When a drain does not drain - mosquito breeding investigation in 2 Darwin suburbs in 2016

Allan Warchot and Nina Kurucz, Medical Entomology, Centre for Disease Control, Darwin

Abstract

In May 2016, Culex sitiens mosquito numbers sharply increased in a routine adult mosquito CO₂-baited trap as part of the encephalitis virus surveillance in the northern Darwin suburb of Coconut Grove. A mosquito complaint was received from a resident in Nightcliff in July, with Cx. sitiens numbers also high in a mosquito trap subsequently set at the residence. To find the source of the high mosquito numbers, the Medical Entomology unit of the Department of Health (DoH) carried out larval mosquito surveys in May and found several blocked stormwater outfall drains, some of which were found to be breeding mosquitoes. The drains were treated for mosquito breeding, followed by maintenance works carried out by the City of Darwin (CoD) as part of the combined DoH and CoD mosquito engineering program. Subsequent mosquito surveillance results showed a dramatic decrease in mosquito numbers, highlighting the importance of the collaborative mosquito engineering program carried out in Darwin urban and the routine ground mosquito control program.

Key words: Mosquito engineering program; mosquito survey; mosquito control.

Background

The Medical Entomology (ME) unit of the Northern Territory (NT) Department of Health (DoH) has the responsibility to reduce the impact of biting insects on the health and wellbeing of NT residents. This is achieved through a number of ME programs, including the combined mosquito engineering program between the DoH and the City of Darwin (CoD), which was established in 1983 as a result of a Legislative Assembly order to ‘rectify the mosquito problems in Darwin.’ The program focuses on storm water drain maintenance and rectification in Darwin urban and filling of depressions to eliminate mosquito breeding.

In addition, weekly adult mosquito surveillance carried out by the ME unit, in the form of CO₂ baited traps as part of encephalitis virus surveillance are set at strategic points around Darwin. Information provided is used to investigate mosquito breeding and carry out mosquito larval control. Despite extensive mosquito control at times when salt marsh mosquito numbers are high, the DoH receives public complaints. There are also occasional complaints that are attributed to mosquito breeding caused by blocked stormwater drains or backyard breeding.

Between May and July 2016, numbers of the salt water mosquito, Culex sitiens increased dramatically in the adult mosquito trap set in Coconut Grove, with a public mosquito complaint received from a Nightcliff resident in early July 2016. ME launched an investigation to detect mosquito breeding and rectify the situation.

Mosquito breeding investigation and rectification

Cx. sitiens is a brackish coastal ground pool breeder, including tidal storm water drains. It bites humans, is a potential vector for Ross River virus and can occur in pest numbers within 2km of the breeding site. Larvae of this species are frequently detected during larval surveys in Darwin including Coconut Grove.

Weekly adult mosquito surveillance has been carried out in Coconut Grove since 1976, with a trap set at the end of Ostermann Street, providing long term data on mosquito abundance and species composition (Figure 1).

Between May and July 2016, Cx. sitiens numbers increased dramatically in Coconut Grove, with up to 500 specimens collected in the overnight trap (Figure 2).

As the general area was dry at the time, mosquito breeding was suspected in the stormwater drain, located behind Ten Pin Bowling, a known Cx. sitiens breeding site, receiving dry season low flows (Figure 3). High density mosquito breeding, but of a different
species, was found on 25 May and controlled using a 30 day residual insecticide (Figures 1 and 2). Interestingly, Cx. sitiens numbers shortly decreased before another sharp increase in early and mid-June, despite mosquito control of all known tidal affected sites in the area, including the Kulaluk Reserve drains, following a 7.66m tide on 7 June (Figure 2).

Another high tide event in early July led to another comprehensive mosquito larval survey, with high density and minor Cx. sitiens breeding found in the Ten Pin Bowling and the Sunset Cove drain respectively (Figures 1, 3 and 4). The 2 drains, in addition to the old Phoenix Hotel open drain and all Kulaluk Reserve drains were re-treated with 30 day residual methoprene pellets on 8 July.
On 12 July, DoH received a public complaint from a resident in Hakea Street, Nightcliff, who mentioned high mosquito pest problems had been occurring for the last 3 to 4 weeks, coinciding with the sharp increase of *Cx. sitiens* in the Coconut Grove trap in June. To investigate, an adult mosquito trap was set at the residence on 12 July, with 30 *Cx. sitiens* collected, accounting for 81% of the total catch. The number of *Cx. sitiens* was relatively high, considering the trap was set well away from any major tidal breeding sites.

Following the complaint, the stormwater outlet drain from Progress Drive opposite Hickory Street was surveyed for mosquito breeding on the 13 July (Figure 1). The drain was found blocked by shifting beach sand causing the pipe at the outlet to be partially submerged in water, with water also ponding in the upstream pipe system (Figure 5). The sources of water in this drain were high tides and dry season urban water runoff. Low density larval breeding was detected, and although the larvae collected were not *Cx. sitiens*, the drain appeared to be an ideal breeding site for this species, especially with organic nutrients present (leaf litter, lawn clippings), which were evident in the upstream side entry pits. Although no larvae were found in the side entry pits, the outlet drain section and pits up to 100m from the outfall were treated with methoprene 30 day pellets as a precautionary measure.

To eliminate future mosquito breeding, the drain was desilted by CoD under the mosquito engineering program on 18 July to remove all sediment and debris, with the pipe also flushed by CoD the following day. While this operation ensured free flow in this particular drain, the Ten Pin Bowling, Sunset Cove and the old Phoenix Hotel drains were placed on a regular insecticide treatment program until maintenance works could be carried out by CoD in June 2017 using an excavator for sediment and vegetation removal.

Due to the flat topography, with a fall of about 0.1% in the drains, some minor pooling remained in the upper reaches of the open drains, allowing localised *Cx. sitiens* breeding (Figure 6). Thus, further minor works are required in 2018 to drain the remaining pools and remove any new sediment accumulation and debris.

Since the comprehensive insecticide treatment of all mosquito breeding sites and the rectification of the Hickory Street/Progress Drive drain, *Cx. sitiens* numbers have remained at relatively low levels in the Coconut Grove trap (Figure 2).
Figure 6. Old Phoenix Hotel drain desilted, with minor shallow ponding

Discussion

This investigation highlighted several important aspects for a successful mosquito control program. Firstly, routine adult mosquito surveillance is crucial, as it identifies the fluctuation in mosquito abundance. In this case, the change in *Cx. sitiens* numbers in the weekly set trap indicated increased mosquito breeding within about 2km of the trap site, and triggered larval mosquito surveys to identify the source. The Coconut Grove trap was located 440m from the nearest breeding site (Sunset Cove drain) and 500m from the most productive breeding site (Ten Pin Bowling drain), indicating that *Cx. sitiens* was dispersing in appreciable numbers at least 500m from localised breeding sites. The address of the resident issuing the complaint was about 300m from the Hickory Street outfall drain, and 500m from the Ten Pin Bowling drain and was therefore within the flight range of this mosquito from localised productive breeding sites.

The investigation further shows the importance of routine larval surveillance for all known breeding sites, regardless of their history, as nutrient input into open stormwater drains as a result of urban runoff or rotting organic matter can quickly turn a relatively small site into a productive mosquito breeding site. In addition, and most likely in this case, stormwater drains over time can become productive breeding sites due to silt deposition and vegetation growth blocking the drains and subsequently preventing water from free draining.

However, it needs to be highlighted that source reduction should always be the preferred option for mosquito control, as it eliminates breeding sites and the requirement for continuous mosquito control. Although mosquito numbers decreased following the insecticide treatment of all known mosquito breeding sites in the Coconut Grove area in early July, the fact that numbers further decreased and remained low after all drains were desilted highlights the importance of mosquito breeding prevention. The long-standing mosquito engineering program in Darwin, which is part of an integrated mosquito control program, is therefore a critical component in preventing urban mosquito breeding.

Finally, this scenario showed the importance of responding to public complaints, particularly from long-term residents, as they can assist in identifying the extent of mosquito problems by reporting unusual mosquito activity.

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References

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