Laboratory larvicidal efficacy of etofenprox (Trebon) against four species of mosquitoes of public health importance

H.H. Yap, S.K. Lim and C.Y. Lee

Abstract: A laboratory evaluation was conducted on the efficacy of Trebon against four species of mosquito larvae viz., Aedes aegypti, Anopheles dirus, Culex quinquefasciatus and Mansonia uniformis. Results indicated that Trebon was most effective against M. uniformis (LD₅₀ = 1.92 µg/l), followed by A. aegypti (LC₉₀ = 3.51 µg/l), C. quinquefasciatus (LC₉₀ = 7.59 µg/l) and A. dirus (LG₉₀ = 21.05 µg/l). The effectiveness of Trebon when comparing to other insecticidal larvicides is discussed.

Introduction

Trebon (etofenprox) is a diphenyl compound consisting of C, H and O only. It was introduced in Japan in 1987 by Mitsui Toatsu Chemicals Inc (Udagawa, 1986; Thompson, 1992). Besides being marketed under the trade name Trebon, etofenprox is also sold commercially under the name Permit.

A literature review indicated that Trebon possesses good efficacy against various insect pests, particularly agricultural. It was shown to be highly effective against the brown planthopper Nilaparvata lugens without causing any resurgence (Udagawa, 1986). In addition, it has an exceedingly low acute mammalian toxicity (acute oral toxicity LD₃₀ for rats, 40,000 mg/litre) and possesses good residual activity (Thompson, 1992).

Though various trials have been carried out to determine the efficacy of Trebon against agricultural pests, information on its efficacy against public health insects is lacking. The present investigation was undertaken to evaluate the comparative laboratory efficacy of the insecticide against mosquitoes of public health importance in Malaysia.

Materials and Method

Mosquitoes: Four species of mosquito were used in this study: A. aegypti, A. dirus, C. quinquefasciatus and M. uniformis. They were all from laboratory colonies which were established from field populations on Penang Island and northern peninsular Malaysia. These cultures have been reared at the Vector Control Research Unit, Universiti Sains Malaysia since 1980.

All mosquito larvae were maintained in enamel trays in the laboratory at 26 ± 2°C and relative humidity 65 ± 10%, except for M. uniformis larvae which were reared in plastic aquarium troughs with Eichhornia crassipes as host plants. The rearing procedures for each mosquito species were essentially as described in Gerberg (1970) and Foo and Yap (1982).

Bioassay Methods: The bioassay methods used in the tests were essentially those of Yap and Hanapi (1976).

Results and Discussion

Results of the comparative efficacy tests are shown in Table 1. Trebon was shown to be most effective against M. uniformis larvae with LC₉₀ values of 1.92 and 3.78 µg/litre, respectively. Earlier, Yap and Hanapi (1976) had reported the effectiveness of chlorpyrifos and temephos against the larvae of the same species (LC₉₀ values for chlorpyrifos and temephos were 1.54 and 1.92 µg/litre, respectively). When compared to the findings of this study, it can be inferred that Trebon has a similar toxicity to Mansonia larvae as chlorpyrifos and temephos.

In so far as common vector mosquitoes are concerned, information on the efficacy of control agents (both chemical and biological) for the control of Mansonia, especially at the larvae stages, is thin (Yap, 1986). This may be due to the difficulty of culturing these mosquitoes in the laboratory. In addition, the habit of Mansonia larvae to attach themselves to aquatic plant roots is thought to make them less accessible to larvicides.

More recent laboratory and field tests of both chemical and microbial insecticides indicate that there are basically no major differences in the treatments of Mansonia larvae compared with other major genera of vector mosquitoes (Foo and Yap, 1983; Yap et al., 1991; Yap et al., 1992).

A. aegypti were also shown to be susceptible to Tre-
Table 1: Comparative laboratory susceptibility of Trebon against four species of mosquitoes. A minimum of 360 late 3rd/early 4th instar larvae were used per test. Results analysed by probit analysis using microcomputer.

<table>
<thead>
<tr>
<th>Mosquito species</th>
<th>No. of tests</th>
<th>LC50 (95% CL)*</th>
<th>LC90 (95% CL)*</th>
<th>Regression Slope ± Std Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aedes aegypti</td>
<td>6</td>
<td>3.51 (3.37-3.65)</td>
<td>7.82 (7.39-8.33)</td>
<td>3.69 ± 0.11</td>
</tr>
<tr>
<td>Anopheles balabacensis</td>
<td>6</td>
<td>21.05 (19.85-22.16)</td>
<td>32.58 (30.17-36.31)</td>
<td>6.76 ± 0.50</td>
</tr>
<tr>
<td>Culex quinquefasciatus</td>
<td>7</td>
<td>7.59 (7.53-7.65)</td>
<td>11.44 (11.29-11.59)</td>
<td>7.19 ± 0.12</td>
</tr>
<tr>
<td>Mansonia uniformis</td>
<td>5</td>
<td>1.92 (1.88-1.95)</td>
<td>3.78 (3.67-3.89)</td>
<td>4.35 ± 0.97</td>
</tr>
</tbody>
</table>

* CL = Confidential Limit

Bioassays of Trebon against C. quinquefasciatus (LC50 value of 7.59 µg/litre) indicated that Culex is more tolerant when compared with Mansonia and Aedes. In addition, earlier studies using some pyrethroids against C. quinquefasciatus, indicated better efficacies with lower LC50 values. LC50 values (µg/litre) for the pyrethroids tested were as follows: cypermethrin, 0.05; fenpropathrin, 0.27; deltamethrin, 0.02-0.07; fenfluthrin and cyfluthrin, 0.70 (Mulla et al., 1978; Daz and Kalyanasundaram, 1984; Rajavel et al., 1986).

Finally, bioassay tests of Trebon against A. dirus, resulted in the highest LC50 value (21.05 µg/litre) in this study (Table 1).

In short, comparative laboratory bioassays of Trebon against four species of vector mosquito indicated that M. uniformis was the most susceptible, followed by A. aegypti and C. quinquefasciatus. A. dirus was the most tolerant of all the species tested. In comparison with earlier laboratory bioassay studies of other larvicides, higher dosages of Trebon are needed to achieve similar efficacy.

This may also imply that higher dosages of Trebon are needed to achieve desirable levels of mosquito vector control in the field. However, the need for higher dosages can be compensated for by the very low mammalian toxicity of Trebon compared with existing chemical larvicides. Further simulated and field trials are needed to substantiate the use of Trebon for vector mosquito control.

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References