Larvicidal activity of eugenol and its derivatives against *Aedes aegypti*

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**Introduction**

*Aedes aegypti* is the vector known to carry yellow and dengue fever, diseases responsible for a number of morbidity and mortality around the world, due to its severe symptoms. Although several million dollars are spent attempting to eradicate the vector, no success has been achieved in many parts of the world.

The necessity for continued research has been even more apparent in the late years, aiming to find new methods to control the vector and reduce the incidence of dengue.

The search for efficient larvicide or pesticide substances with low environmental toxicity has increased. Terpenes, such as eugenol, are known to be toxic to *A. aegypti*. However, no studies are found in the literature about synthetic modification of such compounds as larvicide. In view of these facts, it was of our interest to synthesize derivatives of eugenol and evaluate their larvicidal activities against *A. aegypti* larvae.

**Results and Discussion**

In addition to eugenol, six other derivatives were evaluated for their larvicidal activities in Rockfeller and resistant field collected *A. aegypti* larvae. The synthetic strategy for the formation of the derivatives was based on the protection of the aromatic hydroxyl group (Figure 1). Eugenol methyl and ethyl ethers, as well as, eugenol acetate and benzoate esters, instead of the hydroxyl group of eugenol, were synthesized.

![Figure 1. Synthesis of compounds 1-6](image)

**Table 1. Lethal concentration (LC₅₀) and 95% confidence limits (CL) of eugenol derivatives on A. aegypti Rockfeller larvae.**

<table>
<thead>
<tr>
<th>Compound</th>
<th>LC₅₀ (CL)</th>
<th>Compound</th>
<th>LC₅₀ (CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>77 ppm (62-83)</td>
<td>5</td>
<td>723 ppm (542-902)</td>
</tr>
<tr>
<td>2</td>
<td>101 ppm (94-107)</td>
<td>6</td>
<td>278 ppm (217-358)</td>
</tr>
<tr>
<td>3</td>
<td>76 ppm (70-81)</td>
<td>7</td>
<td>332 ppm (273-412)</td>
</tr>
<tr>
<td>4</td>
<td>113 ppm (102-125)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ethyl eugenol exhibited the highest larvicidal activity and the benzoyl eugenol the lowest activity. Both, Rockfeller and field collected *A. aegypti* showed similar activity profiles.

**Conclusions**

The larvae of *A. aegypti* are susceptible to the compounds herein evaluated, particularly to the ether derivatives. Protection of the aromatic alcohol moiety induced to an overall decrease in activity, suggesting that an aromatic alcohol is important to the larvicidal activity. No cross-resistance to temephos was observed.

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