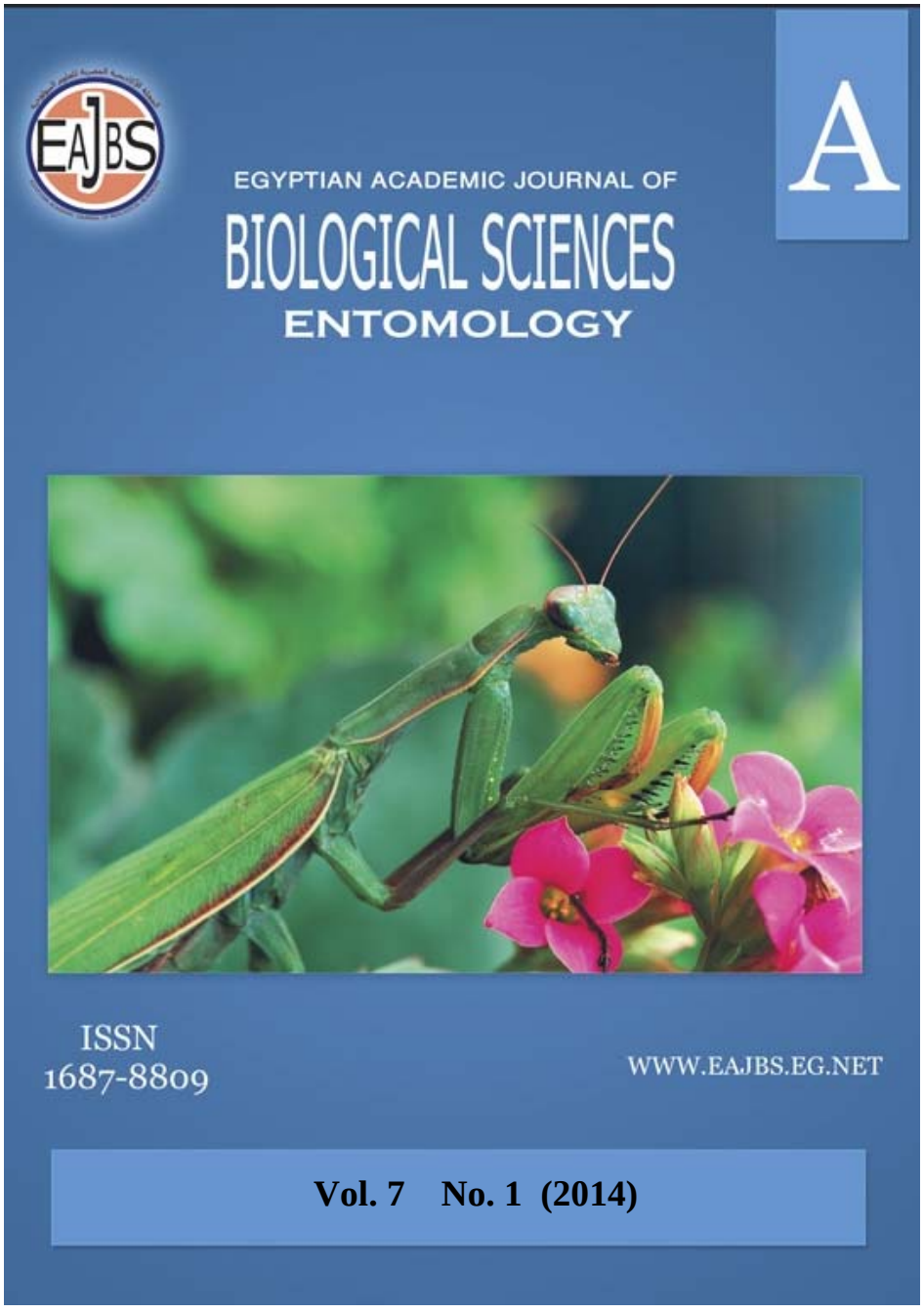

Egyptian Academic Journal of Biological Sciences is the official English language journal of the Egyptian Society for Biological Sciences, Department of Entomology, Faculty of Sciences Ain Shams University.

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www.eajbs.eg.net

Received :8/5/2014 Accepted :7/6/2014

Egypt. Acad. J. Biolog. Sci., 7(1): 179 – 184 (2014)

Egyptian Academic Journal of Biological Sciences
A. Entomology

ISSN 1687-8809
www.eajbs.eg.net

Preliminary Investigation of Dengue Vectors in District Dehradun, Uttarakhand.

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ABSTRACT

Preliminary investigation were carried out concerning the occurrence of dengue vectors *Aedes aegypti* and *Aedes albopictus* in rural and urban areas of various localities of Distt Dehradun. The distribution of dengue vectors, *A. aegypti* and *A. albopictus* vary from place to place. Epidemiological interpretation of various entomological indices like house index, container index, breteau index and pupal index were carried out by WHO norms. A total of 971 houses were searched during house to house larval survey for *Aedes* breeding in all kinds of temporary and permanent water bodies both indoors and outdoors in rural and urban areas. Of 971 houses breeding of *Aedes* could be detected in 226 houses, 684 water containers were searched for *Aedes* breeding, out of which 93 were found positive. The over all house index (HI), Container index (CI), breteau index (BI) and pupal index (PI) were 23.27%, 13.60%, 9.58% and 5.87% respectively. All the indices were found to be higher than normally acceptable limits (WHO, 2003) and *Aedes* breeding was recorded in all the localities except Mussorie and found to vary from locality to locality. Dengue viruses circulate mainly between human and vector mosquitoes, and the presence of vector is a limiting factor of transmission. Therefore, spatial distribution of dengue vectors is a significant concern in the epidemiology of the disease.

Keywords: Dengue viruses, *Aedes aegypti*, *Aedes albopictus*, house index, container index, breteau index, pupal index, Dehradun.

INTRODUCTION

Dengue is one of the most important mosquito- borne viral diseases in the world, and is endemic in approximately 120 countries. It has been estimated that there are 50-100 million cases of dengue fever and 3.6 billion people are at risk of infection. It is emerging and re-emerging in the tropics and currently poses the most significant arboviral threat to humans (Sivagnaname, 2012).

Dengue fever has been known in India for over two centuries. It has been endemic in several parts of the country with interspersed random epidemics being reported from various places throughout India. After 2000, dengue and dengue hemorrhagic fever (DHF) have

Received :8/5/2014 Accepted :7/6/2014

become disease of serious concern due to thousands of reported cases and hundreds of death every year (Raheel,*et al.* 2011). In India *Aedes aegypti* Linn(Diptera: Culicidae) is a principal vector of dengue and dengue haemorrhagic fever(DHF), Kaul *et al.*,1998), it has a wide spread distribution in many towns and cities of India, Sharma *et al*., and Tandon *et al*., 2000).

The hilly regions of India exceeding an elevation of 500 meters are known to be free of *Aedes aegypti* infestation. Towns below this altitude in the foot hills of the Himalayas show a very scanty population of the vector (Kalra *et al.,* 1997). As far as in the concern of Uttarakhand, first of all two cases of dengue reported in Haldwani town, situated in the foot hills of the Kumaon hills in the western Himalayas, in 1996(Shukla and Sharma, 1999). There-after eight cases of dengue with one death reported from Uttarakhand in 2003(unofficial report from CMO office). During 2006 to 2012 the number of dengue cases were as 12, 67, 140, 76, 4140, 454 and 538. During 2010 a major outbreak of dengue were reported in this state in which 8 deaths were reported.

As far as the availability of *Aedes* species from Dehradun district is concerned, only *aedes albpictus* was recorded in the past (Wattal *et al.,* 1958 and Bhat, H.R., 1975). Dengue has so far not been reported in Distt Dehradun till the year 2003. Pemola and Jauhari (2004 and 2008) reported first time the existence of *Aedes aegypti* in Garhwal region including Distt Dehradun.

During an outbreak in 2010, 2889 cases of dengue were reported from this district including 4 deaths. Dengue was considered as a urban and semi-urban disease (Kalra *et al*., 1968). However, over the years, large scale development activities, *viz*., rapid growth of the transport system through networks of railways and roads, industrial and building activities, provision of the safe piped drinking activities, electricity, overall improvement in civic amenities and socio-economic conditions of rural masses, have resulted in the establishment and proliferation of Aedes aegypti mosquito in urban and rural areas alike (Yadav and Narasimham, 1992 and Rakesh *et al.,* 1997).

MATERIAL AND METHODS

Study area:

Dehradun is a district of Uttarakhand state in northern India, geographically it lies between $29^0$55’ and $30^0$30’ N latitude, and $77^0$35’ and $78^0$20’ E longitude. The district has 6 tehsils, 6 community development blocks, 17 towns and 764 inhabited villages, and 18 unpopulated villages. As of 2011 census it is the second most populous district of Uttarakhand (out of 13), after Haridwar.

The Climate of the district is generally temperate. It varies greatly from tropical to severe cold depending upon the altitude of the area. The district being hilly, temperature variations due to difference in elevation are considerable. In the hilly regions, the summer is pleasant, but in the Doon, the heat is often intense, although not to such degree as in the plains of the adjoining district. The temperature drops below freezing point not only at high altitude but even at places like Dehradun during the winters, when the higher peaks are also under snow. The area receives an average annual rainfall of 2073.3 mm. Most of the annual rainfall in the district is received during the months from June to September, July and August being rainiest.

The present study was conducted between January, 2011 to December, 2012. The survey of adult as well as larval mosquitoes was done in selected localities viz. Mussorie, Malsi, Rajpur, Kalsi, Vikasnagar, Sahaspur, Rishikesh, Ranipokhari, Doiwala, Raipur, Patel Nagar and ISBT of Dehradun. The study area was not homogeneous and is characterized by thick forest, heavy rainfall, slow running hill streams, forest bus tees, with more than 60% of inhabitants from low socio-economic communities. Some area is extensively canal irrigated

and the villages are surrounded by a network of irrigation canal, distributaries and drainage systems. Water logging and seepage from canal has created ideal mosquito breeding sources. In some area agriculture is dependent on tube wells and or monsoon.

Entomological data:

The number of houses visited in each locality varied depending expanse of the area and types of houses. All kinds of breeding habitats in the study areas like unused wells, tree holes, drums, tubs, tanks, overhead tanks, iron/metal drums, empty battery boxes, junk materials, desert coolers, curing tanks, etc were searched for the presence of immature stages of the *Aedes* mosquitoes. The data on larval surveys were analyzed and calculated in terms of container index(CI), house index(HI), Breteau index (BI) and pupal index(PI) as per WHO(2003) guidelines.

The entomological indices: house index (HI), Container index (CI) and Breteau index (BI) were used for measuring the larval population, as per following formulae:-

$$HI = \frac{\text{No. of house positive (Larvae)}}{\text{No. of houses inspected}} \text{ X } 100$$

$$CI = \frac{\text{No. of container positive}}{\text{No. of container inspected}} \text{ X } 100$$

$$BI = \frac{\text{No. of container positive}}{\text{No. of houses inspected}} \text{ X } 100$$

Adult *Aedes* mosquito collection was done using an aspirator and battery -operated torch(WHO, 1975) from tyros, cement tanks, iron pipes, etc during morning hours (0600 - 0800hrs) on fortnightly basis between January 2011 and December 2012. The collected mosquitoes were first narcotized and then brought to the laboratory for identification. Mosquitoes were identified according the key of Das and Kaul (1998).

Epidemiological data:

Epidemiological data were obtained from the district malaria office Chander Nagar, Dehradun and it was reviewed to ascertain the past and current trends of dengue incidence in the district. Comparative dengue incidences in different PHCs were also studied.

RESULT

During the period of observation dengue cases were reported from different parts of District Dehradun. The seasonal occurrence surveys showed that the post monsoon period was the most affected period.

The different breeding habitats and percentages are shown in Table 1. The breeding sites of *Aedes* larvae differ from one area to another. Major breeding sites of *Aedes* were found in discarded tyres (22.81%) and Plastic containers/tubs/drums/tanks (18.25%) followed by Junk materials, broken glass wares, bottles and broken plastic wares and cemented tanks (13.84%), Domestic earthen pots(8.77%), Flower pots (6.32%), Desert coolers (4.91%), Discarded iron OHTs (4.21%), Discarded plastic tea cups (2.11%), Iron drums (1.75%) and Daubers (1.40%) were also detected through in less number respectively (Table 1). In addition, breeding was also observed in unused wells, tree holes and curing tanks during survey in study area.

Distribution of *Aedes* larvae in different breeding habitats and breeding preference ratio(BPR) for different habitats like discarded tyers (1.18), cemented tanks (1.11), Flower pots (1.10), Junk materials, broken glass wares, bottles and broken plastic wares (1.07), Plastic containers/tubs/drums/tanks (1.02), discarded plastic tea cups (0.97), Discarded iron OHTs (0.85), Domestic earthen pots (0.87), Daubers (0.75), Desert coolers (0.70) and Iron drums (0.45).

Table 1: Breeding preference ratio (BPR) of *Aedes* spp in different breeding habitats in district Dehradun (Uttarakhand).

Types of breeding Habitats	Number of containers with water				Breeding preferences Ratio
	Examined	(X%)	With *Aedes* larvae	(Y %)	BPR (Y/X)
Desert coolers	45	6.99	14	4.91	0.70
Flower pots	37	5.75	18	6.32	1.10
Domestic earthen pots	65	10.11	25	8.77	0.87
Cemented tanks	85	13.22	42	14.74	1.11
Plastic containers/tubs/drum/tanks	115	17.88	52	18.25	1.02
Discarded tyers	124	19.28	65	22.81	1.18
Iron drums	25	3.89	5	1.75	0.45
Discarded iron OHTs	32	4.98	12	4.21	0.85
Junk materials/broken glass wares, bottles and broken plastic wares	89	13.84	42	14.74	1.07
Daubers	12	1.87	4	1.40	0.75
Discarded plastic tea cups	14	2.18	6	2.11	0.97
Total	643		285		

A total of 971 houses were searched during house to house larval survey for Aedes breeding in all kinds of temporary and permanent water bodies both indoors and outdoors in rural and urban areas. Of 971 houses searched, breeding of *Aedes* could be detected in 226 houses, 684 water containers were searched for *Aedes* breeding, out of which 93 were found positive. The overall house index (HI), Container index (CI), Breteau index (BI) and pupal index (PI) were 23.27%, 13.60%, 9.58% and 5.87% respectively (Table 2). All the indices were found to be higher than normally acceptable limits (WHO, 2003) and *Aedes* breeding was recorded in all the localities except Mussories and found to vary from locality to locality.

Table 2: Prevalence indices of *Aedes* in different localities of district Dehradun, Uttarakhand

Localities Searched	Houses checked	Houses positive	Containers checked	Containers positive	Pupae collected	HI (%)	CI (%)	BI (%)	PI (%)
Mussorie	25	-	12	-	-	4.00	8.33	4.00	4.00
Rajpur	32	2	23	1	-	6.25	4.35	3.13	3.13
Malsi	34	3	12	1	-	8.82	8.33	2.94	2.94
Kalsi	65	4	45	4	2	6.15	8.88	6.16	3.08
Vikash Nagar	53	9	42	3	2	16.98	7.14	5.66	3.78
Sahaspur	87	12	58	7	6	13.79	12.07	8.05	6.90
Rishikesh	120	28	71	12	9	23.33	16.90	10.00	7.50
Ranipokhari	134	56	123	25	12	41.79	20.33	18.66	8.96
Doiwala	143	43	102	11	10	30.07	10.78	7.70	6.99
ISBT	90	23	78	12	4	25.56	15.38	13.33	4.44
Patel Nagar	112	34	96	9	8	30.36	9.38	8.04	7.14
Raipur	76	12	22	8	4	15.79	36.36	10.53	5.26
Total/Average	971	226	684	93	57	23.27	13.60	9.58	5.87

DISCUSSION

Observations during the study period showed the occurrence of *Aedes aegypti* and *Ae. albopictus* in rural and urban areas of District Dehradun, it indicate the possibilities for future outbreak of DF/DHF at any time. Immature stages and adult of *Aedes* were recorded probably

for the first time in all the localities surveyed within the urban and rural agglomeration of this district.

All entomological indices were above the critical level (i.e. more than one). The present study confirms that *Aedes* breeding is well established in Distt Dehradun with most of the areas showing high larval and adult indices.

In district Dehradun, during the survey, different larval stages of *Aedes* were recorded in almost all the selected localities and breeding were found to vary from locality to locality. In Lal kuan town, District Nainital (Singh *et al*., 2010) and in Delhi (Nandi *et al*., 2008) also, the distribution pattern of *Ae. aegypti* and disposition varied from ward to ward. The present study results also confirm to those observed in Haldwani (Kumar *et al*., 2008). Another study conducted on *Aedes* mosquitoes in Haldwani distt Nainital (Shukla and Sharma, 1999) and in NCT Town Gurgaon, Haryana (Rakesh and Sarita, 2010 and Singh *et al*., 2010) are similar to the present study.

The highest level of breeding was detected in discarded tyres (19.28%), these finding are similar with that of Shukla and Sharma (1999) in Haldwani, Singh *et al*., (2008) in Ranchi and Singh *et al*., (2010) in Lal kuan town Nainital district. Though in the state Uttarakhand an outbreak of dengue was reported for the first time in 2010, where 4140 cases of dengue were reported including 8 deaths, out of 4140 cases, maximum cases (2889) were reported from Distt Dehradun including 4 deaths(data from Deptt of health service, Govt of Uttarakhand). All entomological indices were above the critical level and potential cause of this seems to be the compulsion of storing water in different containers without cover, to meet the acute shortage of water in the area.

Aedes breeding indices have been recorded above the critical levels imply their potential for future out breaks. This is mainly attributed to change in ecology, cultural and social behaviour of population, life style changes, non availability of tap water supply enforcing water storage in containers etc., the reporting of Dengue and high density of Dengue vectors might be due to rise in temperature making it favourable for transmission of Dengue. Therefore entomological surveillance should be undertaken effectively in the known endemic localities and the information should be utilized to forecast the possibility of future outbreaks of DF/DHF, so that necessary control measures could be undertaken to avoid any dengue outbreak in future.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. V.K. Dua, Director, national Institute of Malaria Research, Delhi for proper guidance and encouragements. The authors wish to thank Dr. D.K. Bhasin principal and Dr. R.K. Jauhari, Head Dept. Of Zoology, D.A.V.(P.G.)College, Dehradun for providing necessary facilities. Thanks are also to UGC for providing fund for this work.

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