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Research Article

PREVALENCE OF DENGUE FEVER IN SHIMOGA DISTRICT OF KARNATAKA, INDIA

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ABSTRACT

Objective: To understand the prevalence pattern of dengue in Shimoga district of Karnataka, India.
Methods: A comprehensive data collection about dengue infection, prevalence, transmission and severity in different taluks of Shimoga district of Karnataka, India from district health department, hospital records, meteorological departments and district surveillance board. Data analysis and rate of prevalence of Dengue in the district was calculated.
Results: Data analysis revealed Shimoga district having an alarming rate of 67 fold increase in dengue cases in 2013. Shikaripura taluk emerged as the most dengue prevalent taluk and females were less prone to dengue epidemic in all taluks of Shimoga. Monitoring Aedes mosquito larvae or larval indices such as Container Index (CI) and Breteau Index (BI) soon after the outbreak showed higher rate than accepted by WHO which was correlated with the number of dengue incidence in the taluk.
Conclusion: The study showed a direct relation between Dengue prevalence in district during monsoon months due to the increase in the *Aedes* mosquito larval breeding sites. This also gave insights about improper eco-epidemiological settings for the increase in the magnitude of this epidemic in the district.

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INTRODUCTION

Dengue a mosquito (*Aedes aegypti*) borne viral infection has become growing menace in the world now. Dengue virus is Flavivirus belonging to the family Flaviviridae, occurs mainly in four closely related serotypes (DENV1- 4). All these four serotypes share common geographical and ecological niche. They are causing a wide spectrum of illness having clinical manifestations of dengue fever (DF), dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) [1-3]. All the four serotypes are now circulating in Asia, Africa and American continents. Their infection, transmission, varied manifestation and pathogenesis are posing stiff challenge to public health.

The epidemiology of dengue in Indian subcontinent is very complex and changed over time. Dengue was previously assumed to be an urban disease as most cases were reported from bigger cities. But from last decade there are many outbreaks from rural areas of southern and western India [4, 5]. In 2012 an outbreak of dengue epidemic in the country involving 47,029 cases were about three times higher than the previous years. Twelve states of the country recorded a large number of cases and Karnataka state ranked second in total number of dengue positive cases [4, 6]. Viral infection in early stage is misleading, 90% of dengue cases will be asymptomatic following infection and such people play an important role in disease spreading[7]. Dengue virus infects *Aedes aegypti* female mosquito midgut and spreads to salivary glands over a period of 8-12days. Then it can be transmitted to human host during subsequent feeding. Dengue fever symptoms include high-degree fever, headache, muscle and joint pains, retro-orbital pain and skin rash similar to measles. Severe dengue characterized by plasma leakage, hemoconcentration, hemorrhagic shock and multiple organ failure leading to patient death[7].

Mortality rate in Karnataka due to Dengue is 0.8-1% from reported cases from medical record. There is no licensed dengue vaccine available. Several trial vaccines such as attenuated virus, inactivated virus, DNA vaccines and recombinant vaccines are in trial stage[8]. Hence preventive measures and controlling steps against dengue outbreaks are presently used in the regions where threat of dengue is high. Primary preventive measure to reduce dengue infection is the control of mosquito populations. Apart from this, detailed investigation of causative factors of epidemic outbreak, spatial variation and people's healthy living practices are some of the important aspects which may control the outbreak. This study has been undertaken to know the pattern and nature of dengue prevalence in Shimoga district of Karnataka. It is also planned to

investigate ecological and social determinants which are involved in viral transmission.

METHODS

Study area:

Shimoga district of Karnataka, India lies in Western Ghats region (Fig.1). District has 80.2% literacy rate and a population of 1,755,512 distributed in seven taluks: Bhadravathi, Hosanagara, Sagara, Shimoga, Shikaripura,Soraba and Thirthahalli. Shimoga district which lies in the tropical region, receives an average annual rainfall of 1813.9mm. Rainy season occurs between June-October.

Study design:

Details about dengue occurrence were collected from District health department records section, Shimoga Institute of Medical Sciences Medical Record Section and from district surveillance board. Total number of patients enrolled, positive cases, treatment received, progress in recovery, mortality rate etc., were collected from the medical records and documents section. Monthly averages of rainfall of last five years were collected from local meteorological stations reports and meteorological websites. Survey records to assess container indices and House Indices of infestations with immature mosquito stages were collected from District Surveillance Unit. They have conducted an exhaustive survey and analyzed water samples for larvae from all indoor containers, tanks, ant guards etc., and also outdoor containers, cement and plastic tanks, coconut shells, areca husks, animal pans, discarded plastic bottles and tiers.

Data Management and Analysis

The Epidemiological situation was analyzed from the data collected. Percentage of the annual occurrence, monthly occurrence, mortality were calculated and analyzed through graphs generated from the data. Percentage of prevalence was calculated as per the population of region from 2011 census. Results were processed by computer program Microsoft excel 2007 series software.

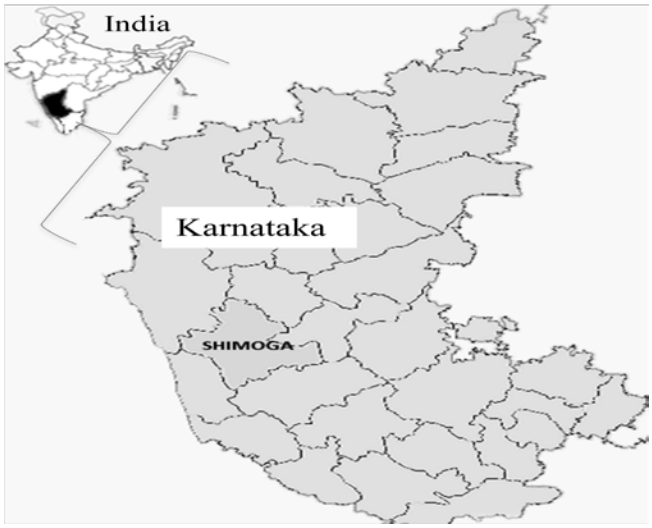

Fig.1. Map of India with study site –Shimoga district of Karnataka state.

Table 1. House, Container and Breteau indices (HI,CI,BI) of *A.aegypti* larvae of taluks of Shimoga District. Survey was undertaken soon after dengue outbreak in August 2013(Survey duration:1st August to 15th August 2013).

	Taluks of Shimoga District	House Index(HI %)	Container Index(CI %)	Breteau Index(BI %)
1	Shimoga	4.1	3.2	4.3
2	Bhadravathi	4.1	1.2	4.1
3	Shikaripura	12.6	6.8	17.6
4	Thirthahalli	4.7	2.1	7.2
5	Soraba	12.4	3.2	16.3
6	Sagara	0.6	0.3	1.2
7	Hosanagara	3.6	1.5	5.4
	District total	10.3	5.2	14

RESULTS

Temporal distribution of dengue cases:

Over the period of seven years (2007-2013) prevalence of dengue in the district varied significantly. There is a dramatic 21 fold increase in dengue in the population recorded during 2012, which increased to 67 fold in 2013 when compared to 2007 (Fig. 2). Interestingly the highest number incidence of 0.07% population in Shikaripura taluk was affected by dengue during 2013 and the taluk showed 35% of prevalence rate (Fig. 3 and Fig. 6).

Gender differences in dengue affected cases:

Fig.4 shows males clearly outnumbered the females among dengue affected cases in all taluks of Shimoga district during 2013 indicating the greater level of prevalence among men in the district. The female to male ratio in the prevalence varied greatly from 1: (1.5-4) (data is not shown here).

Climatic influences.

The dengue outbreak in Shimoga district coincided mainly with monsoon period with heavy rainfall started from June and lasted up to September. Pre monsoon (January to May) and post monsoon (October to December) period showed a significant reduction in dengue incidence. During monsoon season Shimoga district received the highest rainfall in the month of July 2013 and also the dengue outbreak reached the highest number positive cases in that month (Fig.5).

Aedes aegypti larval indices:

Aedes aegypti larvae can be found breeding in almost all indoor and outdoor, temporary and/or permanent collections of water[9]. The prevalence of dengue in an area may have positive relationship with larval indices[10]. Hence District Surveillance department undertook a mosquito larval survey soon after the outbreak in the first and second week of August 2013. *Aedes* larvae were collected from indoor and outdoor containers using fine meshed nets. The rate of dengue prevalence is significantly correlated with number of vector breeding places. The highest number of dengue incidence reported from Shikaripur taluk coincided well with the number of *Aedes aegypti* breeding places (Table 1). Larval indices such as Container Index (CI) and Breteau Index (BI) clearly indicated the reasons for dengue prevalence of the region (Fig.6).

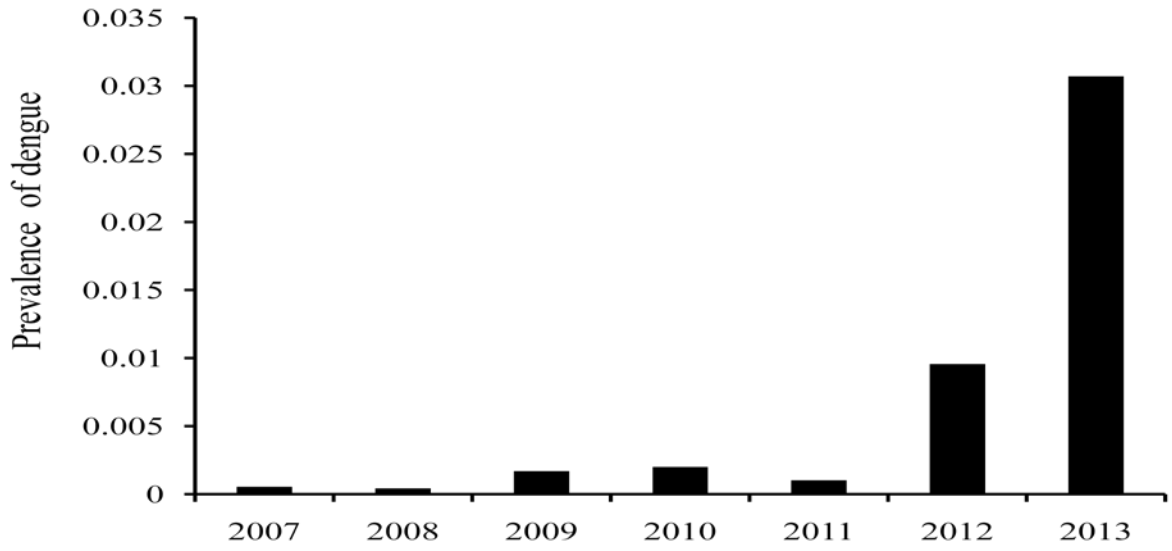

Fig.2. Prevalence of dengue in last 7 years in Shimoga district of Karnataka.

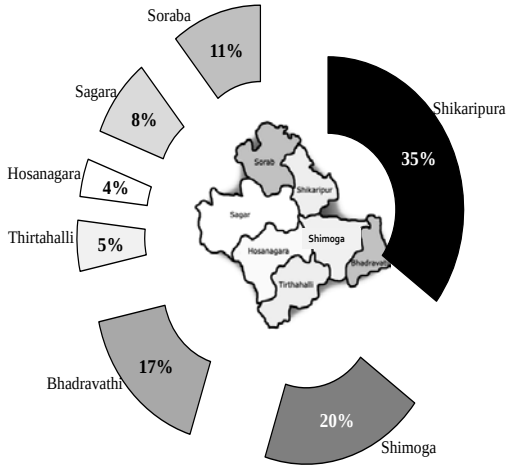

Fig.3. Percentage distribution of dengue prevalence in different taluks of Shimoga district during 2013.

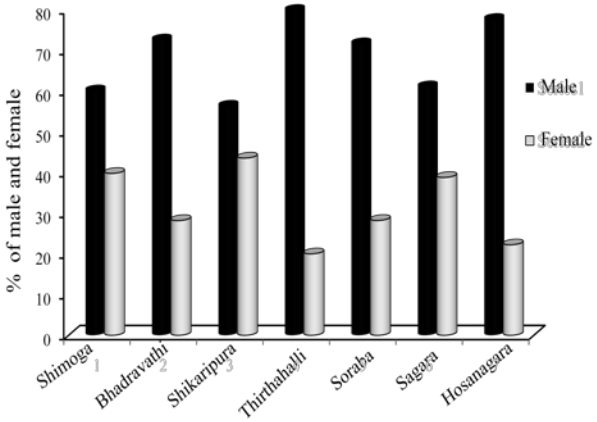

Fig.4. Proportion of male and female in dengue reported cases from different Taluks of Shimoga district during 2013.

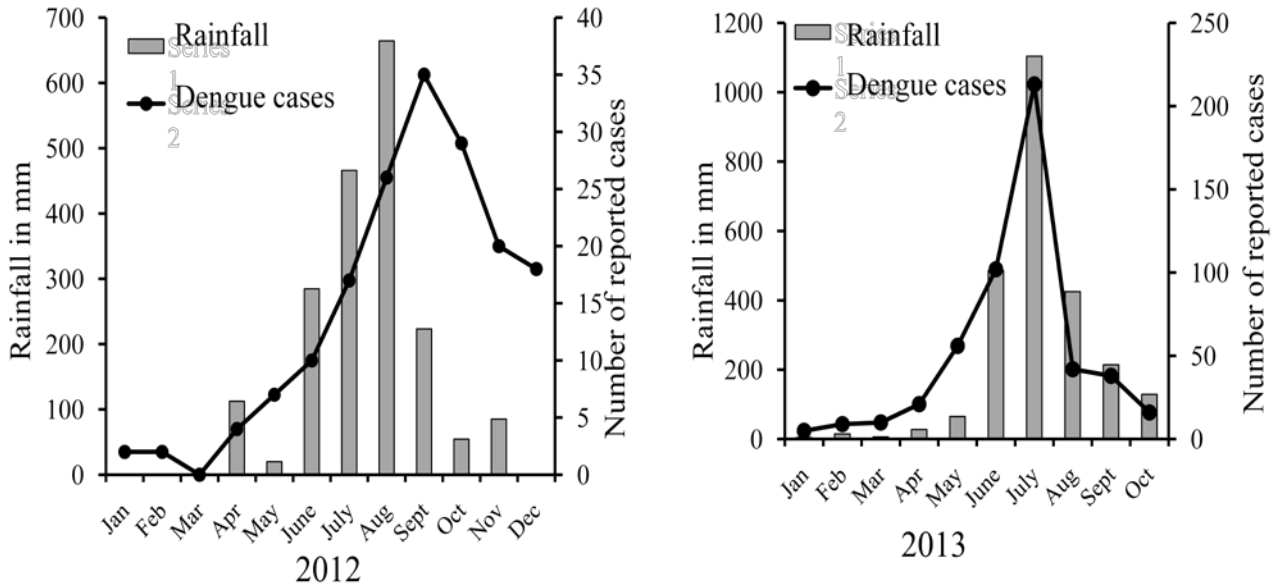

Fig.5. Monthly average rain fall was plotted against number of dengue cases during 2012 and 2013.

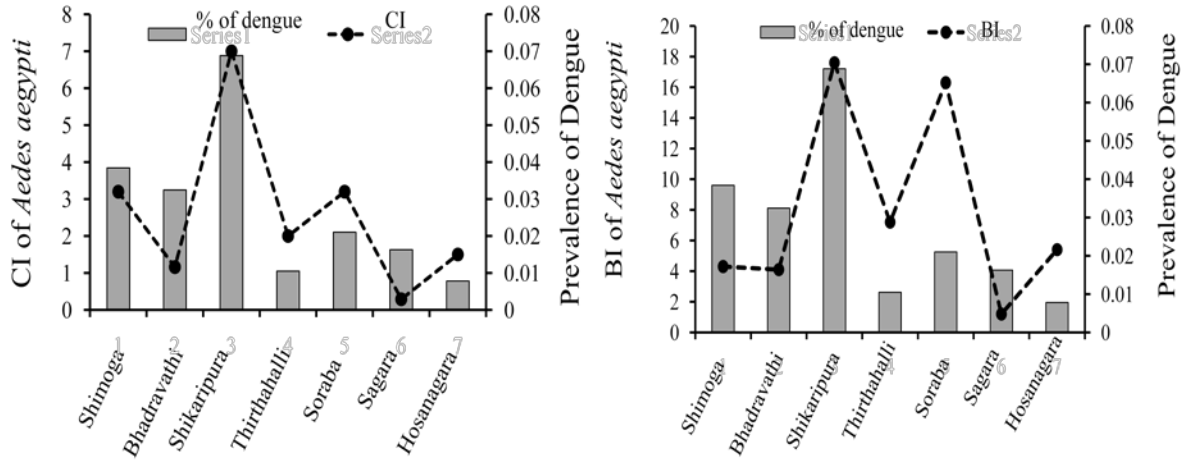

Fig.6. Prevalence of Dengue was plotted against Container Index (CI) and Breteau Index(BI).

DISCUSSION

Dengue is the fastest re-emerging arboviral disease worldwide imposing a heavy economic and health burden[11]. Recurrent dengue epidemics with increased frequency in last few years in Karnataka initiated us to take-up a detailed investigation of several aspects related to dengue infection, prevalence, transmission and severity in Shimoga district of Karnataka. Health department and hospital records based data analysis revealed some insights which are important to check the increased magnitude of this epidemic.

There was a widespread dengue fever outbreak in India in the year 2012. South Indian states Tamil Nadu, Karnataka and Kerala showed the highest prevalence[4]. Shimoga district too showed an alarming rate of 67 fold increase in dengue cases in 2013 when compared to previous years was in accordance with the rise in the other parts of the state. Interestingly Shikaripura emerged as the most dengue prevalent taluk. We found females are less prone to dengue epidemic in all taluks of Shimoga. Generally males who remain long hours outside the home will face greater exposure to mosquito as well dengue[12].

Many vector borne epidemics exhibit a distinctive seasonal pattern. Heavy rainfall associated weather has proven to be conducive for the breeding of vector and pathogen they transmit. According to WHO bulletin, alterations in global weather and rainfall has an effect on dengue outbreak [12, 13]. This study also confirmed the positive temporal association with heavy rainfall of monsoon and number of reported dengue cases. Geographically Shimoga district is a part of Western Ghats and receives an average annual rain fall 1813.9mm. June-September monsoon months have turned into "Dengue season" since last two years. Dengue vector *Aedes* larvae are aquatic, female mosquitoes which lay eggs in any stagnant water such as domestic containers, natural waters in tree holes, leaf axel, bamboo stumps and coconut shells are primary breeding sites.

Monitoring Aedes mosquito larvae or larval indices will indicate the rate of dengue transmission and controlling measures necessary to prevent the spreading of dengue. In this study, we examined larval indices soon after the outbreak. Larval indices HI,BI and CI were higher than those accepted by WHO in all taluks[14]. Data of Shikaripura taluk showing the higher percentage of these indices well correlated with the highest number of dengue incidence in the taluk. In dengue prevention, vector control program takes frontline as we don't have proper vaccines. Hence these entomological indicators/ entomological surveillance are the research priorities for WHO at present [14]. District wise data of larval indices and dengue prevalence indicated that increase in potential breeding sites in Shikaripura taluk are linked with environmental and social factors as district received fairly same amount of rain as in all taluks. Social factors related to health systems, vector control, sanitation, sewage and garbage collection etc., have played a major role in the increased prevalence of Dengue. Improvement in local eco-epidemiological settings together with educational programs definitely will be the strategy for the future dengue vector control and dengue eradication.

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ETHICAL APPROVAL

None sought as this study is based on medical records.

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COMPETING INTERESTS

None stated

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