

Entomo-epidemiological investigations on chikungunya outbreak in the Lakshadweep islands, Indian Ocean

P. Philip Samuel, R. Krishnamoorthi, K.K. Hamzakoya* & C.S. Aggarwal**

Centre for Research in Medical Entomology, Indian Council of Medical Research, Madurai

**Medical & Health Services, UT of Lakshadweep, Kavarati & **National Vector Borne Disease Control Programme, Delhi, India*

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Background & objectives: An outbreak of chikungunya fever characterized by prolonged incapacitation in the Lakshadweep islands in Indian Ocean occurred in November 2006. We undertook the entomological and epidemiological investigations on the Chikungunya outbreak in the Lakshadweep islands, Indian Ocean.

Methods: Epidemic information in the affected places was obtained from the local hospital records. Entomological observations like larval survey and the adult resting/landing collections by the hand collection methods were individually conducted in the two affected islands Andrott and Kalpeni in November and December 2006.

Results: The main breeding sources of the mosquitoes were the rodent-devoured coconuts, coconut shells, areca nut soaking mud and plastic pots, discarded containers, grinding stones, metal containers and plastic containers. *Aedes albopictus* was pre-dominantly present in the Lakshadweep islands.

Interpretation & conclusion: It is concluded that the routine campaigns need to be organized regularly within the community highlighting the potential breeding grounds of mosquitoes and the possible control methods. Source reduction strategies like destruction of coconut shells and rodent-devoured coconuts by burning or by burying them inside the ground. *Ae. albopictus* played major role as the vector mosquitoes responsible for the chikungunya transmission.

Key words *Aedes albopictus* - chikungunya outbreak - entomological investigations - Lakshadweep islands

Chikungunya (CHIK) virus, has been reported to be associated with several millions of cases during outbreaks, particularly in the islands of Indian Ocean¹. Since its first reporting from Africa in the 1950s, the disease occurred in India with a much milder intensity of incapacitation due to myalgia and arthralgia, and with *Aedes aegypti* incriminated as the sole vector².

In 2006, CHIK fever re-emerged in as many as 16 states and Union Territories inflicting 1.39 million people, without any mortality. In November 2006, an outbreak of CHIK fever characterized by prolonged incapacitation occurred in the Lakshadweep island in Indian Ocean. We report here findings of an entomo-epidemiological survey of chikungunya outbreak

from Lakshadweep islands situated in south western direction that had remained a *terra incognita* for the infection so far³.

Material & Methods

Lakshadweep archipelago (population 60,595), a Union Territory of India, comprises ten inhabited islands. Fishing, coconut cultivation, coir twisting and tourism are main sources of livelihood of the people of the archipelago.

Epidemiological investigations: Epidemic of chikungunya emerged early in November, 2006 in the islands, namely, Andrott and Kalpeni being among the worst affected. Epidemic started in Andrott from November 20 onwards and about 200 cases were recorded daily during the peak time. The number of cases decreased to 100-150 cases per day by the first week of December. According to the hospital authorities both the sexes were affected equally and no mortality was reported. About 80-90 per cent of the total population in Andrott was affected with this fever (Fig. 1). Information was collected from records of the local hospitals in the area.

Similar survey was conducted in the neighbouring island (Kalpeni), which was also badly affected with more than 90 per cent population with the suspected chikungunya fever (Fig. 2). In Kalpeni island suspected fever cases started earlier than Andrott since November 6 with more than 100 cases per day during the peak period of virus activity from November 13 to December 3. Major clinical symptoms observed in the cases were high fever (104-105°F), headache, retro-orbital pain, puffiness, myalgia, arthralgia and rashes, which are all characteristic symptoms of chikungunya. The most significant symptom was arthralgia in large number of cases which persisted for more than a month.

Entomological investigations: Entomological surveys were carried out in Andrott and Kalpeni islands. A central team rushed to the Lakshadweep islands following the CHIK fever epidemic. Entomologic surveys were carried out during the month of December 2006. Larval survey was conducted in all types of peri-domestic and domestic water stored facilities like rodent-devoured coconuts and coconut shells, areca nut soaking mud and plastic pots, discarded containers, grinding stones, cement tanks, cement cistern, metal containers, and plastic containers. The adult resting/landing collections were made by the hand collection method and stored inside

the test tubes. Most of the mosquitoes caught were *Aedes*.

Results & Discussion

Ae. albopictus was found predominantly breeding in rodent-devoured coconuts and shells of coconuts, areca nut soaking mud and plastic pots, discarded containers, grinding stones, cement tanks, cement cistern, metal containers, and plastic containers. In certain situations, *Armigeres subalbatus* co-inhabited with *Ae. albopictus*. House Index, Container index, Breteau index and pupal index were 24.6, 3.4, 33.3 and 214 in Andrott and 55.6, 17.7, 61.1 and 88.9 in Kalpeni islands, respectively. *Ae. aegypti* was not found in any of the breeding grounds in the affected islands (Table).

The outbreak of CHIK fever in 2005 in the Comoros islands led to the first documented CHIK virus infections imported into France by travelers who

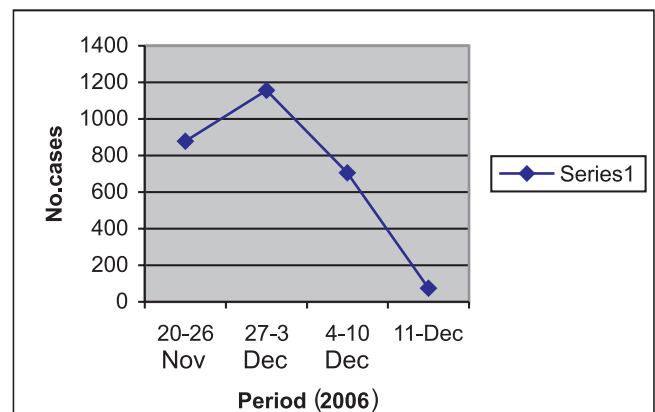


Fig. 1. Suspected chikungunya cases in Andrott island (n=2815).

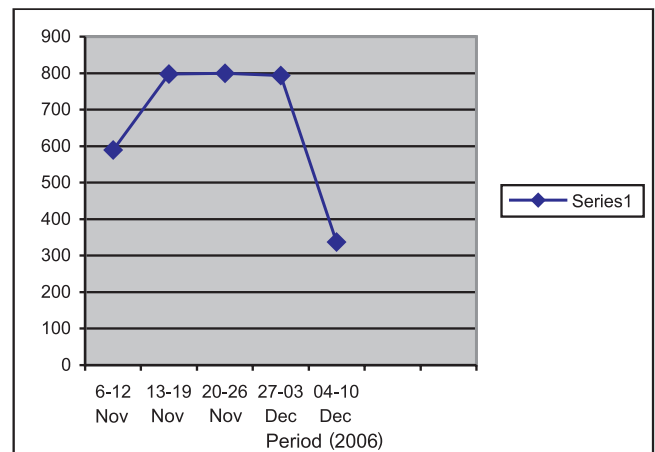


Fig. 2. Suspected chikungunya fever cases in Kalpeni Islands (n=3388).

Table. Immature survey conducted in the two affected islands of Lakshadweep

Sl.No.	Ward No.	HI	CI	BI	PI
<i>I. Andrott</i>					
1	1	40	12.5	40	100
2	2	16.7	8.3	16.7	0
3	3	40	5.3	100	140
4	4	40	1.6	40	100
5	5	20	1.2	20	0
6	6	0	0	0	0
7	7	42.9	16.7	42.9	428.6
8	8	14.3	4	14.3	0
9	9	14.3	3.3	42.9	500
10	10	20	1.4	20	800
Total		24.6	3.4	33.3	214
<i>II. Kalpeni</i>					
1	2	100	100	100	200
2	3	50	33.3	50	0
3	4	33.3	16.7	33.3	133.3
4	5	66.7	28.6	66.7	100
5	6	33.3	10	33.3	0
6	7	66.7	22.2	66.7	66.7
7	8	66.7	11.5	100	166.7
Total		55.6	17.7	61.1	88.9

HI, house index; CI, container index; BI, breteau index; PI, pupal index

had visited the islands⁴⁻⁶. Moreover in the Reunion island epidemic *Ae. albopictus* was implicated as the vector⁷⁻⁹.

So far in India *Ae. aegypti* has been incriminated as the principal vector of CHIK virus, however, in the Lakshadweep islands, entomological survey clearly revealed that *Ae. aegypti* was absent and *Ae. albopictus* made maximum proportion of all the species of mosquitoes sampled. Numerous peri-domestic breeding containers strewn around places were highly preferred breeding grounds of *Ae. albopictus*. Adult sampling also showed the dominance of *Ae. albopictus* mosquitoes compared to any other mosquitoes. In addition to these reasons, confirmation of the presence CHIK virus in the serum samples also proved the presence of CHIK fever in this area¹⁰. Immediately after summer showers all the discarded containers strewn around the houses mainly in the coconut shells were filled with the rain water and an immediate surge in the vector population was reported which spilled over the infection from mosquitoes to human beings in an epidemic proportion. Prevention is therefore important by avoiding day-biting mosquitoes.

In view of these circumstantial evidence it is evident that *Ae. albopictus* transmitted CHIK virus infection in these island in Lakshadweep islands. In Kerala, *Ae. albopictus* was the predominant vector to play a role in the transmission of dengue viruses^{8,9}. *Ae. aegypti* and *Ae. albopictus* were reported during March 2000 in Agatti and Kavaratti islands¹¹. Now *Ae. albopictus* was predominant species in the Andrott and Kalpeni islands which could have possibly played the role as the main vector responsible for the CHIK transmission. The predominance of *Ae. albopictus* could be the sole reason for the spread of CHIK transmission in these islands as also reported in Kerala¹²⁻¹³.

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Reprint requests: Officer in- Charge, Centre for Research in Medical Entomology, Indian Council of Medical Research
4, Sarojini Street, Chinnachokkikulam, Madurai 625 002, Tamil Nadu, India
e-mail: crmeicmr@icmr.org.in