Introduction

Since the dengue vector, *Aedes aegypti*, was declared eliminated in 1969, the Northern Territory (NT) has remained free of this exotic vector. However, *Ae. aegypti* as well as *Ae. albopictus* pose a real threat to the NT, with the Darwin and other NT port areas particularly vulnerable to the importation of such vectors. Numerous incidents of risk importations in Darwin have been recorded over the years, with the latest incursion of *Ae. aegypti* recorded in 2011.

In April and May 2013, there were 2 incursions detected at the Toll Marine Logistics (TML) port facility in Darwin. Both incursions were responded to following the protocols outlined by the National Arbovirus and Malaria Advisory Committee (NAMAC). This report describes the response to both incursions.

Detection, elimination and surveillance

Detection and identification – April 2013

On 23 April 2013, Department of Agriculture Forestry and Fisheries (DAFF) Biosecurity collected and delivered a sample from a routine Biogents® (BG) trap that was set on 18 April and collected on 23 April to Medical Entomology (ME) of the Centre for Disease Control (CDC) NT Department of Health (DoH). The trap (BG2) was set at the international quarantine shed of the TML port facility in Darwin.

The sample was processed on 24 April and 3 adult female and 2 adult male *Ae. aegypti* were identified.

Survey and control operations – April 2013

Following the positive identification of *Ae. aegypti*, ME in liaison with DAFF Biosecurity carried out a comprehensive larval survey and treatment operation of all receptacles at TML and the adjacent Frances Bay Marine premises on 24 April. Receptacles were treated with alpha-cypermethrin (Bestox®) and s-methoprene pellets (Prolink®). No exotic mosquitoes were detected during the survey. In the evening of 24 April, ME carried out Ultra Low Volume (ULV) fogging using biosmuthrin (Reslin®) at TML and Frances Bay Marine to eliminate any *Ae. aegypti* adults that might have been present in the area (see Figure 1).

On 26 April, additional exotic larval surveys were carried out by ME at properties neighbouring TML (TML engineering and the navy fuel storage depot). No exotic mosquitoes were detected. Barrier treatment of the TML international quarantine shed with alphacypermethrin was carried out on 30 April.

TML advised that the international cargo vessel, Kathryn Bay, docked at TML on 22 April and left on 23 April.

Enhanced surveillance – April 2013

Ovitraps

ME constantly maintains 4 ovitraps (egg traps) within TML and the adjacent premises of Frances Bay Marine, with 2 sentinel tyre traps also located at TML and maintained by DAFF Biosecurity.

There were 4 extra ovitraps set by ME at TML on 26 April 2013 and all traps were serviced weekly for 4 weeks (see Figure 2).

Adult traps

Following the incursion, the 2 routine BG sentinel traps at TML (BG1 and BG2) were serviced on 24 and 25 April, with an additional 3 BG traps deployed at TML on 26 April (Figure 2). The BG traps were baited with CO₂ gas delivered through a regulator attached to a D size gas bottle and these were serviced daily, with samples also collected daily until 3 May.
Detection and identification – May 2013

On 3 May 2013, a female adult *Ae. aegypti* was collected in the BG trap in the TML quarantine shed and later identified by ME. In addition, 36 fourth instar *Ae. aegypti* larvae and 3 pupae were collected from the sentinel tyre at the same quarantine shed by DAFF Biosecurity and identified by ME on 14 May. All larvae were s-methoprene affected.

Survey and control operations – May 2013

Following the second *Ae. aegypti* detection at TML another comprehensive receptacle survey and control operation was carried out by ME in liaison with DAFF Biosecurity at TML on 3 May. No exotic mosquitoes were found during the survey. ME carried out ULV fogging at TML and Frances Bay Marine in the evening of 3 May using phenothrin (Twilight®). The fogging route was similar to that shown in Figure 1.

The detection of the adult *Ae. aegypti* on 3 May coincided with the docking of the *Starbird* cargo ship at the international wharf on 2 May. The *Starbird* is an international vessel but had been travelling on a national route between Cairns, Gove and Darwin during the previous month. ME and DAFF Biosecurity carried out an exotic vector survey and set an overnight BG trap on board of the *Starbird* on 9 May. No exotic mosquitoes were detected.

Enhanced surveillance – May 2013

Ovitraps

Due to the second incursion of *Ae. aegypti* on 3 May and the detection of the additional *Ae. aegypti* larvae in the sentinel tyre trap on 14 May, all 8 ovitraps were again serviced weekly by ME and DAFF Biosecurity over the next 4 weeks.

Adult traps

All 5 BG traps were again serviced daily from 4 to 21 May and then weekly until 11 June 2013.

Discussion and conclusion

The 2 incursions of *Ae. aegypti* at TML in April and May 2013 once again demonstrated the vulnerability of the Darwin port area as an entry point for exotic mosquito vectors in the NT and the importance of routine vector surveillance and control operations in such areas to keep the NT free of exotic vectors and disease.

The April incursion was most likely associated with the berth of the *Kathryn Bay* an international vessel, at the TML port facility, while the May incursion was most likely associated with the berth of the *Starbird*, an international vessel travelling on a national route between Cairns, Gove and Darwin. The larvae
and pupae collected in the sentinel tyre on 14 May were most likely a result of a female *Ae. aegypti* that escaped from the *Starbird* and deposited eggs in the sentinel tyre between 30 April and 7 May, the period between when the vessel arrived and the refilling of the tyre with water and residual insecticide by DAFF Biosecurity. The eggs would have hatched on 7 May when the tyre was serviced and re-filled with water, inundating the eggs attached to the inside of the tyre.

Although an international vessel, the *Starbird* has been travelling the national Darwin to Gove route since 28 March 2013, and was present in Gove on 8 to 9 April, 1 day prior to Gove receiving 88 millimetres of rain. The vessel was also present in Cairns, when the exotic vector, *Ae. albopictus* was detected on 21 March 2013.

International vessels are routinely inspected to minimise the potential for exotic vector importations into the NT.\textsuperscript{5,10} However, vessels travelling on national routes from *Ae. aegypti* endemic areas, such as northern Queensland (QLD) to the NT are not currently inspected to prevent the transportation of exotic vectors. This poses a high risk of transporting *Ae. aegypti* from QLD ports to the NT or Western Australia.

The *Starbird* was not subjected to inspections while travelling on a national Australian route. This posed a risk of exotic mosquitoes being transported to Gove or Darwin as adults or eggs, with eggs potentially hatching following the significant rainfall in Gove the day after the arrival of the vessel.

Due to the potential risk of exotic vector importations in the Gove port area, ME in liaison with Environmental Health established a routine BG trap in the Gove port area in addition to existing routine ovitraps and sentinel tyre traps, and carried out a comprehensive exotic vector survey in May 2013. No exotic mosquitoes were detected.

To minimise the potential for future exotic vector incursions in the NT, a revision of current procedures should be considered. It would be recommended that vessels travelling on national routes from *Ae. aegypti* endemic areas should be subjected to routine inspections on arrival at NT ports or other areas currently free of dengue.

Acknowledgements

We thank all ME, DAFF Biosecurity and TLM staff who were part of the survey and control operations, and who assisted by providing access to properties as required. We would also like to thank the Commonwealth Government for providing relevant funding.

References

10. National Arbovirus Malaria Advisory Committee, vector sub-committee, November 2006 (Draft). Proposed protocol for action when a 'risk importation' or introduced exotic mosquito is detected.
EDITORIAL

Exotic mosquito incursions

By 5 December 2013 5 exotic mosquito incursion had been detected in the Darwin port area of the Northern Territory (NT) for the year. The 5 exotic mosquito incursions for 2013 have included:

1. *Aedes aegypti* incursion at Toll Marine Logistics on 23 April 2013
2. *Aedes aegypti* incursion at Toll Marine Logistics on 3 May 2013
3. *Aedes albopictus* incursion at East Arm Wharf on 16 August 2013
4. *Aedes albopictus* incursion at Toll Marine Logistics on 28 November 2013 and
5. *Aedes albopictus* incursion at East Arm Wharf on 5 December 2013.

The last detection, 5 December, was another single female Asian Tiger mosquito (*Ae. albopictus*) that was collected in a routine Biogents® (BG) trap set by the newly named Department of Agriculture (DoA) on 28 November and recovered 5 December 2013 at the East Arm Wharf in Darwin. In response to this new incursion Medical Entomology (ME) staff of Centre for Disease Control, NT Department of Health, in liaison with the Australian Government DoA, carried out activities as per protocol.

On 5 December, following the identification by ME staff of the single *Ae. albopictus* female from a BG trap, fogging (adult mosquito control) was carried out by ME at the East Arm Wharf. On 6 December ME staff carried out comprehensive larval surveys and treatment of all receptacles, including barrier spraying at East Arm Wharf. Further action included:

- ME staff setting an additional BG trap to the 2 routine BG traps set by DoA. All BG traps were serviced daily by DoA staff for 1 week and from 13 December all BG traps serviced weekly.

- ME staff placing an additional ovitrap at the East Arm Wharf in addition to the 2 routine DoA ovitraps and the DoA sentinel tyre trap. All ovitraps were to be serviced weekly for a total of 4 weeks.

While 5 international vessels on route from Asia visited the East Arm Wharf between 27 November and 5 December, the most recent incursion could not be associated with a particular vessel. Surveillance results and other relevant information will be reported and evaluated as they become available.

In the 13 years, 2000 to 2012, a total of 20 *Ae. aegypti/albopictus* incursions were associated with cargo vessels in the NT (Darwin). The incursions per year were as follows:


These data show that there were 2 other years (2000 and 2010) that also had 5 incursions. Increased numbers of incursions are concerning and action should be taken to reduce incidences in the future. Actions to be considered include:

- Targeting high risk cargo vessels directly (with barrier spray),
- Changing procedures so that risk cargo is inspected immediately by DoA and
- DoA inspections of vessels that travel to the NT from *Ae. aegypti* endemic areas, such as north Queensland.

Preventing incursions of exotic mosquitoes that have the potential to serve as vectors for viruses that cause diseases such as dengue fever and chikungunya is a high priority for the NT.

***************