

## A comparative study on instances of malaria in four different ecological zone of district Hardwar of Uttarakhand state (India)

\*Pankaj Saini<sup>1</sup>, Bishambhar D.Joshi<sup>2</sup> and Trilochan Sharma<sup>3</sup>

<sup>1</sup>Dept. of Environmental Sciences,  
SMJN (P.G.) College Hardwar (Uttarakhand), India

<sup>2</sup>Dept. of Zoology and Environmental Sciences  
Gurukul Kangri Vishwavidyalaya, Hardwar, India

<sup>3</sup>National Institute of Malaria Research (Field Station), Hardwar, India

\*E-mail: [sainip\\_1984@yahoo.com](mailto:sainip_1984@yahoo.com)

**Abstract:** The present study was conducted to find out the instances of malaria in four different ecological zones in district Haridwar during the year of 2008. The malarial instances were also correlated with climatic factors. Four different ecological zones i.e. (i) Industrial Ecological Zone (Township of BHEL), (ii) Urban Ecological Zone (Township of Roorkee ), (iii) Pre-urban Ecological Zone (Township of Laksar), (iv) Rural Ecological Zone (Bahadarabad village) were selected for the present study.

[Pankaj Saini<sup>1</sup>, Bishambhar D.Joshi<sup>2</sup> and Trilochan Sharma. A comparative study on instances of malaria in four different ecological zone of district Hardwar of Uttarakhand state (India). Academia Arena, 2011;3(8):14-17] (ISSN 1553-992X). <http://www.sciencepub.net>.

**Keywords:** Malaria, Environmental Zone, Correlation,

### 1. Introduction:

**Human** beings have long been living with malaria. As far back as 2700 BC, medical writing in India and China allude to what is likely malaria, and the disease is also described in the writings of Homer (**Heggenhougen et al., 2003**). In one of the four Vedas of the Hindus, malaria is referred as “a disease most dreaded affliction, king of disease.” While Chinese referred to the disease as “Mother of Fevers.” The relationship of fever to swamps and low-lying water was also recognized by the Greeks in the sixth century (**Sharma et al., 1996**).

Malaria has been a major public health problem in our country even though modern medical science has reached its peak. Except for areas situated 5000 ft. above sea level malaria is endemic all over India. The endemicity varies from place to place depending on survival condition of malaria vector as well as its longevity (**Saini et al., 2010**)

The most prevalent parasite is *Plasmodium vivax* (65%) followed by *P. falciparum* (35%), while *P. malariae* cases are only a few thousands, recorded from some foot hill areas in Orissa state. Occurrence of *Plasmodium ovale*, the forth malaria parasite species, has not been very common in India and till date only three reports of *P. ovale* are available from Kolkata, Orissa and more recently from Delhi. Among the four parasites found in India, *P. falciparum* is the most dangerous. It may cause serious illness and death, diagnosis is often difficult and almost all deaths due to malaria are caused by *P. falciparum*. This parasite has also become resistant to chloroquine and resistance to long acting sulphha drugs has also been reported.

*Plasmodium vivax* also produces serious illness but death is very rare (**Prakash et al., 2003**).

In India, occurrences of epidemics and focal outbreaks have worsen the malaria situation. During the first half of the twentieth century, malaria has affected every walk of life so much that became one of the major problem before developing countries. According to an estimate in 1935, out of 100 million malarial cases, one million deaths occurred in Indian subcontinent. Another estimate in 1947 about 75 million cases of malaria (21.8% population) were found and 8, 00,000 deaths. It is notable to mention that India's malaria situation is very important in the world scenario as the peak of malaria cases in India in 1976, was also a peak year at global level (**WHO, 1990**). India had an estimated 10.6 million cases in 2006 that account for approximately 60% of cases in the whole of the South-East Asia Region. The states most affected with this epidemic are Uttar Pradesh, Bihar, Karnataka, Orissa, Rajasthan, Madhya Pradesh and Pondichery (**WHO, 2008**).

Over the last one decade the land use and related environmental scenario of district Haridwar has drastically changed due to growth and development projects including growing urbanization and floating population. In the North India, the main vectors of malaria are *Anopheles culicifacies* and *A. stephensi*, *A. fluviatilis* (**Saini et al., 2009**). The permanent changes in local malaria endemicity are always due to man-made environmental changes in the areas. Some times the problem arises up to the extant, which takes the

shape of epidemic. Entomological, parasitological, clinical related issues are looked into to bring down the morbidities and loss to human lives.

**A true epidemiological picture of malaria instances is required for planning and execution of its control operation and to obtain feed-back of effect of intervention methods. Therefore, the true instance of disease is important for:**

- **The success of control operations.**
- **In incorporating timely corrective measures.**
- **Tackling the epidemics.**

## 2. Materials & Methods:

**Study area:** The area of present study is spread with in the district Haridwar, situated between latitudes  $29^{\circ} 45' - 29^{\circ} 58' N$  and longitudes  $77^{\circ} 52' - 78^{\circ} 75' E$ . The area of the district is 2360 sq Km. Haridwar district is located in Garhwal Region of Uttarakhand state in India. Population and its density is 14,44,213 and 612 per sq Km, respectively (as per 2001 census).

**Spots for survey:** In the present study, a total of four different ecological zones were selected to find out the burden of malaria in the community of Haridwar district of Uttarakhand (India). The malarial instances were also correlated with age, sex, economic status, religion of people and climatic factors. Four different ecological zones i.e. (i) **IEZ** (Township of BHEL), (ii) **UEZ** (Township of Roorkee), (iii) **PUEZ** (Township of Laksar), (iv) **REZ** (Bahadarabad village) were selected for the present study.

### 2.1 Methods for field work:

To assess the burden of malaria in community of different ecological zones, survey method was used, which was conducted during 2008, through consulting local medical practitioners, hospitals, nursing homes, pathologist of selected ecological zones in Haridwar district. In each ecological zone, randomly selected households were also surveyed to find out the infected patients of malaria and method of prevention and treatment at house level. Head of the household was the first choice as respondent. In his/ her absence a person above 18 years of age was taken as respondent and the relevant details were filled up. The residential areas of these reported

patients were also surveyed to find out the sanitation condition in their living areas.

### 2.2 Methods of analysis:

This study is based on the survey which was conducted during 2008. The data were analyzed for correlation with key factor(s) like socio-economic and environmental conditions etc. The data were also analyzed for Annual Blood Smear Examination Rate (ABER), Slide Positivity Rate (SPR), Slide falciparum Rate (SfR), Annual Parasite Incidence (API) and data was also statistically analyzed for Coefficient of correlation (r-value) using standard statistical methods (Sharma *et al.*, 1996, Mather, 1973, Bailey, 1995).

### 3. Results:

In the present study, maximum (231) and minimum (71) instances of malaria were found from PUEZ and IEZ, respectively. Out of 518 malaria patients found from these four different ecological zones of district Haridwar, 65 patients were found infected by *P. falciparum*(Pf), while rest 453 patients were found infected by *P. vivax* (Pv). It was also observed that about 66 % of malarial patients in selected Ecological zones of Haridwar district belonged to below poverty line (BPL) category. The distribution of malaria patients and correlation to environmental condition are depicted in Table 1 and 2. In the present investigation relatively fewer cases were found in winter season and maximum cases of malaria were recorded during monsoon and post-monsoon months of the year. During the study period of 2008, the values of correlation (r) showed that overall total correlation of total instances of malaria with average temperature was found to be moderately and positively significant ( $r = +0.53$  to  $0.65$ ). The overall total correlation of total instances of malaria with average humidity was found to be slightly positive significant ( $r = +0.24$  to  $+ 0.43$ ). The overall total instances of malaria was observed to be highly and positively significantly correlated to monthly total rainfall ( $r = +0.76$  to  $+0.88$ ) (Table 2).

**Table 1: Instances of malaria infection in selected ecological zones of Haridwar district, during the study period of 2008**

Study area	No. of the patients (malaria + ve)							
	2008							
	Total Blood Slide	No. of malaria +ve	<i>Pv</i>	<i>Pf</i>	SPR	SfR	ABER	API
IEZ	1059	71	64	7	6.7	0.6	2.2	1.4
UEZ	1650	91	79	12	5.5	0.7	1.6	0.9
PUEZ	1920	231	204	27	12.0	1.4	8.9	10.8
REZ	1532	125	106	19	8.1	1.2	16.3	13.3
Grand Total	6161	518	453	65	-	-	-	-

IEZ = Industrial Ecological Zone  
PUEZ = Pre-urban Ecological Zone

U EZ = Urban Ecological Zone  
REZ = Rural Ecological Zone

**Table 2: Coefficient of correlation (r- value) between instances of malaria and environmental factors during the year 2008**

Environmental Factors	(r-values)			
	No. of Instances (malaria + ve)			
	IEZ	UEZ	PUEZ	REZ
Temperature	+0.53	+0.64	+0.65	+0.62
Humidity	+0.43	+0.31	+0.24	+0.29
Rainfall	+0.76	+0.88	+0.86	+0.79

#### 4. Discussion:

During the present study, the association between monthly rainfall and instances of malaria was found greater than that for between temperature and malarial instances. This apparently is indicative of that humidity caused due to rainfall play an important role in the growth and transmission of disease than ambient temperature, as has been postulated by few earlier workers from different places. But it was also observed that proper management can fight against this dominant favorable factor of malarial infection. This can be easily explained in case of IEZ where a well managed plan is in good functional condition rain water harvesting and drainage. The management of BHEL is working in collaboration of National Institute of Malaria Research (NIMR) to control malaria on a

large scale since 1986. This necessarily warrants a status of good health for the whole population of the industrial area, otherwise a discarded population will hit hard and impact severely to the productivity of the industry and in long term shall prove far costlier to the industrial management. On the other hand, In PUEZ and REZ area of higher instances is a low-lying area and many breeding sites of mosquitoes were spread with stagnant water holes in and around this zone. On account of this, the man – mosquitoes contact reaches at higher level, increasing the instances of malarial infection. The present findings are in accordance with the studies of *Lieshout, et al, (2004)* and *Tyagi, et al, (2005)*, in which the climatic condition and socio-economic status were found most important factors in malaria infection. It was observed that about 66% of malarial patients were

from Low Income Group (LIG) and most of them were residents of slum localities in different environmental zones of Haridwar district.

It would be appropriate to emphasize that there is no single solution to malaria problem but awareness play key role in the field of malaria control. Because of this, the awareness programme on a mass scale should be encouraged. A team comprising of professional workers, social scientists & administrators may be entrusted with the task of evolving an effective method of combating malaria from all sides and at every level. If worked sincerely such a team is sure to provide healthy results. However, the most desirable participation and contribution would be from the general population. There is strong need to change the mind set of the people to follow the norms about health hygiene, sanitation, cleanliness, and environmental ethics and using natural resources in such a way which may help in eradication of mosquitoes and the diseases like malaria.

**Correspondence to:**

Dr. Pankaj Saini  
Department of Environmental Science, S.M.J.N.  
(P.G.) College,  
Haridwar-249404 (Uttarakhand), India.  
E.mail: [sainip\\_1984@yahoo.com](mailto:sainip_1984@yahoo.com)  
Mobile No. 91-9837878385

**References:**

- 1 Heggenhougen, HK, Hackethal, V. and Vivek, P. The behavioural and social aspects of malaria and its control. [http://apps.who.int/tdr/publication/tdr-research-publications/social-aspects-malaria-control/pdf/seb\\_malaria](http://apps.who.int/tdr/publication/tdr-research-publications/social-aspects-malaria-control/pdf/seb_malaria). Pdf 2003.
- 2 Sharma RS, Sharma GK, Dhillon GPS. Epidemiology and Control of Malaria in India. Government of India Ministry of Health &

- Family welfare NMEP (Directorate General of Health Service). 1996.
- 3 Saini, P., Joshi, B. D. and Sharma, T. An investigation on instances of malaria in two different environmental ambiances of district Haridwar of Uttarakhand state. Indian J. Env. Bio-Sci, 2010; **24** (1):9-12
- 4 Prakash, A., Mohapatra, P.K., Bhattacharyya, D.R., Goswami, B.K. and Mahanta, J. Plasmodium ovale: First case report from Assam, India. Curr. Sci. 2003; **84**(9): 1187-1188.
- 5 World Health Organization. Global estimates for health situation assessment and protections, 1990; WHO/HST/902. pp: 25.
- 6 World Health Organization; World malaria report 2008. WHO/HTM/ GMP/2008.1. pp: 1-25.
- 7 Saini, P., Joshi, B. D. and Sharma, T. . Socio-economic conditions act as dominant factors for the occurrence of human malaria: A case study from India. researcher, 2010; **2** (6):50-53.
- 8 Mather, K. In: Statistical analysis in biology. Chapman and Hall Ltd. & Science paperbacks, London, 1973.
- 9 Bailey, N.T.J. In: Statistical methods in biology. Cambridge University press, Australia, 1995.
- 10 Lieshout, M.V., Kovats, R.S., Livermore, M.T.J. and Martens, P. Climate change and malaria: analysis of the SRES climate and socio-economic scenarios. Global Environmental Change, 2004; **14**: 87-99.
- 11 Tyagi, P., Roy, A. and Malhotra, M.S. Knowledge, awareness and practices towards malaria in communities of rural, semi-rural and bordering of east Delhi. J. Vect Borne Dis., 2005; **42**: 30-35.

**Date: 26-08-2011**