A Territory Health Service mosquito survey of Dili, East Timor, and public health implications.

Peter Whelan, Medical Entomology Branch, Darwin

There has been no documented mosquito surveys carried out in East Timor since the work of Portuguese workers in the 1960’s. The last was a Territory Health Service (THS) Medical Entomology Branch survey of Dili in September 1991 to assist the Indonesian government in controlling general mosquito problems of Dili.

Following the referendum and subsequent humanitarian crisis in East Timor in September 1999, there was widespread destruction of houses and breakdown of all public health services. THS quickly appreciated the public health risks from mosquito borne diseases and conducted briefings with the World Health Organisation (WHO) and defence forces on the potential risks based on the results of the 1991 mosquito survey. It was realised that the information from the 1991 survey, while of great assistance, was in urgent need of reassessment to evaluate the wet season mosquito borne disease potential. Of particular importance was an evaluation of the potential for dengue and malaria outbreaks.

In early October 1999 WHO requested THS to conduct a medical entomological survey of Dili. Initial mosquito trapping was carried out in mid October by sending equipment with a visiting WHO staff member from Geneva who received basic training in Darwin on setting the traps. The trapped mosquitoes were sent back to Darwin for identification and assessment. The results revealed that there were few vector mosquitoes and a comprehensive survey was planned to coincide with first rains and the presence of a THS contact with an international aid agency in Timor. The aim of the survey was to determine the presence of pest and disease vectors in Dili, to determine their actual and potential breeding sites, and to provide advice on mosquito control and the reduction of mosquito borne disease.

The senior medical entomologist from THS carried out the survey in December 1999 with assistance from an environmental health officer working with Oxfam International. A house mosquito breeding container survey, a general mosquito larval survey and various mosquito adult collections were made.

The house survey involved an inspection of 20 houses in Balide and Kaikoli for water holding containers. A sample of mosquito larvae was collected from those containers with larvae. General larval surveys were carried out both in domestic situations and in a range of other habitats including suburban swamp areas, beachside coastal areas, storm drains, wells, rice paddy fields, and roadside pools. (see figure 1) Adult trapping was carried out using dry ice baited EVS traps. Three trap sites were selected, including one in a swamp area in central Dili, one in an urban area near the Santana River on the east side of Dili, and one in a semi rural area on the southern outskirts of Dili in the foothills near Balidae adjacent to a forest and a small stream. Opportunistic biting collections were carried out at sites of reported mosquito pest problems. Collections were made just after sundown in sheltered positions away from concentrations of people and lights. The mosquitoes were collected with the aid of a small aspirator as the mosquitoes were about to bite exposed legs.

A detailed report was prepared for the United Nations. Fifteen mosquito species were recovered, including the vectors of malaria, dengue and Japanese encephalitis. Various mosquito control options were discussed, together with strategies for reducing mosquito borne disease. The potential for importations of exotic mosquitoes and mosquito borne disease into Australia was outlined. The conclusions from the survey are outlined briefly below.

**Dengue**

* Ae*des aegypti, the vector of dengue, breeds principally in rain filled artificial containers (rubbish such as drums and tyres) and containers (200 litre drums and rainwater tanks) used to store potable water.

The house container survey results indicated a considerable amount of breeding sites of * Ae. aegypti* in residential areas. The following relationships have been suggested between the calculated indices of containers with * Ae. aegypti* and the transmission of dengue (WHO 1972).
Table 1 Suggested relationships between calculated indices of containers with *Ae. Aegypti* and the transmission of dengue

<table>
<thead>
<tr>
<th>House Index*</th>
<th>Container Index*</th>
<th>Breteau*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>House survey</strong> Dili 1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission unlikely</td>
<td>1-3</td>
<td>1-2</td>
</tr>
<tr>
<td>Significant Risk</td>
<td>8-17</td>
<td>6-9</td>
</tr>
<tr>
<td>18-28</td>
<td>10-14</td>
<td>20-30</td>
</tr>
<tr>
<td>29-37</td>
<td>15-20</td>
<td>31-49</td>
</tr>
<tr>
<td><strong>High Risk</strong></td>
<td>38 and over</td>
<td>20 and over</td>
</tr>
</tbody>
</table>

* House index is the percentage of houses positive for *Ae aegypti* breeding. Container index is the percentage of water holding containers positive for *Ae aegypti* breeding. Breteau index is the number of water holding containers positive with *Ae aegypti* larvae per 100 houses.

The House index of 55, container index of 29 and Breteau index of 135 placed Dili in the high-risk category for dengue transmission. The results of the residential inspections during the general larval survey supported the results of the house container survey, and confirmed that *Ae. aegypti* was present in high numbers in close proximity to large concentrations of people, and posed a very high risk for arbovirus transmission.

The mandi (a cubic upright concrete tank open at the top continuously holding water for splash bathing, flushing and other domestic uses. They are usually in the bathroom or toilet areas of houses and often have a tap attached for adding water.) breeding sites for *Ae. aegypti* at the Care International headquarters and at Oxfam headquarters provided ideal mosquito breeding and feeding sites, and indicated that conditions for transmission of dengue in these situations were ideal.

The possible solutions

- The reduction of risk for dengue requires source reduction, personal protection, education about mosquito breeding sites, and control of domestic breeding sites.
- Control in mandies by local fish is a real and immediate possibility, as the fish are hardy, readily available, and capable of mosquito control.
- Simple reduction measures could include sealing water tanks, and installing drum tops and taps on drums holding potable water.
- Application of the residual insecticide deltamethrin to walls inside houses and outside near mandies could reduce adult mosquitoes.
- Troops and aid workers require impregnated clothing, nets, and repellents.
- There is a high risk of importation of dengue vectors into Australia, via machinery and equipment via cargo and defence vessels returning to Australia.
- Australian aid could be used to reduce vectors in ports in Timor as a training exercise and ensure a reduced risk for Australia.

Malaria

The problems

- There were limited *Anopheles* mosquito breeding sites in urban Dili but there are productive *An. subpictus* and *An. sundaisicus* breeding sites present on the outskirts of Dili in coastal areas and in rural and semi rural areas.
- Potential *Anopheles* breeding sites occur in rice paddies on the outskirts of Dili.
- Malaria transmission was a relatively low probability in most urban areas of Dili but higher in semi urban or urban areas adjacent to coastal mosquito breeding sites.

The possible solutions

- Malaria control requires source reduction, personal protection and education.
- Larval control opportunities by engineering means exist in coastal areas with the use of drainage and tide valves in drainage pipes to the sea.
- Larval control opportunities exist by using fish in irrigation channels and management
of irrigation water in rice husbandry.
- Impregnated bed nets are the best immediate measure to interrupt malaria transmission.
- Australian aid could be used to determine malaria transmission locations and the relevant entomological factors for transmission in Timor with an aim to interrupting transmission.

Japanese encephalitis

The problems
- Many Japanese encephalitis vectors are likely to be present on the outskirts of Dili.
- Culex annulirostris, Cx. vishnui, Cx. pseudovishnui, Cx. fuscocephala, Cx. gelidus and Cx. tritaeniorhynchus are vectors of JE and all are present in Dili and probably in many areas of east Timor.
- Their primary breeding sites are rice fields, rain filled depressions, and some drains.
- Most storm drains are not mosquito breeding sites due to fish predation.
- The JE potential is limited in urban Dili, but higher on the outskirts, particularly where pigs are present to act as amplifiers of the virus.
- There is a risk of infected mosquitoes being blown to Australia by monsoons or cyclones. The greatest risk areas in the NT, would be Bathurst Island and other coastal areas where there are feral pigs in close contact with residential areas.

The possible solutions
- The reduction of risk requires source reduction, personal protection and education.
- Control opportunities could include the use of fish in rice fields and water management practices.
- Personal protection by the use of bed nets can interrupt transmission.
- Reduction of pigs in urban areas, or their isolation from residential areas in rural areas can reduce the probability of transmission.
- Australia aid could reduce JE transmission in Timor by assisting with education.
- Quarantine authorities need to increase surveillance for JE incursions into the NT.

Filaria

The problems
- Three species of filaria parasites are probable.
- Potential vectors include Cx. quinquefasciatus, An. subpictus, and Ma. uniformis.
- High numbers of Culex and Mansonina mosquitoes are present in urban Dili.
- The highest Mansonina numbers are present in the Kaikoli locality in Dili associated with Pistia (water lettuce), Eichhornia (water hyacinth) and kankung aquatic vegetation.

The possible solution
- An assessment of the presence of filariasis is required in Timor among residents, and returning aid workers and troops.

Pest species

The problems
- Aedes vigilax, Cx. quinquefasciatus, and Ma. uniformis are important pests in Dili.
- Aedes vigilax has limited but productive breeding sites on the west outskirts of Dili.
- Culex quinquefasciatus is associated with waste water and drains.
- Mansonina uniformis is associated with deeper permanent water and aquatic plants.

The possible solutions
- There is an opportunity for engineering (drain clearing) and chemical control of these pest breeding sites.
- Good larval control opportunities exist by the use of local fish.
- Kankung cultivation in storm drains and flooded plots is not causing a mosquito problem.
- Control opportunities exist with the reclamation or alteration of swampland.

Since the report was presented to the United Nations there have been requests for the report from various aid agencies and defence forces from various countries. It is not known how much of the advice in the report has been implemented. Many of the potentials outlined in the report have now been realized, with a large outbreak of dengue in both troops and locals, continuing malaria transmission, and the first recorded cases of Japanese encephalitis in East Timor. The report emphasizes the value of good vector and vector borne disease information and the necessity to act quickly on such information in an emergency situation to improve public health.
For further information contact:
Peter Whelan AM
Senior Medical Entomologist
Territory Health Services
ph 08 892 28333
fax 08 892 28820
email peter.whelan@nt.gov.au