Initial survey of underground mosquito breeding sites in Darwin, NT

Gisela Lamche & Peter Whelan, Medical Entomology Branch, CDC Darwin

Introduction

Several studies on the dengue vector *Aedes aegypti* in northern Queensland have revealed a considerable percentage of the larval population to be living and surviving the unfavourable dry or winter season in underground breeding sites.[1],2 Service pits and manholes have been found to contain mosquito larvae. 1,3 The presence of natural predators of mosquito larvae such as *Mesocyclops* (Crustacea, Copepoda) species is known to considerably reduce mosquito breeding in service pits and manholes?,3

Darwin and the NT are free from the two main dengue vectors *Aedes aegypti* and *Aedes albopictus.*[4],5 Darwin is considered a locality of high risk for the introduction of these exotic *Aedes* species.[5], 6 The Medical Entomology Branch (MEB) and the Australian Quarantine and Inspection Services (AQIS) carry out a comprehensive exotic mosquito surveillance program with the main goal to enable early detection of any exotic mosquito importation and institute elimination procedures.[7]

Since surveys began in 1974 all importations of exotic *Aedes* mosquitoes in Darwin have been successfully eliminated.[4], 8,9 However, there is always the possibility of late detection, which could lead to the establishment of dengue vectors. The current paper is a preliminary investigation of the abundance of, and potential for, mosquito breeding in underground sites such as Telstra pits and manholes in Darwin. The purpose of the survey was to confirm" the presence of water in pits and manholes, and sample these for mosquito larvae and aquatic" predators such as *Mesocyclops.*

Methods

A Telstra officer and a MEB officer jointly carried out the initial survey on 27th March 2003. The Telstra officer opened the pits and manholes according to Telstra safety procedures and requirements. A manhole allows the entry of personnel to inspect and work inside the facility. The smaller pits are designed for inspection and maintenance purposes and do not allow physical entry by personnel. The manholes and pits sampled were selected for their likelihood of holding water near the end of the wet season.

The presence or absence of water was recorded. Water depth was measured using a ruler. Sampling for mosquito larvae and other aquatic invertebrates, including plankton, was carried out using a 100 im mesh plankton net of 20 cm length with an opening of 20 cm x 10 cm on an extendable handle. ID The net was swept along the sides and corners of the manhole/pit on the surface and then in deeper water for 50-60 seconds. The net was emptied into a photographic tray and the sample transferred to sealable containers. The samples were taken to the MEB laboratory and placed into 70% ethanol. Mosquito larvae were identified using a stereo microscope. Plankton was sorted and *Mesocyclops* specimens were identified to genus level under a compound microscope.

Results

During the initial survey, ten service manholes and six pits were sampled (Table 1). Of these, more than half of the manholes were found to hold water, but only 1 pit held water (Table 1). The service pit holding water did not contain mosquito larvae or *Mesocyclops.* Of the 6 manholes holding water, 3 were breeding mosquitoes and 1 had *Mesocyclops* (Table I). The copepods remain to be identified to species level to determine if they are potential mosquito larval predators. The mosquito larvae were all *Ochlerotatus (Mac) tremulus.*

Discussion

This survey of service manholes and pits at the end of the wet season in Darwin revealed the presence of water and mosquito larvae. The only mosquito species recorded was *Ochlerotatus tremulus,* an endemic species that is known to use both natural and artificial containers as breeding sites. ı ı This species was also commonly found in the survels of underground breeding sites in Queensland. ,3, 12 These studies often found a close association between the presence of *Ochlerotatus tremulus* and *Aedes aegypti.*[2], 12 The presence of *Ochlerotatus*

Table 1. Summary of survey of Telstra service pits and manholes in Darwin, 27 March 2003

Type	Number sampled	Number holding "Water	Number positive for mosquito larvae	Number positive for *Mesocyclops*
Manhole	10	6 (60%)	3 (30%)	1 (10%)
Pit	6	1 (16.7%)	0 «()oIo)	0(0%)
Total	16	7 (43.8%)	3 (18.8%)	1 (6.3%)

tremu/us in manholes in Darwin indicates their potential to serve as potential breeding sites for *Aedes aegypti*.

A larger survey is planned for the wet season 2003/04 to establish the amount of endemic mosquito breeding in manholes and pits, and the duration of breeding throughout and after the wet season. Part of the study will aim at establishing the relationship between a manhole or pit holding water with the recent rainfall, the soil type and topography. It is also planned to survey other underground breeding sites, such as PowerWater manholes and roadside side entIy pits (SEP's) of underground stormwater drains. The results of these surveys will form the basis of a dengue management plan for Darwin and the Northern Territory.

Conclusions

Mosquito breeding does occur in underground manholes, indicating the possible use of underground breeding sites by exotic *Aedes* mosquitoes. These sites will require specific precautionary treatment in the quarantine area for all future risk importation of exotic *Aedes* mosquitoes. A larger survey in cooperation with Telstra will investigate mosquito breeding in the underground. sites on a temporal and spatial scale.

Acknowledgments

Special thanks to the following people for their support: Ananda Waniganayake, John Stopp, and Andrew Donnolly from the Telstra Corporation.

References

1. Russell BM, McBride WJH, Mullner H, Kay BH. Epidemiological Significance of Subterranean *Aedes aegypti* Breeding Sites to Dengue Virus Infection in Charters Towers, 1993. *J Med Ent* 2002; 39: 143-145.
2. Kay BH, Ryan P A, Russell BM, Holt JS, Lyons SA, Foley PN. The Importance of Subterranean Mosquito Habitat to Arbovirus Vector Control Strategies in North Queensland, Australia. *J Med Ent* 2000; 37: 846-853.
3. Kay BH, Lyons SA, Holt JS, Holynska M, Russell BM. Point Source Inoculation of *Mesocyclops* (Copepoda: Cyclopoidae) Gives Widespread Control of *Ochlerotatus* and *Aedes* (Diptera: Culicidae) Immatures in Service Manholes and Pits in North Queensland, Australia. *J Med Ent* 2002; 39: 469-474.
4. Lamche GO & Whelan PI. Variability of larval identification characters of exotic *Aedes albopictus* (Skuse) intercepted in Darwin, Northern Territory. *Commun Dis Intell 2003;* 27:105-109.
5. Whelan PI. Northern Territory remains free of dengue fever. *Bull Mosq Contr Ass Aust* 1991; 3: 7-9.
6. Russell RC. First Port Vector Monitoring Program. A report to AQIS (Australian Quarantine and Inspection Services). Canberra; 1998.
7. Whelan PI & Tucker G. Exotic *Aedes* surveillance and exclusion from the Northern Territory of Australia. Suppl *Bull Mosq Contr Ass Aust* 1998; 10: 86-99.
8. Whelan PI. Exotic mosquitoes arriving on seagoing vessels: recommended inspection and eradication procedures. *Bull Mosq Contr Ass Aust* 1998; 10: 14-22.
9. Kay BH, Ives W A, Whelan PI, Barker-Hudson P, Fanning ID & Marks EN. Is *Aedes albopictus* in Australia? *Med J. Aust* 1990; 153: 31-34.
10. Tun-Lin W, Kay BH, Burkot TR. Quantitative sampling of immature *Aedes aegypti* in metal drums using sweep net and dipping methods. *J Am Mosq Contr Ass* 1994; 10,390-396.
11. Lee DJ, Hicks MM, Griffiths M, Russell RC, Marks EN The Culicidae of the Australasian Region, Vol 3. Canberra: Austral Gov Publ Service; 1984.
12. Kay BH, Ryan PA, Lyons SA, Foley PN, Pandeya N, Purdie D. Winter Intervention Against *Aedes aegypti* (Diptera: Culicidae) Larvae in Subterranean Habitats Slows Surface Recolonization in Summer. *J Med Ent* 2002; 39: 356-361.

****