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Interim report to the National Arbovirus and Malaria Advisory Committee on the detection of exotic mosquitoes in tyres at Perkins Shipping, Darwin, Northern Territory on 12 May 2006

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Detection

A Perkins container ship arrived in Darwin Harbour from Singapore on Wednesday 10 May 2006 and docked at the international wharf at Perkins Shipping at 04.30. An Australian Quarantine and Inspection Services (AQIS) officer conducted a pre-clearance inspection of the container ship on Thursday 11 May 2006. A quarantine inspection of the container ship was then conducted by AQIS on the morning of Friday 12 May 2006. During this quarantine inspection, mosquito larvae were found breeding in water pooling at the bottom of 6 large earthmoving tyres. The tyres were stacked upright, and protruding from the top of an open, uncovered shipping container.

Six mosquito larvae, 1 pupal skin and 1 pupae were collected and preserved in 70% ethanol on site by the AQIS officer. There were larvae observed in all of the 6 tyres that were inspected and adults were observed flying in the vicinity. AQIS estimated that there were at least 50 larvae observed in 3 of the tyres and probably less than

50 larvae in the other 3 tyres. Following a preliminary identification of the samples at the AQIS vector laboratory a medical entomologist at the Medical Entomology Branch (MEB) of the Northern Territory Department of Health and Community Services (DHCS) confirmed them to be *Aedes albopictus* on the same day of collection. This exotic species is a very good potential vector of dengue and chikungunya virus.

This risk importation was assessed as being moderate to high because the tyres were exposed and untreated at Perkins international wharf for a period of over 48 hours, and large numbers of larvae (and probably pupae) and adults were observed, and a pupal skin was collected in the sample, indicating that adult mosquitoes had probably emerged from this breeding site and dispersed out of the area. Perkins Shipping is located in very close proximity to Darwin City.

There are a number of residential buildings within 500 metres of the wharf facility that could potentially provide a blood meal for a female

adult *Ae. albopictus*. There are also a large number of potential receptacle breeding sites nearby where a gravid female could lay eggs.

Elimination procedures

The response to this risk situation followed the draft National Arbovirus and Malaria Advisory Committee (NAMAC) guidelines (Proposed protocol for action when a 'risk importation' or introduced exotic mosquito is 'detected', IN PREPARATION). After samples were collected from the tyres by AQIS, the tyres and container were immediately sprayed with a knockdown insecticide (d-phenothrin). The tyres were then taken off the ship and placed on the wharf, where they were covered and fumigated by a contract pest controller with methyl bromide, for 24 hours at 48 g/m³ at 21° or above.

An adulticide fogging operation was conducted at Perkins Shipping and other industrial premises and vegetated areas within 500m of the unloading zone by MEB, using a ULV LECO fogging machine and applying bioresmethrin at a ratio of 1:1.5 insecticide to diesel, and at a rate of 330ml per minute. All Perkins staff were evacuated from the premises between 18:00 and 19:00 on 12 May 2006 and the interior of all the accessible buildings, any areas of vegetation, any accessible opened containers and the engineering yards were fogged between 18:10 and 18:58. The premises next door, Frances Bay Marine, was considered to be a risk premise due to a large number of potential receptacle breeding sites, such as tyres, drums, boat hulls and miscellaneous machinery and boat wrecks being present. This location was also fogged with bioresmethrin between 19:09 and 19:34. Other vegetated areas in public locations and still within 500m of the unloading zone were also fogged between 19:34 and 19:44.

Increased surveillance

The initial surveillance response involved AQIS setting 4 carbon dioxide baited encephalitis virus surveillance (EVS) traps at harbourage sites within the Perkins Shipping site on 15, 16 and 18 May. MEB set another 4 carbon dioxide baited traps at harbourage sites outside Perkins Shipping, within approximately a 400m radius of the shipping facility, on the same dates. Extra adult mosquito trapping will also be conducted

at these 8 locations once a week for another 3 weeks.

AQIS maintain 4 routine ovitraps within Perkins Shipping and another 2 routine ovitraps outside the premises, but within the 400m quarantine zone. MEB also maintain another 3 routine ovitraps inside Perkins, and another 2 routine traps maintained outside Perkins Shipping, but within approximately 500m of the overseas shipping facility.

In response to the exotic incursion on 12 May 2006, AQIS set an extra 4 ovitraps inside Perkins, and MEB placed another 6 ovitraps within an 800m perimeter of the unloading site. These traps will be monitored for a 1 month period after the incursion incident, and will also be reset 1 week after the next rain event.

Prior to the detection of the exotic vector, the last significant rainfall event (over 25mm) was 49.8mm on 26 April 2006. Another 16mm was recorded at Stokes Hill on 22 May, 10 days after the incursion incident. The prevailing wind direction between 10 and 12 May 2006 was SSE-ESE at 33-41 km/h (all information on Bureau of Meteorology web site www.bom.gov.au). On 22 May, 4 days after the rainfall, AQIS and MEB conducted a receptacle survey at Perkins and at 3 other premises within the surrounding 400m quarantine zone. All receptacles that held water and were breeding mosquitoes, or could potentially breed mosquitoes, and receptacles that were empty but could potentially hold water were treated with methoprene pellets or methoprene briquettes and Bifenthrin. Another receptacle survey and treatment operation will be conducted around the whole Darwin city waterfront area after the next significant rainfall event, which will probably be in the early wet season.

Results

Since the risk importation, there have been 2 weeks of extra adult trapping and a receptacle survey of the surrounding premises. Paddles from the extra MEB ovitraps were collected and reset on 29 May, and eggs and larvae are being reared out for identification. No further evidence of *Ae. albopictus* has been observed in the area since the initial detection of larvae, pupae and pupal skins at Perkins Shipping on 12 May 2006.

Figure 1. Exotic vector incursion response 12 May 2006



Conclusions and recommendations

- It would be desirable if pre-clearance surveys by AQIS could target tyres as a high-risk cargo with the potential to import exotic vector larvae and/or eggs and be flagged for examination on the day of arrival.
- The proposed NAMAC protocols for action when a 'risk importation' is detected, recommends treating with a residual

pyrethroid larvicide (such as Bifenthrin or Deltamethrin). This is advisable, as there may be a delay in setting up fumigation proceedings, and a residual treatment will target any recently emerged adults harbouring in the tyre or re-entering the tyre after initial treatments, as well as killing any larvae and pupae in the tyre. The d-phenothrin applied by aerosol can is a good protocol for immediate action to kill any flying adults after detection, but may not

have sufficient residual action to kill adults that later harbour in the tyre or kill larvae or pupae in the water. The effectiveness of aerosol d-penothrin on larvae or pupae should be further examined.

- Only 6 larvae and a pupal skin were collected from a single tyre and preserved in alcohol. It is recommended that samples from all receptacles with water and larvae be collected as separate labelled collections, as this will give a better indication of risk and may indicate other species of mosquitoes.
- In this instance it appears fumigation took place very soon after detection, which is very commendable and will be an important factor in keeping exotic mosquito vectors out of the NT. However if there is a delay, or if there is a sufficient period of time between detection and fumigation, local DHCS medical entomologists can be contacted before fumigation to assist with the collection of adult and larval specimens.
- The local AQIS vector officer put the treatment and enhanced surveillance operations in place quickly and systematically. The notification of the detection to DHCS was very speedy and the increased number of adult traps and ovitraps at Perkins were implemented by AQIS and DHCS rapidly.
- No further evidence of *Ae. albopictus* has been detected in the area following a thorough preliminary joint receptacle survey by AQIS and DHCS at Perkins or other premises within 500m of the overseas docking point. We will not be confident there has been no introduction of *Ae. albopictus* until the end of the extra surveillance measures, and when the additional receptacle survey is undertaken following the next rain event.

Recommended interim water receptacle treatment for exotic mosquitoes on international foreign fishing vessels arriving in Australia

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Introduction

Exotic *Aedes* mosquito larvae are commonly found in receptacles as equipment or cargo that hold or have held water, on overseas vessels arriving in the Northern Territory (NT) of Australia. This applies especially to international foreign fishing vessels (IFFV) from Indonesia, which are commonly intercepted fishing in Australian waters by the Royal Australian Navy (RAN) and Customs and detained in Darwin or Gove harbours. The drinking water storage receptacles aboard these vessels are often found to contain *Aedes aegypti* and *Aedes albopictus* larvae. Drinking water storage receptacles are the most commonly detected type of container to carry exotic mosquito pupae, larvae and eggs into the NT. *Aedes* species eggs are desiccation resistant and can often be present in either water holding or dry receptacles. The eggs are laid just above the water level on the inner surfaces of receptacles. Approved procedures to treat drinking water receptacles only allow the use of chlorine, due to the residue concerns posed by the use of insecticides. These treatments are part of routine quarantine inspection and control

procedures on vessels or aircraft in the 400 m quarantine zone around air and seaports.

As part of the previously recommended chlorination procedures, any water holding receptacles were emptied and treated with a chlorine spray to kill possible exotic *Aedes* eggs on inner surfaces.^{1,2,3} However, the previously recommended receptacle treatments that involved spraying the receptacle surface with a 1% active ingredient (AI) chlorine solution to the point of run-off did not adequately kill 100% of mosquito eggs.⁴ This was due to the mosquito eggs not being exposed to the chlorine solution for a long enough period. The vertical position of the treated surface, the large clusters of eggs, the sometimes low relative humidity and the dilution of the chlorine solution are all factors that affected the efficacy of the previous treatment recommendations.⁴

Recent re-evaluations of the efficacy of chlorine against *Aedes aegypti* eggs, as well as the development of new egg treatment methods that use detergents, can be combined to provide an improved interim method of receptacle