Ovipositional attractancy of waters containing larvae of *Aedes aegypti* and *Aedes albopictus*

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(Received: April 4, 1981)

**Abstract:** The effect of the waters containing larvae of *Aedes aegypti* and *Aedes albopictus* on the oviposition of these 2 species was studied in the laboratory. The results revealed that the numbers of eggs of both species were affected during the first 4 days of oviposition. During the first 4 days, *A. aegypti* were attracted to the *albopictus* larva water. *A. aegypti* laid more eggs than *A. albopictus* when they were attracted to the larva water of the counterpart throughout the oviposition period. *A. aegypti* survived better in their own larva water than in tap water and lived even better in the *albopictus* larva water. In contrast, *A. albopictus* died more than *A. aegypti* in the larva water of the counterpart. These findings indicate the superiority of *A. aegypti* to *A. albopictus* on the breeding potential and survival when bred together.

**Introduction**

Ovipositional attractancy of mosquito larva water was shown first by Hudson and McLintock (1967) and subsequently by many other workers (Soman and Reuben, 1970; Kalpage and Brust, 1973).

Bentley *et al.* (1976) also presented an attractant of *Aedes triseriatus* in the larva waters of the same species and another species *Aedes atropalpus*. Wilton (1968), Gubler (1970) and Sucharit *et al.* (1978) studied interspecific competition of aedine mosquito larvae. Studing the interaction between the larvae of *A. aegypti* and those of *A. albopictus* in mixed populations, Sucharit *et al.* have indicated that *A. aegypti*, the primary vector of dengue haemorrhagic fever in urban area of Southeast Asia, will reduce the *A. albopictus* population, the vector of this illness in rural areas. They also mentioned other factors including decreased oviposition which could be responsible for the reduction and subsequent disappearance of *A. albopictus*.

This paper deals with oviposition behaviors of the 2 species in the light of the possible attractants produced by their larvae.

**Materials and Methods**

*A. aegypti* (Bangkok strain) was derived from Sapan Khao, Bangkok, and *A. albopictus* from Kanchanaburi province. Both species were maintained in the laboratory of the Faculty of Tropical Medicine, and used throughout these oviposition experiments.

Larva waters were prepared by placing 4th-instar larvae of each species in water (1 larva per ml) for 24 hr and then filtering them out. Fresh larva water was prepared for each oviposition experiment.

**Oviposition experiments**

Fifty fully engorged female *A. aegypti* or *A. albopictus* of 3 to 5 days of age, after feeding on white rats, were put in a 33×33×33 cm cage, and allowed to oviposit on the white filter paper soaked in water or larva
water in an enamel bowl at 28°C and 80% R.H. in the insectary. The eggs laid were observed daily and counted under low magnification of a dissecting microscope until no further eggs were laid. At the end of experimentation all the surviving mosquitoes were dissected and the number of ova was recorded. The number of dead mosquitoes was recorded daily.

In the case of oviposition of A. aegypti, tap water, aegypti larva water and albopictus larva water were used to induce oviposition. A. albopictus was allowed to oviposit similarly. Each experiment was replicated 6 times. The numbers of eggs laid and mortalities of adult mosquitoes were recorded at 4-day intervals.

RESULTS

Oviposition of A. aegypti and A. albopictus on tap water and aegypti or albopictus larva water was recorded daily together with adult mortalities and summed up at 4-day intervals as shown in Table 1. They laid more eggs during the first 4 days and the egg number decreased gradually until the 24th day. Not all the eggs were laid out, for living mosquitoes still contained eggs at the end of experimentation. Mosquitoes that had laid eggs for 24 days were dissected 4–5 days after the experiment to check for the remnant eggs. It was found that 9.84, 5.60 and 4.13% of A. aegypti and 43.28, 26.24 and 18.75% of A. albopictus retained eggs in the experiments with tap water, own larva water and larva water of its counterpart, respectively. The means and ranges of numbers of ova were 38.8 (13–73), 17.1 (1–53) and 5.2 (1–8) in A. aegypti and 40.7 (1–120), 22.0 (1–88) and 30.0 (1–84) in A. albopictus, respectively.

The numbers of A. aegypti females that died were 100, 88 and 60 in the 24 days under the condition of tap water, larva water of A. aegypti and larva water of A. albopictus, respectively. A. aegypti could survive best with albopictus larva water and better with aegypti larva water (X²=19.06, n=2, p<0.001). The mortalities during the 4 days also behaved similarly (X²=12.74, n=2, p=0.001–0.01).

In contrast to A. aegypti, the numbers of A. albopictus that died were 81, 78 and 108 in 24 days with tap water, larva waters of A. albopictus and of A. aegypti, respectively. More A. albopictus died when they oviposited in aegypti larva water (X²=8.66, n=2, p=0.02–0.05). The mortalities during the 4 days gave no statistical differences (X²=3.31, n=2, p=0.05–0.10).

In the 24 days, A. aegypti died equally to A. albopictus when they were kept with tap water and aegypti larva water (X²=2.84, 0.88). The results showed that A. albopictus could survive better under the condition of A. aegypti larva water than under the condition of tap water.

Table 1  Mean numbers of eggs laid by 50 female Aedes aegypti or Aedes albopictus in 6 replications under tap water and larva waters (LW)

<table>
<thead>
<tr>
<th>Experiments</th>
<th>Mean numbers of eggs counted at 4-day intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1–4</td>
</tr>
<tr>
<td>Aedes aegypti</td>
<td></td>
</tr>
<tr>
<td>Tap water</td>
<td>1024.83 ± 528.36</td>
</tr>
<tr>
<td>LW</td>
<td>1554.67 ± 318.23</td>
</tr>
<tr>
<td>AlboPictus</td>
<td>1554.83 ± 224.71</td>
</tr>
<tr>
<td>Aedes albopictus</td>
<td></td>
</tr>
<tr>
<td>Tap water</td>
<td>716.67 ± 658.37</td>
</tr>
<tr>
<td>LW</td>
<td>806.67 ± 208.27</td>
</tr>
<tr>
<td>AlboPictus</td>
<td>966.83 ± 174.35</td>
</tr>
</tbody>
</table>
n=1 and $X^2=0.72$, $n=1$), respectively, but more A. albopictus died than A. aegypti ($t=108$ against 60, $X^2=19.28$, $n=1$, $p<0.001$) with the larva water of their counterpart species.

Comparison within species

Within these 24 days, 300 A. aegypti laid 11,097, 12,067 and 11,621 eggs under the attraction of tap water and aegypti and albopictus larva waters, respectively. There were no statistical differences among these numbers (Table 2). However, there were more eggs laid on the first 4 days of oviposition when albopictus larva water was used as attractant compared with tap water alone.

A. albopictus laid 9,247, 8,865 and 8,087 eggs respectively on tap water and albopictus and aegypti larva waters. These numbers were not statistically different (Table 2).

Comparison between species

In 24 days, A. aegypti laid the equal number of eggs to A. albopictus on tap water ($t=0.91$, $n=10$, $p=0.3-0.4$) and own larva water ($t=1.69$, $n=10$, $p=0.1-0.2$), but they laid more eggs than A. albopictus with the attraction of the larva water of their counterpart species, 11,621 against 8,087 ($t=2.99$, $n=10$, $p=0.01-0.02$) as shown in Table 3.

In 4 days, A. aegypti laid the same number of eggs as A. albopictus with water ($t=0.89$, $n=10$, $p=0.3-0.4$) but they laid more eggs than A. albopictus with own and counterpart larva water ($t=3.97$, $n=10$, $p=0.001-0.01$; $t=5.98$, $n=10$, $p<0.001$), respectively.

**Discussion**

Bentley et al. (1976) showed that the holding waters containing 4th-instar larvae of both A. triseriatus and A. atropalpus possessed an oviposition attractant of A. triseriatus. They further showed that the attractant was contained in the volatile fraction and reasonably stable. The acetone extract of the eggs of A. triseriatus did not contain an oviposition attractant of such species as Culex tarsalis or C. pipiens.

The oviposition attractancy of the larva water of A. albopictus was established by the present study. The attraction occurred in the first 4 days of the oviposition period.

A. aegypti laid more eggs than A. albo-

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**Table 2.** The values of $t$-test in comparing numbers of eggs laid by *Aedes aegypti* and *Aedes albopictus* in various experiments ($n=10$)

<table>
<thead>
<tr>
<th>Species</th>
<th>Days of oviposition</th>
<th>Tap water vs. own LW</th>
<th>Tap water vs. counterpart LW</th>
<th>Own LW vs. counterpart LW</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>A. aegypti</em></td>
<td>4</td>
<td>2.104</td>
<td>2.26*</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>0.435</td>
<td>0.277</td>
<td>0.248</td>
</tr>
<tr>
<td><em>A. albopictus</em></td>
<td>4</td>
<td>0.899</td>
<td>0.319</td>
<td>1.445</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>0.259</td>
<td>0.995</td>
<td>1.584</td>
</tr>
</tbody>
</table>

* Highly significant

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**Table 3.** Comparison of the numbers of eggs laid by *Aedes aegypti* against those of *Aedes albopictus* ($n=10$)

<table>
<thead>
<tr>
<th>Experiments</th>
<th>No. of eggs of <em>A. aegypti</em> against <em>A. albopictus</em></th>
<th>Period of observation (days)</th>
<th>$t$ values</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap water</td>
<td>6,149/4,300/11,097/9,247</td>
<td>4</td>
<td>0.894</td>
<td>0.3-0.4</td>
</tr>
<tr>
<td>Own LW</td>
<td>9,328/5,801/12,067/8,865</td>
<td>4</td>
<td>3.967</td>
<td>0.001-0.01</td>
</tr>
<tr>
<td>Counterpart LW</td>
<td>9,329/4,840/11,621/8,087</td>
<td>4</td>
<td>5.979</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
pictus when they were attracted by the albopictus larva water throughout the 24 day period (Table 3).

The ability of A. aegypti in having more potential in oviposition and in adult survival than A. albopictus during the first 4 days and throughout the oviposition period offered the former species the superiority of breeding potential when bred together. Superiority in the larval development of A. aegypti in the mixed population (Sucharit et al., 1978) will also reduce the A. albopictus population, especially when the former species is predominant. Urbanization and clearing of forest and plantation which reduce the breeding places of A. albopictus also give advantage for the survival of A. aegypti. The selective advantages of A. aegypti upon A. albopictus on these respects will finally lead to reduction or extermination of the A. albopictus population.

Acknowledgements

The authors wish to express their sincere thank to Professor Chamlong Harinasuta, Dean of the Faculty of Tropical Medicine, Mahidol University, for encouraging this study, and also to Professor Rokuro Kano, Head of the Department of Medical Zoology, Faculty of Medicine, Tokyo Medical and Dental University, for reading the manuscript and translating our summary into Japanese. They appreciate for the grant supported by the Mahidol University as well.

References


摘 要
ネタイシマカとヒトスジシマカの
幼虫生息水の産卵誘引性

ネタイシマカとヒトスジシマカの幼虫生息水の、これら2種のカの産卵に対する影響を実験室内で調べた。その結果、産卵開始後4日間に両種の産卵数が影響されることがわかった。最初の4日間でネタイシマカはヒトスジシマカの幼虫生息水に誘引された。ネットイシマカがヒトスジシマカの幼虫生息水に誘引されたときの産卵数は、ヒトスジシマカがネットイシマカの幼虫生息水に誘引されたときの産卵数よりも多かった。ネットイシマカ幼虫は、水道水よりもネットイシマカの幼虫生息水の中で長く生存したが、ヒトスジシマカの幼虫生息水の中でさらに長く生存した。これに対して、ヒトスジシマカの幼虫では、ネットイシマカの幼虫生息水中の死亡が、これらの反対の組合せに比べて多かった。以上の所見から、ネットイシマカとヒトスジシマカが混生した場合には、ネットイシマカが優勢になることを示していると思われる。