent. Climate change, infrastructural disabilities and availability of breeding beds result in surveillance of mosquitoes (Episton,1998; Gubler, 1998; Reiter, 2001). It provides favorable condition for mosquito distribution and their abundance. It is main cause for spreading of infectious diseases like Malaria, Chikungunia, Yellow, Fever, Elephantiasis, Dengue etc.

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Day by day global change is occurring across a wide range of fields and those changes affect almost every aspect of human societies. There are a number of drivers of global change that are changing the physical and social environment on planate to such an extent that they have the potential to influence the status of many vector-borne diseases. These complex global phenomenon and natural as well as infrastructural disabilities are favorable for mosquito development and mosquito borne diseases. In India the major mosquito vectors of these diseases belong to the genera Anopheles, Culex, Aedes and Mansoni. The knowledge on biodiversity of mosquitoes in an area provides adequate information on population diversity, distribution pattern and preferential habitat selection which will help to evolve a suitable strategy and implement the same for the meaningful suppression of the mosquito population and in turn to reduce the mosquito menace. In last few decades cases of dangerous diseases like Malaria, Chikungunia, Dengue, Elephantiasis, Yellow fever and other Viral fever were reported from villages in Marathwada region of Maharashtra. Hence the present investigation was carried out to morphological identification of mosquito species and their prevalence for planning of mosquito vector control measures in Ashti taluka of Beed district of Maharashtra (India).

MATERIALS AND METHODS

The study was carried out for twelve months during August 2019 to July 2020. Collection of mosquito specimens from

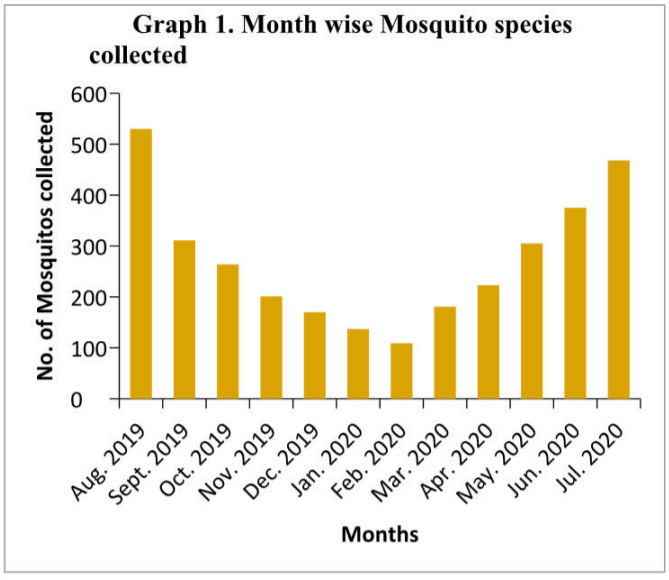
different nine geographical regions of Ashti tehsil, District Beed (M.S.). These regions includes Ashti, Murshadpur, Dnyandeep colony Kada, Bus station Kada, Dhamangaon, Dhanora, Shirapur and Belgaon which cover the maximum study area. The study area lies between 18°48′19″N and 75°10′22″E. Ashti taluka is draught prone area. An average temperature of Ashti tehsil is near about 33 ^{0}C to 42^{0}C in summer and 19^{0}C to 28^{0}C in winter. A rainfall is moderate in the study area. An average rain fall is 670.2 mm. Whereas humidity ranges from 19 to 83 %. Both larvae and adult mosquitoes were collected from nine different habitats localities which covers maximum study area. Overall random sample of Mosquito and mosquito larvae were collected in one year during August 2019 to July 2020. Collections of mosquito were carried out indoor as well as outdoor by aspirator and Net method. For Larvae dipping method is used and the sample was carried out immediately to laboratory for identification and fixed in insect preservative ie. 70 to 80% alcohol. Each locality was sampled at least once in each month. Identification of adult and larvae were carried out with the help of Identification key (Christopher, 1933; Sharma et al., 1995), WHO. 1975, Barraud and Nagpal 1995), and also used electronic key developed by NIMR Delhi. Morphological identification of the specimens carried out by using characters like, mouth parts - proboscis, maxillary palps, antennae wing venation, scales on wings and legs.

RESULTS AND DISCUSSION

A total number of 3274 mosquitoes were collected from nine different localities (i.e. Ashti, Murshadpur, Kada, Dhanora. Daegaon Dhamangaon, Doithan Belgaon, and Shirapur) which covers most of the study area (Graph 2). The habitat types found during this survey included water storage tanks, plastic vessels, metal vessels, ceramic vessels, barrels, a tucker box, tires, coconut shell, temporary pools, ditches and drainage (gutters). A diverse collection of Mosquitos reveals the presence of Seventeen species belonging to five genera i.e. Anopheles, Aedes, Culex Armigeres and Mansonia. Anopheles genus dominated with seven species i.e, An. culicifacies, An. annularis, An. barbirostris, An. quadrimaculatus An. hyrcanus, An. subpictus and An. gigas. Aedes aegypti, Ae. albolateralis, Ae.albopictus and Ae. vittatus the four specieswere recorded from Aedes. Genus Culex also reported with four species i.e Cx. quinquefasciatus, Cx.tritaeniorhynchus, Cx.vishnui and Cx. Psedovishnui whereas Armigeres and Mansonia was representing only one species each i.e. Ar. subalbatus and M. uniformis. The diversity of mosquitoes in these localities showed the availability of resting places for males, and favorable ambient factors like temperature and rainfall. Month wise diversity of collected Mosquito species from different localities during Study period is given in table No.2. According to Harbache (2013) a total of 3539 species of mosquitoes belonging to 112 genera are found on this earth. Pandian R. S. (1998) also recorded same results in an urban area in Tamilnadu. Sathe ans Girhe (2001) also studied Biodiversity of mosquito in Kolhapur, Maharashtra. Month wise collected Mosquito species from different localities during study period are shown in table No. 1. The habitat types found during this survey included water storage tanks, plastic vessels, ceramic vessels, metal vessels tucker boxes, barrels, tires, coconut shell, pools, ditches and drainage etc.

Table 1. Month wise collected Mosquito species from different localities

Sr. No.	Location	Aug. 2019	Sept. 2019	Oct. 2019	Nov. 2019	Dec. 2019	Jan. 2020	Feb. 2020	Mar. 2020	Apr. 2020	May 2020	June 2020	Jul 2020	Total
1	Ashti Bus Station	92	44	48	35	32	24	19	38	43	48	56	68	547
2	Murshadpur	62	36	37	24	25	16	13	18	33	52	68	77	461
3	Kada Bus Station	82	52	46	32	29	22	20	33	35	41	49	67	508
4	Dadegaon	58	33	31	23	21	15	11	23	26	33	32	37	343
5	Dhamangaon Bus Station	62	39	40	26	24	16	10	15	21	38	51	56	398
6	Dhanora Bus station	67	38	36	34	14	14	10	19	28	35	47	52	394
7	Shirapur	28	22	10	8	8	9	11	13	15	18	17	32	191
8	Belgaon	38	26	9	9	8	10	8	12	13	19	27	43	222
9	Doithan	41	21	7	10	9	11	7	10	9	21	28	36	210
	Total	530	311	264	201	170	137	109	181	223	305	375	468	3274



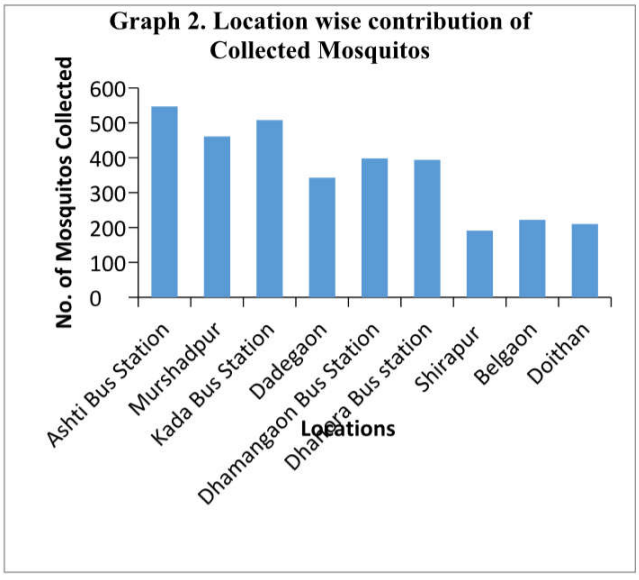


Table 2. Genus wise Contribution of Collected Mosquitos

Genus	Aug. 2019	Sept. 2019	Oct. 2019	Nov. 2019	Dec. 2019	Jan. 2020	Feb. 2020	Mar. 2020	Apr. 2020	May. 2020	Jun. 2020	Jul. 2020	Total	Percentage
Anopheles	123	95	91	64	56	51	42	74	92	130	133	158	1109	33.87
Aedes	157	102	79	61	60	44	31	49	52	79	97	128	939	28.68
Culex	174	82	65	47	35	29	26	43	60	69	109	134	873	26.66
Armigeres	71	26	23	23	19	13	10	11	12	18	26	35	287	8.766
Mansonia	5	6	6	6	0	0	0	4	7	9	10	13	66	2.016
Toal	530	311	264	201	170	137	109	181	223	305	375	468	3274	100

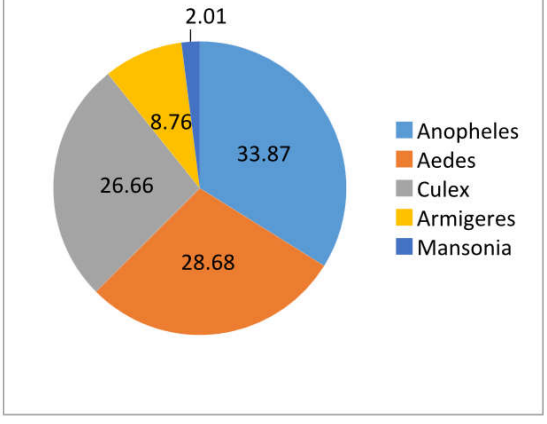
Table 3. Month wise diversity of collected Mosquito species from different localities during Study period

Genus and Species	Aug. 2019	Sept. 2019	Oct. 2019	Nov. 2019	Dec. 2019	Jan. 2020	Feb. 2020	Mar. 2020	Apr. 2020	May. 2020	Jun. 2020	Jul. 2020	Total	Cont. %
Anopheles														
An. culicifacies	23	16	21	12	17	18	13	26	31	38	33	42	290	8.86
An. annularis	6	8	11	7	9	11	7	11	11	21	21	21	144	4.4
An. barbirostris	4	10	3	0	0	0	5	9	12	15	9	10	77	2.35
An. quadrimaculatus	18	9	6	8	11	6	8	8	11	18	15	17	135	4.12
An. hyrcanus	11	11	7	8	6	0	0	4	9	13	6	12	87	2.66
An. subpictus	55	36	39	26	13	16	9	11	12	16	41	47	321	9.8
An. gigas	6	5	4	3	0	0	0	5	6	9	8	9	55	1.68
Total	123	95	91	64	56	51	42	74	92	130	133	158	1109	33.87
Aedes														
Aedes aegypti	60	33	27	15	13	9	8	13	15	23	40	49	305	9.32
Ae. albolateralis	32	24	23	17	15	10	6	10	11	22	21	26	217	6.63
Ae.albopictus	41	28	17	17	15	12	7	13	17	23	25	36	251	7.67
Ae. vittatus	24	17	12	12	17	13	10	13	9	11	11	17	166	5.07
Total	157	102	79	61	60	44	31	49	52	79	97	128	939	28.68
Culex														
Cx. quinquefasciatus	132	57	46	33	26	27	18	23	34	37	81	99	613	18.7
Cx.tritaeniorhynchus	19	10	7	8	0	0	0	4	3	8	10	9	78	2.38
Cx.vishnui	11	9	5	0	0	0	4	6	14	15	8	13	85	2.6
Cx. Psedovishnui	12	6	7	6	9	2	4	10	9	9	10	13	97	2.96
Total	174	82	65	47	35	29	26	43	60	69	109	134	873	26.66
Armigeres														
Ar. subalbatus	71	26	23	23	19	13	10	11	12	18	26	35	287	8.77
Mansonia														
M. uniformis	5	6	6	6	0	0	0	4	7	9	10	13	66	2.02
Total	530	311	264	201	170	137	109	181	223	305	375	468	3274	100

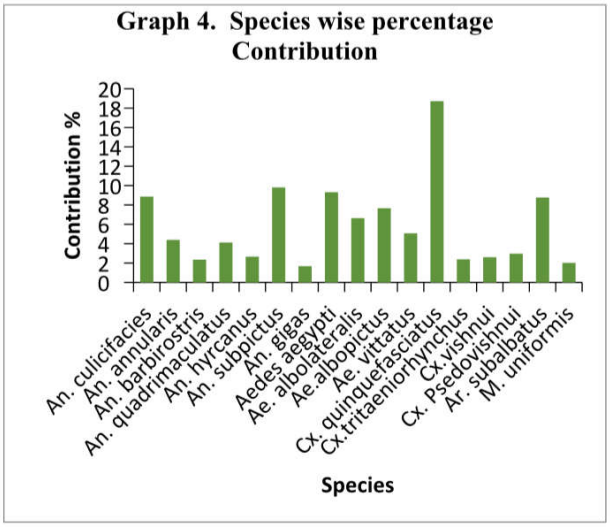
Table 4. Shows minimum, maximum and average temperature, a rain fall and humidity during the study period (August 2019 to July 2020)

Month	Temperature			Average Rain fall	Average Humidity %
	Min	Max.	Aver.		
Aug. 2019	23	30	27	374.2	77
Sept. 2019	22	28	26	599.4	83
Oct. 2019	22	29	26	244.7	78
Nov. 2019	20	29	25	90.3	67
Dec.2019	19	28	24	21	59
Jan. 2020	19	29	24	4.5	48
Feb. 2020	21	41	36	2.3	36
Mar. 2020	24	41	31	13.7	29
Apr. 2020	28	40	36	2	19
May. 2020	29	41	37	5.5	21
June 2020	27	34	31	170.8	58
July 2020	24	31	28	686	75

Graph 3. Genus wise Contribution (percentage) of Mosquitos



Graph 4. Species wise percentage Contribution



Maximum number mosquito species were collected from Ashti bus station (547) and Kada bus station (508) and lowest number of mosquitos were collected from Doithan (210) and Shirapur (191) village (Graph 2). A significant variation in mosquito density and species richness was observed in the different study sites (Table 1) may be due to the observed differences of breeding sources available, planned and unplanned area of the city and surrounding villages. Pawar et.al(2016). also collected and studied Distribution and Diversity of Mosquito Larvae from Kopargaon Teshil, Dist. Ahmednagar (M.S.) India. Maximum Population dynamics of Mosquitos was observed during monsoon and minimum in summer months. Maximum number (530) of mosquitos were collected during the month of August 2019 and minimum (137) during the month of February 2020 Table 1). The highest population of mosquito species observed in the rainy season when the Maximum and Minimum temperature was recorded 22^0C to 28 ^{0}C and average humidity was (83%) , and rainfall was 599.4mm in the month of September. While minimum density of mosquito species was observed in the summer i.e in the month of February , when the maximum and minimum %; temperature was 41^0C/21^0C, average humidity was 36 % and rainfall recorded was 2.3 mm. (Table No. 3). Thus the maximum and minimum temperature, humidity and rainfall is an ideal condition for the proliferation of mosquito species. Environmental parameters around these levels can be used as early warning for the outbreaks of mosquito population which is directly related to mosquito vector borne diseases. These finding indicated that in winter the diversity is highest because of stagnant water bodies. Sanjay Karlekar, Raymond Andrew (2015) also recorded same results as total number of individual observed are more in rainy season followed by winter and summer. They studied Mosquito diversity and vector species status in and around Nagpur city of Maharashtra state, India.

Rudha and Chandra (2008) reported a collection of 2306 mosquitoes belonging to 14 species and 6 genera in three seasons from four villages of Dooars forest in West Bengal, India and also reported that the number of mosquitoes were more in rainy and in winter season. Similary, Amala and Aunradha (2011) noticed the presence of 505 mosquitoes belonging to 4 genera (Anopheles, Aedes, Culex and Armigers) in villages at the foot hill of Sirumalai hills, Dindigul District, Tamilnadu, India. Overall, Genus wise Contribution (percentage) of Mosquitos was dominated by *Anopheles sp.* (33.87%), followed by *Aedes sp*. (28.68%), *Culex sp*. (26.66%), *Armigeres s*p. (8.77%) and *Mansonia Sp* (2.02%) (Graph 3). The maximum (157) population of *Anaphele* was recorded in July and it was observed lowest (42) in the month of February. *Aedes* shows very less (31) collection in February maximum (157) August due to availability of much more breeding beds, optimum temperature and humidity for their surveillance. Percentage of *Culex* shows maximum (174) in August and minimum (26) in February. Maximum population of *Armigeres subalbatus* was recorded during August and Minimum in the month of February. Whereas maximum (13)population of *Mansonia uniformis* recorded during the month of July. Shinde et al (2011) also studied Vector mosquito diversity in association with environmental factors. The most dominant species collected from study areas were *Culex quinquefasciatus* (18.7%) followed by *An. subpictus* (9.8%), *Aedes aegypti* (9.32%) and *An. culicifacies (8.86 %) and* the least collected species was *Anopheles gigas (1.68%), Mansonia uniformis (2.02%), Anopheles barbirostris (2.35%) and Cx. tritaeniorhynchus (2.38%).* Anopheles mosquitoes are responsible for spreading of Malaria, Aedes mosquitoes are vectors for chickungunya and dengue fever, Culex mosquitoes are vectors for viral Arthritis and Bancroftain filariasis whereas Mansonia are vectors for Malayan filariasis. Bhargava, A. and Chatterjee, B. (2007), Das, N.G., D.Goswami and B. Radha (2007) There is acute need of action to reduce the breeding sites of mosquitoes and public awareness regarding mosquitoes and the diseases caused by them.

Conclusion

The study of mosquitoes providing a primary checklist as an investigation which is necessary to assess the distribution, diversity and density of mosquitoes. It is inferred from the data obtained that different season, localities and available major breeding sources have different effects on mosquito species diversity and abundance. The mosquito species present in this area predispose the inhabitants of this area to risk of infections of mosquito borne diseases. Obtained diversity of mosquito and vector species are not only helpful to the study of mosquito biodiversity in India, but will also help in formulating strategies for the control over mosquito borne diseases.

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