Maningrida mosquito survey 2010/11
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Abstract

Background
Maningrida was assessed by Medical Entomology in 1984 to determine the potential for malaria and mosquito borne disease transmission and was identified as having the potential for malaria transmission and local mosquito borne disease transmission. The 1984 survey did not include peak season trapping to identify the magnitude of potential problems.

Methods
The current survey was designed to carry out trapping during peak season months for important mosquito species.

Results and conclusions
Results from this survey concurred with the 1984 findings that there is potential for malaria transmission, and the community would be affected by pest mosquitoes and mosquitoes that can transmit endemic mosquito borne diseases. Mosquito species such as the northern salt marsh mosquito Aedes vigilax were recorded in very high numbers throughout the study area, while certain areas surrounding Maningrida recorded high numbers of potential malaria (Anopheles sp.) vectors and relatively high numbers of the common banded mosquito Culex annulirostris. Results can be used by government and local council to improve the management of mosquito problems, and assist in future expansions of Maningrida by indicating which areas to avoid.

Key words: Maningrida, mosquito, malaria, endemic, management

Introduction
Maningrida lies on the north coast of the Northern Territory (NT), located approximately 370km east of Darwin, and approximately 270km west of Nhulunbuy. The community is located in the vicinity of seasonally flooded tidal and freshwater areas that are potential sources of pest and disease carrying mosquitoes. Surveys in 1984 identified many of the main potential mosquito breeding sites affecting Maningrida and the problem mosquito species affecting the community.\textsuperscript{1} The purpose of the current adult mosquito trapping was to identify peak season abundance of certain mosquito species to complement the existing data that had been previously gathered, as well as to conduct a desktop examination of potential breeding sites using high resolution aerial photography.

Adult mosquito trapping was to be carried out during the nominal peak seasons for important mosquito species. These included from 9 to 16 days after the October monthly high tide event to locate peak season northern salt marsh (Aedes vigilax) mosquito problems and in January and in June to identify the usual months of increased abundance for many freshwater or brackish water breeding mosquitoes.

Methods

Trapping
CO\textsuperscript{2} baited encephalitis virus surveillance (EVS) traps were set at 5 locations around Maningrida

Figure 1. Maningrida mosquito Trap Sites October 2010, January and June 2011
in the sites as shown in Figure 1. Traps were set by Environmental Health Darwin-Rural staff during the afternoons of 21 October 2010, 12 January 2011 and 1 June 2011 and collected the following morning after sunrise at each location.

Results

21 to 22 October 2010 trapping

The October trapping revealed high to extremely high levels of adult female *Ae. vigilax* at all sites with Trap Sites 3 and 1 recording extremely high numbers. See Table 1.

Table 1. 21-22 October 2010 trapping results by Trap Site and 7 selected important mosquito species

<table>
<thead>
<tr>
<th>Trap location</th>
<th><em>Ae. (Och) vigilax</em></th>
<th><em>An. (A collection number)</em></th>
<th><em>An. (Cox) farauti s.l.</em></th>
<th><em>Cq. (Coq) xanthonogaster</em></th>
<th><em>Cx. (Cox) annulirostris</em></th>
<th><em>Cx. (Cox) sittens</em></th>
<th><em>Mso. (Mso) uniformis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Trap Site 1 Sewage Ponds</td>
<td>10741</td>
<td>66</td>
<td>33</td>
<td>330</td>
<td>66</td>
<td>1124</td>
<td>6147</td>
</tr>
<tr>
<td>Trap Site 2 Monsoon Jungle</td>
<td>1203</td>
<td>35</td>
<td>12</td>
<td>35</td>
<td>23</td>
<td>304</td>
<td>2441</td>
</tr>
<tr>
<td>Trap Site 3 East of Airport</td>
<td>12717</td>
<td>0</td>
<td>157</td>
<td>587</td>
<td>157</td>
<td>39</td>
<td>665</td>
</tr>
<tr>
<td>Trap Site 4 House 440</td>
<td>742</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>82</td>
<td>147</td>
</tr>
<tr>
<td>Trap Site 5 Bottom Camp</td>
<td>2705</td>
<td>55</td>
<td>0</td>
<td>0</td>
<td>44</td>
<td>88</td>
<td>806</td>
</tr>
</tbody>
</table>

*Mansonisia uniformis* was the second most common mosquito, with an extremely high adult mosquitoes recorded at Trap Site 1 (see Table 1).

*Culex sittens* was recorded in very high numbers at Trap Site 1 and *Coquillettidia xanthonogaster* was recorded in moderately high numbers at Trap Site 3. *Anopheles farauti s.l.* was recorded in relatively high numbers for this species at Trap Site 3 with minimal numbers in the other traps.

12-13 January 2011 trapping

Mosquito numbers were very low in January. *Ae. vigilax* was virtually absent, while no individual mosquito species was recorded in levels above 68 per trap night. Trap Site 2 showed the most important result with 62 *An. farauti s.l.* recorded.

1-2 June 2011 trapping

*Culex annulirostris* was recorded in moderate levels at Trap Sites 3 and 2 with low numbers recorded at the other sites.
An. farauti s.l. was recorded in relatively high numbers at Trap Site 3 with minor numbers at the other trap sites. Anopheles meruakensis was also recorded in appreciable numbers at Trap Site 3 with low numbers at the other trap sites.

All other mosquitoes were recorded in low numbers in June.

**Potential mosquito breeding sites**

Potential *Ae. vigilax* breeding sites were discussed in the 1984 report, with those sites and additional potential breeding areas outlined in Figure 2.

The largest potential *Ae. vigilax* breeding site likely to affect Maningrida is the large brackish water reed swamp associated with upper tidal reaches of Gudjerama Creek, 5km east of Maningrida at Site 1, Figure 2. The *Ae. vigilax* breeding area of the swamp appears to be in the order of 50 hectares (500,000 square metres), indicating this site is likely to be an enormous source of *Ae. vigilax*. The most extensive breeding would occur in the months of September to January, after high tides and early wet season rainfall, with productive breeding also likely to occur in the early dry season in some years. This swamp was identified by Davis and Kelton¹ as the most important likely source of *Ae. vigilax* to residents of Maningrida. This swamp is also likely to be a very productive breeding area for *An. farauti* s.l. and *Anopheles hilli* during the late wet-early dry season, and extensive Cx. annulirostris, Cq. xanthogaster, Ma. uniformis and Anopheles bancroftii breeding area in the late wet-mid dry season, although Maningrida is located outside of the usual pest range of these species.

A smaller brackish reed/upper tidal mangrove swamp at Site 2 (Figure 2) is associated with a tributary of Gudjerama Creek, 1.75km east of the nearest residents in Maningrida. The potential mosquito breeding area appears to be approximately 9ha, indicating it is likely to be a productive swamp for *Ae. vigilax* and *An. farauti* s.l. This swamp is therefore likely to be a large source of *Ae. vigilax* to residents in Maningrida, and the source of some *An. farauti* s.l. to the fringe residents in the new subdivision in Maningrida.

The large saltmarsh, Shoenoplectus brackish reed and upper tidal mudflat swamp located in the northern upper tidal reaches of the Gudjerama Creek system at Site 3 (Figure 2) would also be a major breeding site for *Ae. vigilax*, *An. farauti* s.l., Cx. sitiens and *An. hilli*. The swamp is located around 4km northeast of Maningrida, and could be an appreciable source of *Ae. vigilax* to residential areas of Maningrida.

The large brackish swamp located 1.5km southwest of Maningrida (Site 9, Figure 2) was identified as a potential source of *Ae. vigilax* affecting Maningrida by Davis and Kelton.¹ Other mosquito species that are likely to breed in this swamp include various *Anopheles* species mosquitoes, Cx. annulirostris, Cq. xanthogaster and Ma. uniformis, with these mosquitoes likely to affect mainly the southern portion of Maningrida.

A relatively large upper tidal depression (Site 4, Figure 4) is located approximately 700m north of the edge of the new subdivision in Maningrida. The depression is likely to be a productive breeding site for *Ae. vigilax* and Cx. sitiens from September to January and
during the early dry season, and productive Cx. annulirostris. Cq. xanthogaster, Ma. uniformis and Anopheles sp. breeding site in the late wet-early dry season. Due to its relative proximity to Maningrida residents, it would be an important localised source of these mosquitoes. The new subdivision would be particularly affected by mosquito breeding in this depression.

Other potential mosquito breeding sites include upper tidal tributaries, localised depressions and freshwater drainage lines within close proximity to Maningrida (Figure 2). These breeding sites could be localised sources of mosquito species such as Ae. vigilax, An. farauti s.l., Cx. annulirostris and Cx. sitiens.

Distant Ae. vigilax breeding sites associated with upper tidal tributaries of the Liverpool River and the Tomkinson River tidal plains, greater than 10km from Maningrida, could affect residents of Maningrida to some extent, mainly during very large breeding events. The large swamps associated with the peninsular starting 5km north-east of Maningrida appear to be freshwater swamps, therefore mosquito breeding in these swamps would not affect residents of Maningrida to any great extent.

Discussion

Ae. vigilax will be the principal pest mosquito affecting residents of Maningrida. Peak abundance is likely to occur from September to January inclusive, with high to very high pest problems likely to be experienced during the months of October to December inclusive. Early dry season problems may occur in May and June in some years. This mosquito is a known vector of Ross River virus (RRV) and Barmah Forest virus (BFV). The risk of mosquito borne disease transmission from this mosquito is likely to be seasonally high to very high in residential areas.

Cx. annulirostris is likely to occur in seasonally moderate to high numbers from January to August, with highest problems affecting the eastern and southern residential fringe of Maningrida closest to the brackish and freshwater swamps. This mosquito is a known vector of RRV and BFV, as well as the potentially fatal Murray Valley encephalitis virus, Kunjin virus and other viruses, and therefore is likely to pose a seasonally moderate to high virus risk in residential areas.

While malaria elimination in Australia was declared in 1981, Maningrida is receptive to potential malaria transmission, due to the presence of Anopheles mosquitoes. Seasonal abundance affecting residential areas is not likely to be high due to the distance from the major swamps, but is likely to be elevated enough to pose a potential malaria risk, should persons with malaria parasites be resident, mainly during the late wet to mid dry season.

Pest mosquitoes such as Cq. xanthogaster and Ma. uniformis are likely to affect residents of Maningrida to a moderate to high degree on a seasonal basis, mainly during the late wet to late dry season.

Localised mosquito breeding sites within 1.6km of residents should be identified and rectified by filling or draining, or a combination of both.

Mosquito control of the large brackish water swamps within 5km of Maningrida would require the use of a helicopter, applying target specific insecticides such as Bacillus thuringiensis var. israelensis or methoprene. An effective aerial mosquito survey and control program is likely to be cost prohibitive for Maningrida.

Ground mosquito control operations could effectively target localised mosquito breeding in depressions and creeklines within 1.6km of Maningrida residents, utilising methoprene 30 day pellets or 150 day briquettes. Ground control could also be effective for treating localised areas of productive mosquito breeding in the large brackish swamps.

The use of barrier insecticides can provide effective control of adult mosquitoes near residences and recreation areas, and can be utilised during mosquito problem periods. Public areas such as swimming pools, sporting ovals, community halls and other evening or early morning use areas, as well as residential houses, could be treated to provide effective residual adult mosquito control for up to 4 weeks.
Information from media warnings regarding mosquito pest problems and mosquito borne disease risk periods should be passed on to the community, along with advice regarding personal protection and avoidance. This could be in the form of community notices and the education of children. An annual publicity program should occur before the wet season, advising residents to prevent backyard mosquito breeding.

A 200m wind buffer should be created on the eastern and northern edge of the new subdivision in Maningrida, and also along the southern edge of Maningrida. The wind buffer should provide an appreciable disruption to the dispersal of most mosquito species except *Ae. vigilax*.

Any further new subdivisions should continue to be located a minimum 1.6km from the nearest swamp or any appreciable mosquito breeding site, in compliance with Medical Entomology planning recommendations for urban residential subdivisions. Where possible, a greater urban residential buffer distance should be provided from the 3 Gujjerama Creek brackish swamps within 5km of Maningrida and the swamp 1.6km southwest of the existing residential areas in Maningrida. A detailed biting insect assessment should be carried out for any future planned subdivisions in Maningrida.

Conclusions

The adult mosquito trapping carried out in 2010 and 2011 was useful in adding to the knowledge gained during the 1984 survey of Maningrida, particularly by identifying actual peak season abundance of important mosquito species. Combined with using high resolution aerial photography that was not available during the time of the 1984 survey, a clearer picture of the mosquito problems and major potential breeding sites affecting Maningrida has been achieved. Information in this report can be used to carry out best practice mosquito control or avoidance strategies in Maningrida, and assist in future planning of new subdivisions in Maningrida.

References


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