Dengue fever and dengue haemorrhagic fever (DF/DHF) have become a serious public health problem in many parts of India in recent years. Several vertical national programmes for communicable diseases, which include vector-borne diseases such as malaria and filariasis have been in operation for over five decades in India. The remarkable increase in dengue fever and DHF related deaths during the last decade has necessitated an effective surveillance system to detect the cases and adopt appropriate control measures against dengue vectors. Although the existence of all the four serotypes of dengue virus was proved as early as in 1960s, it was only after 1990, several outbreaks of DF/DHF were reported in Tamil Nadu. Further, dengue, once considered as urban problem has now penetrated into rural areas also, due to various changes in the environment. The geographic spread, increase in number of cases, reporting system, laboratory diagnosis, monitoring of vector density and investigation of outbreaks in Tamil Nadu during the last decade are comprehensively documented and discussed here to further strengthen the surveillance network to prevent possible major outbreaks of DF/DHF.

Key words Aedes aegypti - dengue fever - dengue haemorrhagic fever - mosquitoes - surveillance

Dengue fever (DF) has been recognized for many years in India, since the outbreak of dengue occurred in 1912 in Kolkata. In south India, all the four serotypes of dengue virus were first isolated from febrile patients in Vellore, Tamil Nadu between 1956 and 1966. During the same period dengue virus isolations were made in wild caught Aedes aegypti mosquitoes. Thus, the activity of different serotypes was established in Tamil Nadu as early as in 1960. However, until 1990, no major outbreak of dengue fever/dengue haemorrhagic fever (DF/DHF) was reported in Tamil Nadu. Epidemics of DF/DHF have been reported only after 1990 and they were confined to certain areas of Tamil Nadu. In this review, the recent increase in number of dengue cases and geographical spread of the disease to new areas in Tamil Nadu and the need for continuous monitoring of vector infections with dengue viruses are discussed.

In Tamil Nadu, there has been an increase in the number of dengue cases reporting units during the last nine years. In 1998, dengue cases were reported from only 4 units which increased to 33 units in 2006 due to
the availability of serodiagnostic facilities at different centres in the State. Similarly, the laboratory-based surveillance system has also considerably improved in all the Health Unit Districts in the State as a result of which an increase in spatial incidence of dengue fever cases has been noticed since 1998. The problem of dengue has now extended to new areas including several rural areas. Of the 30 districts in Tamil Nadu, dengue cases have been reported from 29 districts between 1998 and 2005 which include DF/DHF outbreaks in Chennai in 2001, Nagercoil and Trichirapalli (2003) (unpublished data) and DF outbreaks in Krishnagiri and Dharmapuri districts in 2001. It is not clearly known why dengue cases have not been reported so far in Nilgiris district although the fever surveillance system is well in existence through Primary Health Care network. The probable reason could be that Nilgiris is a high altitude area 2500m above mean sea level (MSL), where the abundance of vector population and vector competence for transmission of the disease need to be studied. Studies on vector potential and serosurveys, to find out the prevalence of haemagglutination inhibiting (HI) antibodies against flaviviruses need to be conducted to find out the risk of infection in this area.

During the last nine years (1998 - 2006), there has been an improvement in the reporting of dengue fever cases in Tamil Nadu, since the laboratory diagnostic facilities have considerably increased. A total of 128 cases and 5 deaths were reported in 1998 which increased to 1600 cases and 12 deaths in 2003 and 1150 cases and 8 deaths in 2005. This is mainly due to the availability of serodiagnostic facilities (In-house MAC ELISA) at the Institute of Vector control & Zoonoses (IVC&Z), Hosur, which receives clinical samples from all over the State and collaborates with the Department of Neurovirology, National Institute of Mental Health & Neurosciences, Bangalore, in laboratory diagnosis. Thus, the laboratory-based surveillance has been extended up to the Primary Health Centre level since 1998. As a part of the Vector-Borne Disease Control Programme in Tamil Nadu, several training programmes have been conducted to medical officers of the PHCs, district entomologists, health inspectors and laboratory assistants of the Tamil Nadu Public Health Department and also to private practitioners with a special emphasis on the dengue-related clinical symptoms, collection and transportation of clinical samples along with prescribed case sheet, reporting of results and action to be taken in their respective areas to prevent major outbreaks. As a result of this, a laboratory-based surveillance system for dengue has been well established in Tamil Nadu (Fig. 1). Besides IVC&Z, Hosur, serodiagnosis of dengue viral infections is performed in the Department of Virology, King Institute of Preventive Medicine, Chennai using Panbio IgM ELISA kits (personnel communication) and in Centre for Research in Medical Entomology (CRME), Madurai using both Panbio IgM ELISA kits and In-house MAC ELISA. Reporting system from these institutes to the Directorate of Public Health, Chennai, has resulted in rapid response to the outbreaks by the district surveillance units. Although the facilities are available for diagnosis of dengue at the Christian Medical College Hospital, Vellore, laboratory diagnosis is restricted to hospital samples only.

Fig. 1. Dengue surveillance network in Tamil Nadu.
The data on month-wise incidence of dengue in Tamil Nadu for the past 9 years (Source: Directorate of Public Health & Preventive Medicine, Chennai) reveal that the number of cases increases from June to December confirming the active transmission period is during monsoon and post-monsoon period every year (Fig. 2). This strongly suggests that appropriate vector control measures need to be implemented during this period to reduce the case incidence. Since the cases are not confined to urban areas only, it is necessary to implement vector control measures such as source reduction in rural areas also through Primary Health Care network and also by involving voluntary organizations and school children.

Of the three aedine mosquitoes viz., *Ae. aegypti*, *Ae. albopictus* and *Ae. vittatus* that are commonly collected in Tamil Nadu, *Ae. aegypti* is found to be the most prevalent species. Dengue virus antigens have been detected in *Ae. aegypti* mosquitoes on several occasions including certain rural areas and *Ae. aegypti* has been proved to be the primary vector of dengue. However, dengue virus has also been isolated from *Ae. albopictus* mosquitoes collected in rural areas of Vellore district. Moreover, vertical transmission of dengue virus has also been shown in *Ae. aegypti* mosquitoes in Vellore district which reveals that the virus may be maintained in mosquitoes even during inter-epidemic periods. Silent transmission of dengue viruses in rural areas has been shown in Tamil Nadu, where circulation of all four dengue virus serotypes were detected during transmission season with a high anthropophilic index of vectors and high abundance of vectors but no apparent DF cases were reported. This emphasizes the need for continuous monitoring of dengue virus infections in vector mosquitoes in the State.

It is evident that there has been an increase in dengue fever case incidence in Tamil Nadu in recent years. There are 42 Filaria and Malaria clinics and 7 Leptospirosis clinics functioning at the Taluk and Non-Taluk hospitals in selected districts of the State, besides 1421 PHCs and 9 Zonal Entomological Teams. Hence, a surveillance network which involves all these agencies needs to be further strengthened.

In summary, the prompt reporting of dengue fever cases by the involvement of several agencies in laboratory-based surveillance network in Tamil Nadu has certainly proved the geographic spread and magnitude of the disease incidence during the last decade. Moreover, the incidence of DF/DHF in newer areas has become a challenge for evolving appropriate vector control strategies to prevent possible outbreaks in time. Hence, the surveillance network needs to be further strengthened to find out actual case incidence in Tamil Nadu which will pave way for evolving effective control strategies. Further studies need to be conducted to map out the prevalence of different serotypes and identify the genotypes of dengue viruses in Tamil Nadu so as to forecast any major outbreak of DHF in the State.

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References


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