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SEASONAL PREVALENCE AND ANOPHELINE MOSQUITO FAUNA OF DISTT. DEHRADUN (UTTARAKHAND), INDIA

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Abstract

A study on the seasonal prevalence and faunal diversity of anophelines was investigated at six selected localities of Distt Dehra Dun between January, 2008 to December, 2009. A total of 8403 specimens of anophelines were collected, which belongs to 11 species. The most abundant species was *An. subpictus* (22.35%) followed by *An. culicifacies* (20.08%), *An. stephensi* (10.41%) and *An. annularis* (9.37%) respectively. While the *An. gigas* (1.20%) was recorded in least number. The density of anophelines starts to increase in summer season and peaked in rainy season and least in winter season, it was due to more availability of breeding sites in rainy season.

Key Words: Anopheline mosquitoes, Anopheles, Dehra Dun

Introduction

Mosquito apart from a biting nuisance are responsible for transmitting diseases like malaria, filariasis, dengue, dengue haemorrhagic fever etc. Malaria is one of the most formidable and serious public health problems in India.

Extensive literature on the records of mosquitoes from District Dehradun in the state of Uttarakhand reveals that the knowledge and information regarding anopheline fauna from this region is not extensive.

The mosquito fauna of Doon valley first of all studied by Thomson [1] who recorded the mosquito specimens belonging to the family Culicidae. Subsequently, in 1909 [2] he provided information on mosquitoes and malaria in Dehra Dun district. Wattal et. al., [3] made observations on the mosquitoes from the Doon valley and collected 25 species of mosquitoes belonging to 7 genera. Wattal and Tandon [4] revealed occurrence of four more species (*An. aitkenii, An. gigas, An. lindesayi* and *An. splendidus)* in addition to 25 species earlier collected by Wattal et. al., [3]. Rao et. al., [5] undertook an extensive survey of haematophagous arthropods including mosquitoes from western Himalayas in between 1966 to 1970 and recorded as many as 70 species of mosquitoes belonging to 8 different genera. Of these, 16 species belonged to *Anopheles*. Thereafter, Bhat [6] undertaken an intensive survey of haematophagous arthropods from Himalayan region of Uttar Pradesh (Now in Uttarakhand state) including Garhwal region and reported seven species of anophelines including *An. splendidus, An*. *stephensi* and *An. lindesayi* not reported by Wattal et. al., [3]. After a gap of about 15 years, i.e. 1992 onwards, Dehradun valley was again explored from the point of view of mosquito occurrence [7, 8, 9, 10, 11, 12, 13]. Recently an update list of the Tribe Aedini has been provided [14] which also include mosquito species from Garhwal region.

In order to update the information on the anopheline fauna of this region studies were undertaken by Pemola and Jauhari [15] who recorded 17 species of *Anopheles* from Garhwal region covering five district Dehradun, Chamoli, Uttarkashi, Tehri and Pauri Garhwal region.

Materials and Methods

District Dehradun is the capital of Uttarakhand state covering an area of 3088 sq km and is located on the north-West corner of the state. It lies between 29^0 58" and 31^0 2'30" north latitude and $77^0$34'45" and $78^0$18'30" east longitudes with an altitude of 640 m (2100 ft) above sea level. The forest area is 1477 sq. kms giving a percentage of 43.70 % of the area of the district. The district at present comprises of 6 tehsils, namely Dehradun, Chakrata, Vikasnagar, Kalsi, Tyuni and Rishikesh. The study area includes the rural part of the Doon valley, particularly the following sites were selected for carrying out the observations namely, Mussoorie, Rajpur, Doiwala in Eastern Doon and Chakrata, Kalsi and Vikas nagar in Western Doon.

The mosquitoes were captured as adult in the morning between 0600 hrs to 0800hrs, using an aspirator and battery - operated torch, when they take rest after feeding at night. In each selected site four collection spots Viz., human dwelling, cattle sheds, mixed dwellings and random collections were chosen as per the situation and 15 minutes time were given for each spot. All adult mosquitoes brought to the laboratory for identification including those emerged from collections of immature were killed with ether. Mosquitoes were identified using the key of Christophers [16], Wattal and Kalra [17] Das et. al., [18] and Nagpal and Sharma [19]. Intensive and extensive anopheline surveys were done during January 2008 to December 2009.

Results and discussion

A total of 8403 anopheline specimens were collected in six selected localities of Distt Dehra Dun during January, 2008 to December, 2009. As many as 11 species of *Anopheles* were collected *viz*. *Anopheles subpictus, An. culicifacies, An. stephensi, An. annularis, An. maculatus, An. splendidus, An. fluviatilis, An. aconitus, An. pulcherrimus*, *An. vagus* and *An. gigas* (Table 1). In the eleven anopheline species collected, the most prevalent species was *An. subpictus* (22.35%) followed by *An. culicifacies* (20.08%), *An. stephensi* (10.41%), *An. annularis* (9.37%), *An. maculatus* (9.18%), *An. splendidus* (8.81%), *An. fluviatilis* (8.31%) and *An. aconitus* (6.31%) respectively.

Table 1 : Result of Anopheline mosquito collections in the Distt Dehradun during January, 2008 to December, 2009

S. No.	Species collected	Total Anopheline collected	Percentage of Total collection
1.	*An. subpictus* Grassi, 1899	1878	22.35
2.	*An. culicifacies* Giles, 1901	1687	20.08
3.	*An. stephensi* Liston, 1901	875	10.41
4.	*An. annularis* Vander Wulp, 1884	787	9.37
5.	*An. maculatus* Theobald, 1901	771	9.18
6.	*An. splendidus* Koidzumi, 1920	740	8.81
7.	*An. fluviatilis* James , 1902	700	8.31
8.	*An. aconitus* Donitz, 1902	431	6.31
9.	*An. Pulcherrimus* theobald, 1902	169	2.01
10.	*An. vagus* Donitz, 1902	164	1.95
11.	*An. gigas* Giles, 1901	101	1.20
	Total	8403	

In a study on mosquito fauna of the forested areas of Doon valley, Mahesh and Jauhari [20] revealed the presence of 13 anopheline species containing *An. varuna, An. minimus* and *An. hyrcanus* , but these three species were not found in this study. After two year, Mahesh and Jauhari [21] reported ten species of *Anopheles* from this region including *An. nigerrimus* but *An. gigas* and *An. splendidus* were not present in that study. Pemola and Jauhari [22] reported 10 species of anophelines at Kalsi area of Dehradun which also included *An. nigerrimus*, but this species was not reported in present study. Among them, the most prevalent species were *An. culicifacies, An. stephensi, An. fluviatilis* and *An. nigerrimus*. Shukla et. al., [23] recorded nine anopheline species from Nainital (Kumaon region) which includes *An. nigerrimus* and *An. barbirostris*, which were not reported in this region.

The result of the present studies revealed that the densities of malaria vectors are influenced by rainfall pattern, which started to increase from the beginning of the winter season (November -February) with peak densities towards the end of rainy season (July –October) for most anophelines except *An. fluviatilis, An. aconitus, An. maculatus* and *An. gigas* that showed high densities in the summer months (Table 2). This occurrence is likely due to increase in environmental temperature suitable for growth and development of the larvae and the numbers of larval habitats during the rains subside.

Higher densities of *Anopheles* vector mosquitoes were sampled from Doiwala localities followed by Vikas agar locality. This was attributed to variability in rainfall, temperature and suitable larval habitats. Large seasonal variation of *Anopheles* mosquitoes was found in all the study areas. The number of malaria vectors was highest during wet monsoon season than in dry summer months except *An. fluviatilis, An. aconitus, An. maculatus* and *An. splendidus* in Eastern Doon valley. Pemola and Jauhari [22] observed higher density of *An. fluviatilis* during summer i.e. April and May while it was a little higher in post monsoon season i.e. August and September. Thus this study is accordance with the study made by Pemola and Jauhari[22].

Table 2: Seasonal Abundance of anopheline mosquitoes in Eastern and Western Doon Valley during January 2008 to December, 2009

S.No.	Mosquito species	Eastern Doon					Western Doon				
		Winter (Nov.-Feb.)	Summer (Mar.-Jun.)	Rainy (July-Oct.)	Total	% relative abundance	Winter (Nov.-Feb.)	Summer (Mar.-Jun.)	Rainy (July-Oct.)	Total	% relative abundance
1.	*An. subpictus*	170 (16.12)	285 (27.03)	599 (56.83)	1054	25.54	87 (10.55)	278 (33.73)	459 (55.70)	824	19.27
2.	*An. culicifacies*	119 (14.11)	288 (34.16)	436 (51.72)	843	20.42	77 (9.12)	305 (36.13)	462 (54.73)	844	19.74
3.	*An. annularis*	74 (22.22)	113 (33.93)	146 (43.84	333	8.07	61 (13.73)	177 (38.98)	216 (47.57)	454	10.62
4.	*An. stephensi*	44 (11.51)	164 (42.93)	174 (45.54)	382	9.26	58 (11.76)	218 (44.21)	217 (44.01)	493	11.53
5.	*An. fluviatilis*	117	217	57	391	9.47	76	205	28	309	7.23

		(29.92)	(55.49)	(14.57)			(24.59)	(66.34)	(9.06)		
6.	*An. vagus*	11 (18.64)	24 (40.67)	24 (40.67)	59	1.43	6 (5.71)	49 (46.66)	50 (47.61)	105	2.46
7.	*An. aconitus*	68 (32.85)	106 (51.20)	33 (15.94)	207	5.02	75 (23.14)	185 (57.09)	64 (19.75)	324	7.58
8.	*An. maculatus*	108 (27.48)	201 (51.14)	84 21.37	393	9.52	90 (23.80)	221 (58.46)	67 (17.72)	378	8.84
9.	*An. splendidus*	105 27.41	191 49.86	87 22.71	383	9.28	83 (23.24)	205 (57.42)	69 (19.32)	357	8.35
10.	*An. gigas*	11 20.75	22 (41.50)	20 (37.73)	53	1.28	7 (14.38)	17 (35.41)	24 (50.oo)	48	1.12
11.	*An. pulcherrimus*	6	11	12	29	0.70	26	76	38	140	3.27
		(20.68)	(37.93)	(41.37)			(18.57)	(54.28)	(27.14)		
	Total	833 (20.18)	1622 (39.30)	1672 (40.51)	4127		646 (15.10)	1936 (45.27)	1694 (39.61)	4276	8403

In the present study, two population peaks of *An. culicifacies* were observed in Doiwala locality, one during June-July and another in September – October. Similarly, Sharma and Prasad [24] observed two population peaks of *An. culicifacies*, one during March to June and another during October –December in Sahjahanpur, Uttar Pradesh; Das et.al., [25] during June –July and the second during February –March in a study carried out in Koraput district of Orissa; and Kulkarni [26] during February and July for *An. culicifacies*, while *An. fluviatilis* was found throughout the year. Bimodal peak of *An. culicifacies* in different seasons may be due to rainfall pattern, availability of breeding habitats and physiographic locations.

In the present study, the peak density of *An. fluviatilis* was observed in the post summer months (March -June) at Kalsi, Chakrata and Doiwala localities and during winter months in Vikas nagar and Rajpur localities but was absent from all the sites during the monsoon months (June –August). Similar observation was also reported from NE regions of India [27], Koraput distt of Orissa[25] and in Rajasthan [28].

Outcome of the results on seasonal abundance of malaria vectors in eastern and western Doon valley, would improve our understanding of the patterns of malaria transmission and the role of vector species in malaria transmission. The information on the seasonal prevalence of malaria vectors may pave the way for designing appropriate vector control strategies.

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