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Vanaja C

Post Graduate and Research
Department of Zoology,
Government College,
Madappally, Vadakara, Kerala,
India

Sumodan PK

Post Graduate and Research
Department of Zoology,
Government College,
Madappally, Vadakara, Kerala,
India

Mosquito-borne diseases in Kerala, India: An update

Vanaja C and Sumodan PK

Abstract

Kerala, the south Indian state, has six mosquito-borne diseases, viz., Malaria, Dengue, Chikungunya, Japanese Encephalitis, West Nile virus and Lymphatic Filariasis. In this paper the status and trend of the first five diseases from 2010 to 2019 have been reviewed. The data on mosquito-borne diseases in the state were collected from Directorate of Health Services, Government of Kerala, National Vector-borne Diseases Control Programme, Delhi and peer reviewed publications. Malaria showed a consistently downward trend from 2299 in 2010 to 656 in 2019. Dengue cases didn't show any clear pattern but showed upward and downward trends throughout the review period. Data showed a major outbreak in 2017 with 21993 cases and 165 deaths. Chikungunya ranged from 54 to 210 without any mortality. Japanese encephalitis cases ranged from 0 to 102 and deaths from 0 to 8. West Nile virus was reported for the first time in 2011 with 33 cases.

Keywords: Malaria, dengue, chikungunya, Japanese encephalitis, west Nile virus.

1. Introduction

According to World Health Organisation (WHO) vector borne diseases contribute one sixth of the total illness and disability in the world. More than half of the world population are estimated to be at risk of contracting one or the other vector borne disease^[1]. Majority of the vector-borne diseases are transmitted by mosquitoes, the important ones being Malaria, Dengue, Yellow Fever, Japanese Encephalitis, Chikungunya, Lymphatic Filariasis, West Nile virus and Zika. In Kerala, the South Indian state, six of these diseases viz., Malaria, Dengue, Japanese Encephalitis, Chikungunya, West Nile virus and Lymphatic Filariasis are prevalent. Malaria has a very long history in Kerala, especially in the highlands and foothills, dating back to pre-historic times. The prevalence of sickle cell anaemia among the tribal population is an indirect evidence for its antiquity in the state^[2, 3]. In the pre-DDT era, malaria was a major problem in the state^[4]. Prevalence of Lymphatic Filariasis was recorded from Kerala as early as 1709 by Clarke, who mentioned elephantiasis legs in Cochin as Malabar legs^[5]. The first outbreaks of Japanese Encephalitis (JE) occurred in the state in 1996 in Kottayam and Alappuzha districts^[6, 7]. The very next year dengue made its first appearance in the form of an outbreak in Kottayam district with 14 cases and 4 deaths. This minor outbreak was followed by a bigger outbreak with 67 cases and 13 deaths in 1998 in the same district. Interestingly, dengue antibodies were detected from human sera collected from various districts in the state as early as 1973^[8]. The next turn of appearance was that of Chikungunya during June-July 2006 along the coastal areas of Alappuzha, Kollam, and Thiruvananthapuram districts^[9, 10]. Finally, West Nile virus (WN) was isolated from a patient with symptoms of encephalitis in May 2011. Besides, 32 sera collected during the encephalitis outbreak were positive for WNV neutralization antibodies^[11].

The objective of the present paper is to update the trends of all the above mosquito-borne diseases (except lymphatic filariasis) in Kerala from 2010 to 2019. Since Lymphatic filariasis is a chronic disease, data on annual incidence of new cases during the period of review were not available. Hence, it was excluded from the study.

2. Materials and methods**2.1 Study area**

The review of mosquito-borne diseases was done for a period of ten years from 2010 to 2019 pertaining to Kerala. Kerala is a South Indian state lying between northern latitude of 8°.17'.30" N and 12°. 47'.40" N and east longitudes 74°.27'.47" E and 77°.37'.12" E.

Corresponding Author:**Sumodan PK**

Post Graduate and Research
Department of Zoology,
Government College,
Madappally, Vadakara, Kerala,
India

According to 2011 census it has a population of 33,387,677.

2.2 Data collection

Data on mosquito-borne diseases from 2010 to 2019 were obtained from the Directorate of Health Services, Thiruvananthapuram, Kerala and National Vector Borne Diseases Control Programme (NVBDCP), New Delhi. Both data were compared for accuracy. Besides the above sources,

published peer reviewed research articles were screened for additional data.

3. Results and Discussion

Data on the cases and deaths due to Malaria, Dengue, Chikungunya, Japanese Encephalitis (JE) and West Nile virus (WN) from 2010 to 2019 are given in table 1.1. The trends of each of these diseases are discussed below.

Table 1: Confirmed cases of mosquito-borne diseases in Kerala

Year	Malaria		Dengue		Chikungunya	Japanese Encephalitis		West Nile Virus	
	Cases	Death	Cases	Death	Cases	Cases	Death	Cases	Death
2010	2299	7	2597	17	210	20	5	0	0
2011	1993	2	1304	10	81	102	8	33 *	0
2012	2036	3	4056	16	62	3	1	0	0
2013	1634	0	7938	29	247	2	0	0	0
2014	1751	6	2548	13	264	3	2	0	0
2015	1549	4	4114	29	152	0	0	0	0
2016	1540	3	7218	21	124	1	0	0	0
2017	1194	2	21993	165	54	1	0	0	0
2018	908	0	4090	32	76	5	2	1	0
2019	656	1	4651	14	109	11	2	11	2

* Source: Anukumar *et al.* (2014)

3.1 Malaria

The annual incidence of Malaria cases during the review period ranged from 656 to 2299. Death due to malaria ranged from 0 to 7 (Table 1). The highest number of cases and deaths were in 2010. As shown in Figure: 1, malaria cases showed a consistently downward trend in the state. In fact, Malaria cases and deaths in the world as a whole have been showing downward trends since 2010. While there were 251 million cases and 585000 deaths in 2010, the cases and deaths decreased to 228 million and 405000 respectively in 2018. Globally, more and more countries are moving towards eradication of malaria. In 2018, 49 countries reported fewer

than 10 000 indigenous cases, up from 46 countries in 2017 and 40 countries in 2010. The number of countries with fewer than 100 indigenous cases increased from 17 countries in 2010, to 25 countries in 2017 and 27 countries in 2018. [12]. In 2015, the Sixty-eighth World Health Assembly unanimously endorsed the Global technical strategy for malaria 2016–2030 (GTS) with an objective to reduce malaria burden in the world by 90% and to completely eradicate malaria from at least 35 more countries by 2030 [13]. Considering this ambitious strategy, Kerala is doing a good job towards the eradication goal.

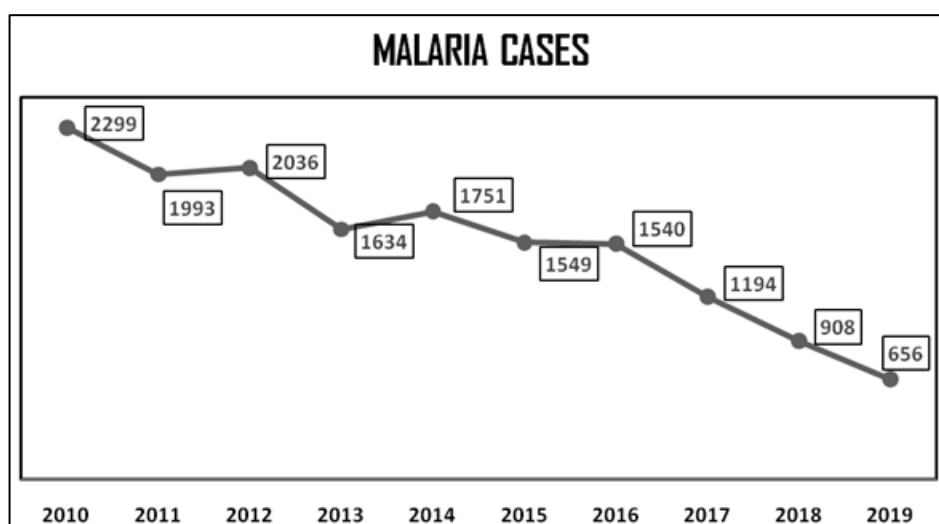


Fig 1: Trend of malaria cases in Kerala from 2010 to 2019

3.2 Dengue

Annual incidence of dengue ranged from 1304 to 21993 and deaths ranged from 10 to 165 (Table-1). The highest number of cases and deaths were in 2017. It is clearly evident that there was a major outbreak of dengue in 2017. The trend of cases doesn't show any clear pattern. From 2010 to 2019 there were upswings and downswings in the number of cases

(Figure: 2). This trend indicates active transmission of the virus in Kerala. Currently, dengue appears to be the most dangerous mosquito-borne disease in the state in terms of number of cases and deaths. This is in fact true for the entire world. Dengue has spread throughout the tropical world over the past 60 years and now affects over half the world's population. The geographical range of dengue is expected to

further expand due to climate change, urbanization and invasion of vectors in new areas. While malaria shows a downward trend, dengue cases in the world are on the rise [14].

Hence, more efforts are needed to contain this disease in the state.

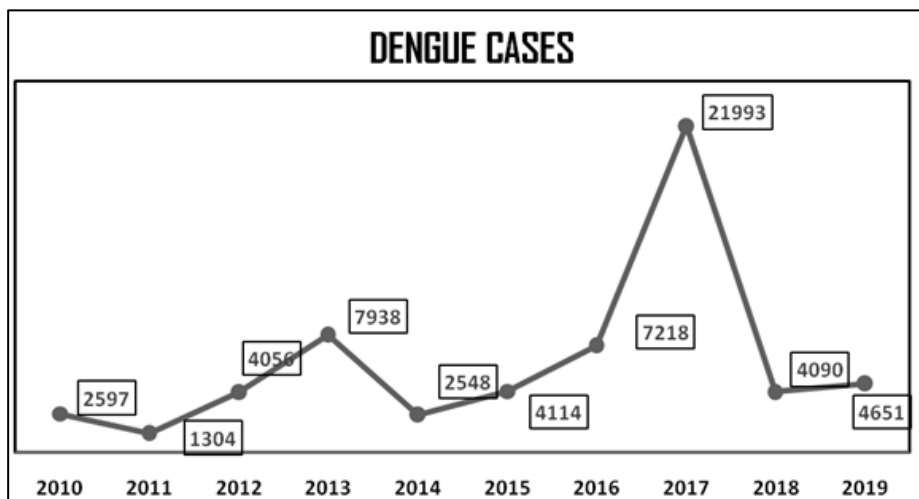


Fig 2: Trend of dengue cases in Kerala from 2010 to 2019

3.3 Chikungunya

Annual incidence of Chikungunya ranged from 54 to 264 (Table-1). Figure 3 shows three peaks in the year 2010, 2012 and 2013. However, there is no consistent pattern of cases. It shows the persistence of Chikungunya virus (CHIKV) in the population throughout the review period. From 2017 cases

showed an upward trend and there could be a major outbreak in the near future. Since Chikungunya is a non-fatal disease the situation is not as alarming as that of dengue. As the vectors of both Chikungunya and dengue are the same the strategies for controlling dengue will give collateral benefit to the control of Chikungunya [15].

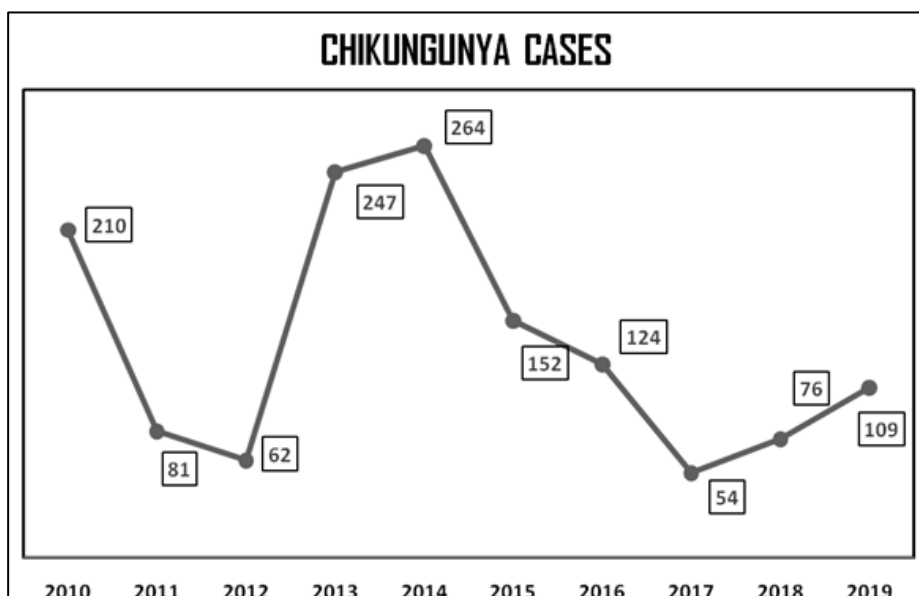


Fig 3: Trend of Chikungunya cases in Kerala from 2010 to 2019

3.4 Japanese Encephalitis (JE)

Annual incidence of JE ranged from 0 to 102 and deaths ranged from 0 to 8 (Table-1). The highest number of cases and deaths were reported in 2011. In the remaining years cases and deaths ranged between 0 to 20 and 0-5. The situation may not appear as alarming as that of dengue. However, the reported rate of mortality due to JE in India ranges between 25 to 30% [16]. In Kerala it was 0 to 66%. This variation could be due to small number of cases. In 2011, when there was a moderate outbreak with 102 cases and 8 deaths mortality rate was 7.8%. However, since it is a fatal disease, it is very important to be vigilant to prevent the

escalation of the cases in Kerala.

3.5 West Nile virus (WN)

WN was first reported in 2011, with 33 cases (Table-1). However, these cases were not reflected in the database of the state department of Health Services. The first WNV case appeared in their report was only in 2018. In 2019 there were 11 cases and 2 deaths. Accordingly, the mortality rate in the state is around 20%. This is comparable with mortality rates in other countries [17]. Since it is a comparatively new disease, the herd immunity could be very low and hence, susceptibility to the virus is very high. This situation calls for serious

approach to surveillance and control of the disease.

4. Conclusion

Mosquito-borne diseases constitute one of the major public health concerns in Kerala state of India. Among the six diseases *viz.*, Malaria, Dengue, Japanese Encephalitis, West Nile virus, Chikungunya and Lymphatic filariasis, the first four are of major concern as they cause mortality. Review of the malaria cases from 2010 to 2019 showed a decreasing trend of the disease and possibly on the way to elimination by 2030 as targeted by World Health Organisation. However, the situation of Dengue is not at all consoling. During the review period, there were outbreaks every year and did not show signs of levelling of cases. It is likely to continue as the most important mosquito-borne disease in the state. Except for 2011, Japanese Encephalitis cases in Kerala ranged between 0 and 20 throughout the review period. Though it is not as alarming as Dengue, it also deserves proper consideration in the control strategies. West Nile virus being a new entrant needs more focused epidemiological investigations to unravel environmental and vector related factors. Chikungunya also has a considerable presence in the state. Since, the epidemiology of Chikungunya is similar to Dengue, separate control strategies are not required for its containment. With the outbreak and fast spread of Covid-19, there are apprehensions about the diversion of resources from vector control programmes in the developing and underdeveloped countries to Covid-19 control, which can result in escalation of transmission of mosquito borne diseases^[18]. Hence, care should be taken not to neglect mosquito-borne diseases and vector control activities in the state in this time of Covid-19.

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