



## **A STUDY ON RESTING PREFERENCES OF ANOPHELINE MOSQUITOES IN SELECTED LOCALITIES OF DEHRADUN, UTTARAKHAND (INDIA)**

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**Abstract** - A survey of anophelines was conducted during January to Decemer 2014 from 4 different localities of Doon Valley viz., Doiwala Dharam pur, Patel Nagar and Kaulagarh. In all, a total of 10 anopheline species were collected namely, *An. culicifacies*, *An. fluviatilis*, *An. subpictus*, *An. maculatus*, *An. annularis*, *An. aconitus*, *An. stephensi*, *An. splendidus*, *An. vagus* and *An. pulcherrimus*. Maximum number of specimens of almost all the encountered species of mosquitoes were recovered from cattle sheds in comparison to human dwellings and mixed dwellings except *An. fluviatilis* which was recorded maximum in human dwellings. With regard to PMHD of anophelines, it was more in cattle sheds of Doiwala (L1), and Dharam pur (L2), while in Patel Nagar (L3) and Kaulagarh (L4), the maximum PMHD was from human dwellings.

**Keywords:** Resting preferences, Anophelines, Doon Valley, Man hour density.

### **1 INTRODUCTION**

Information on the resting preferences of mosquitoes is essential to formulate strategies for the control of vector species. The resurgence of sylvatic vectors in recent past in Doon Valley aroused considerable interest to study the anopheline fauna and its resting behavior in the region. Drastic changes in ecological conditions owing to extensive and illegal deforestation, huge automobile exhaust and rapid urbanization has led to alteration in species composition and their relative abundances and resting behavior in their unique habitats.

Earlier, Jauhari *et al.*, (1992) and (1995) conducted studies related to species composition of anophelines in different habitations in the Doon Valley, India, but no systematic and comprehensive survey regarding resting preferences of anophelines has been made so far in the recent past with exception of Singh *et al.*, (1997) who studies resting habits of *An. stephensi* (Diptera: Culicidae) in Doon Valley. However a number of workers (Wattalet *et al.*, 1958; Bhat, 1975, ab,b; Srivastava and Jauhari, 1992 a,b; Singh *et al.*, 1994, 1995; Mahesh *et al.*, 1995; Mahesh and Jauhari 2000) has added a detailed knowledge about the anopheline fauna of this region. The present investigation incorporates the findings of the study regarding the preferential resting behavior of anophelines during Jauary to December 2014 from four different localities of Doon Valley.



## **2 MATERIALS AND METHODS**

### **(a) Study Area**

Present study was conducted in four different localities viz., Doiwala (L1), Dharam pur (L2); Patel Nagar (L3) and Kaulagarh (L4) of Doon Valley, Uttarakhand, India lying at different altitudes. Details about the localities have been mentioned in Table 1.

### **(b) Methodology**

Adult mosquitoes were collected from the selected localities during the morning hours (0600-0800 hrs.) on fortnightly basis during January to December, 2014 using a flash light and aspirator. In each selected site four collection sites-human dwelling, cattle sheds, mixed dwellings and random collections were chosen and searched for 15 minute each according to the prevailing situation. The collected mosquitoes were brought to the laboratory for further studies. They were separated habitat wise and thereafter the identification was made using keys as adopted by Christophers (1933), Watal and Kalra (1961), Knight and Stone (1977) and Das *et al.*, (1990).

## **3 RESULTS AND DISCUSSION**

Table 2 shows the resting preferences and sex ratio of adult anopheline mosquitoes at the selected localities during the study period. It was recorded the two recognized primary vectors i.e. *An. culicifacies* and *An. fluviatilis*, showing sharp difference in their resting preferences. In general, maximum number of anophelines have been encountered in cattle sheds in comparison to human dwelling and mixed dwellings with exception to *An. fluviatilis* which was recorded maximum in human dwellings. Although there was some alteration in the number of specimens of *An. pulcherrimus* in a particular habitat. Since their number was less and that too not recorded throughout the study period, no satisfactory explanation could be made regarding their fluctuation and resting preference. In almost all the localities the females were more in number than the males. Results of the resting preferences (MHD) of mosquitoes in all the selected localities have been shown in Table 2. *An. culicifacies* primarily prefers cattle shed as shown by its maximum prevalence (Maximum PMHD 9.16) in this particular (L3), habitat, while *An. fluviatilis* was encountered mostly in human dwellings (Maximum PMHD 14.16). In L2 and L3, localities maximum per man hour density (PMHD) was recorded from cattle sheds while in L1 and L4 localities, it was from human dwellings.

There are a number of reports regarding the resting preferences of anophelines mosquitoes inhabiting in different parts of the country. Rao (1944) stated that *An. Fluviatilis* is almost



exclusively found in human dwellings, *An. stephensi* and *An. pallidus* in about equal numbers in human dwellings and cattle sheds, whilst *An. annularis* and *An. culicifacies* appear to prefer cattle sheds as the day time resting places in Jharia mining settlement. Earlier, Sen (1937) carried out studies on the relative prevalence of anophelines in houses and cattle sheds in deltaic Bengal and found that in dwelling houses the most commonly observed species were *An. vagus*, *An. annularis*, *An. subpictus*, *An. splendidus* and *An. hyrcanus* whereas in cattle sheds the order of preference was *An. annularis*, *An. subpictus*, *An. hyrcanus*, *An. vagus* and *An. sundaicus*.

The present findings slightly resemble with Sen (1937), Rao (1944), Sen et al., (1960) and Das *et al.*, (1984, 1990) with regard to maximum number of anophelines from cattle sheds in comparison to human dwelling and mixed dwellings. Further, there is a considerable difference between the present findings and the results of Bhatia *et al.*, (1958) who found *An. annularis*, *An. culicifacies* and *An. subpictus* seem to prefer human and mixed dwellings than cattle sheds while *An. stephensi* preferred cattle sheds than human dwelling and mixed dwellings in Delhi area.

Chand *et al.*, (1993) reported a maximum collection of anophelines from cattle sheds as compared to human dwelling while *An. annularis* occurred throughout the year to cattle sheds with little preference to human dwelling out of a total collection of 15 anopheline species. According to their studies, *An. culicifacies* and *An. subpictus* had also a great affinity for cattle sheds. However, in a study made by Tandon et al. (1995) on 16 species of anopheline mosquitoes from Ayodhya hills of Purulia (WB), only 5 anopheline species (*An. vagus*, *An. subpictus*, *An. annularis*, *An. culicifacies* and *An. splendidus*) resting in human dwellings during a whole year study. Further, they also pointed out the maximum resting place of *An. culicifacies* and *An. annularis* as the cattle sheds. However, a considerable number of *An. fluviatilis* specimens were also encountered in the same habitat during winter months. The results of the present study slightly resemble with Chand *et al.* (1993), Tandon and Tandon (1994), Tandon *et al.*, (1995) and Malakaret *et al.* (1995). Although there is a little difference which may be due to change of habitat and an impact of environment factors.

Conclusively, it can be mentioned here that cattle sheds provide the conditions under which the mosquito breeding/resting occurs comparatively more. The difference between the occurrence of a particular species of mosquito in a particular kind of habitat may be correlated to other factors such as tree-based shaded area, stagnant water on the bank of river/stream and availability of industries in the vicinity of the area under study. Besides this, thick and thin vegetation also played a major role in establishing breeding sites by the mosquitoes.



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**Table 1: Details of the selected localities**

Details of locality	Doiwala (L1)	Dharam pur (L2)	Patel Nagar (L3)	Kaulagarh (L4)
Altitude (Ft)	4000	3404	1600	1960
Latitude	30022' 30"	30022' 30"	30015"	30021'
Longitude	7807' 30"	785 5'	7802' 30"	780 3'
Distance from Clock Tower (Km)	15	12	17	6.5
Population (Male: Female)	273-216	280:243	572:539	1537:1339
Total	489	523	1111	2874
No. of livestock	137	78	370	282
Type of breeding place	TA, PO, DR, CA, IC, RF, RI, PI, TH	TA, PO, DR, CA, IC, RF, PI, TH	TA, PO, DR, CA, IC, RI, PI, TH	TA, PO, DR, PI, IC, TH

TA = tank; PO = pond; DR = drain; IC = intradomestic containers; RF= rice fields; RI = river, PI = pit; TH=tree holes; CA = canals

**Table 2: Showing resting preferences and sex ratio of adult anopheline mosquitoes at L1 to L4 localities between January to December 2014.**

Name of Species	Resting Preferences (Ratios)				Sex Ratios (Male:Females)			
	L1	L2	L3	L4	L1	L2	L3	L4
	HD:CS:M D	HD:CS:M D	HD:CS:M D	HD:CS:M D				



An.culicifaci es An.	1:3.00:5.1 1	1:1.60:3. 40	1:2.89:3. 94	1:3.0:5.6 2.08:1:1.	1:6.3 8	1:3:2 8	:7.27 1:5.20	1:3.4 5
fluviatilis An.	2.65:1:1.5 3	3:1:2 1:1.25:2.	2.06:1:1. 59	58 1:1.28:2.	1:5.6 4	1:7.0 0	1:10.4 7	1:3.3 0
subpictus An.	1:1.37:2.8 2	25 1:1.16:1:2	1:1.22:2. 11	14 1:71:1:2.	1:8.5 7	1:2.2 7	1:10.1 8	1:5.8 8
maculatus An.	1:1.55:2.1 1	1:1.16:2. 11	1:1.51:2. 03	57 1:1.15:1.	1:4.4 1	1:7.3 3	1:6.57 1:3.61	1:4.2 8
annularis An. aconitus	1:2.00:3.0 3	1:3.50:7 1:1.57:1.	1:2.12:3. 24	76 1:2.25:5.	1:12. 58	1:13 1:22.	1:7.10 1:7.17	1:9.2 5
An. stephensi	2.11:1:12. 76	28 1:1.14:1.	1:1.17:1:1. 35	25 1:1.5:3.4	1:5.3 8	00 1:5.0	1:3.83	1:1.8 3
An. splendidus	1.24:1:1.0 8	78	1:1.5:3.4 2	2 1:2.2:1.9	1:4.7 2	0 1:3.5	1:4.00	1:2.9 5
An. vagus (An. pulcherrimus	1:2.08:1.0 8	-	1:2.2:1.9 0	0 2:0:5	1:12. 27	8 -		1:3.6 3
	1:1.5:4.00  1.50:1:4.5 0		2:0:5  1:0:3	1:0:3	1:5.5  1:13. 00	-  -		1:7.0 0  0:4.0 0
Total	1:1.14:1.5 7	1:1.23:1. 84	1:1.15:1. 67	1:1.19:2. 15	1:P6. 65	1:4.9 1	1:6.73	1:3.9 3
Man hour	6:6:12	6:6:12	6:6:12	6:6:12				