
21. The development of tolerance to chemosterilants other than the one to which a strain has been selected, has raised a number of problems for the control personnel. A species resistant to a chemosterilant may be expected to show cross tolerance to other chemicals having similar structure and manner of detoxification in the insect body but a serious threat is posed when it becomes resistant to a chemical having an entirely different structure. Such cross tolerance have already been reported by Absa and Hansens (1969) in M. d. domestica who found that houseflies resistant to apholate were not only tolerant to this chemical but also showed increased tolerance to metepa. Similar results were obtained by Patterson and his associates (1967) in the yellow fever mosquito, Aedes aegypti that had been selected with apholate for 30 generations developed cross resistance to tepa and 3 to 4 fold increase in tolerance to metepa.

No effort has, however, been made to investigate the cross tolerance to chemosterilants in Indian forms of housefly, Musca domestica nebula. Hence, tests were performed to observe if strains resistant to apholate, tepa, metepa, hemepa and hemel developed any tolerance other than the one to which a strain has been selected.

Materials and Methods

During the present studies five strains of M. d. nebulo namely the AR strain, resistant to apholate, the TR strain, resistant to tepa, the MR strain, resistant to metepa, the HR strain, resistant to hemepa or the PR strain resistant to hemel were tested for their susceptibility to other compounds by incorporating the candidate chemosterilant in the food of freshly emerged adults for four days and determining the hatch rate of the eggs in random samples of 100 eggs each. They were initially developed by selecting the adults at an Sc level of 90.0 percent or above with each of the chemicals in successive generations of laboratory rearing at a temperature of 28 ± 1°C and 60 to 70 percent relative humidity and the larvae were reared on cotton pads soaked in diluted milk.

The percentage sterility obtained in the tests was converted into probit and plotted against log-concentration on a graph paper. Regression lines were drawn by calculating the maximum and minimum values of probit.
Results

The Sc50 values (Tables 1-6 and Figures 1-5) clearly indicate that the AR strain was as susceptible to tepa, metepa, and hempa as the normal laboratory strain but developed 2.6 times tolerance to hemel. The tepa resistant strain, however, showed considerable tolerance to metepa, hempa and hemel. Similarly the MR strain showed 3.6, 3.4 and 6.5 times tolerance to tepa,

Table 1. Sensitivity of apholate resistant strain (AR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

<table>
<thead>
<tr>
<th>Chemosterilant</th>
<th>0.00195</th>
<th>0.0039</th>
<th>0.0078</th>
<th>0.0156</th>
<th>0.03125</th>
<th>0.0625</th>
<th>0.125</th>
<th>0.25</th>
<th>0.5</th>
<th>1.0</th>
<th>2.0</th>
<th>4.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apholate</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>7.6</td>
<td>19.9</td>
<td>35.8</td>
<td>76.5</td>
<td>100.0 **</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Tepa</td>
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<td>90.1</td>
<td>100.0</td>
<td>**</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Metepa</td>
<td>—</td>
<td>—</td>
<td>8.5</td>
<td>48.5</td>
<td>70.9</td>
<td>93.4</td>
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<td>**</td>
<td>—</td>
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<td>—</td>
</tr>
<tr>
<td>Hempa</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>12.9</td>
<td>39.08</td>
<td>67.7</td>
<td>86.4</td>
<td>100.0</td>
<td>100.0</td>
<td>**</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Hemel</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td>91.8</td>
<td>100.0</td>
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<td>—</td>
</tr>
</tbody>
</table>

** The females did not oviposit.

Table 2. Sensitivity of tepa resistant strain (TR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

<table>
<thead>
<tr>
<th>Chemosterilant</th>
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<th>0.0156</th>
<th>0.03125</th>
<th>0.0625</th>
<th>0.125</th>
<th>0.25</th>
<th>0.5</th>
<th>1.0</th>
<th>2.0</th>
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<td>Apholate</td>
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<td>—</td>
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<tr>
<td>Tepa</td>
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<td>93.8</td>
<td>100.0</td>
<td>**</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Metepa</td>
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<td>2.6</td>
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<td>98.7</td>
<td>100.0</td>
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<td>—</td>
<td>—</td>
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</tr>
<tr>
<td>Hempa</td>
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<td>—</td>
<td>—</td>
<td>4.9</td>
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<td>64.0</td>
<td>95.6</td>
<td>100.0</td>
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</tr>
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<td>Hemel</td>
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<td>—</td>
<td>—</td>
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<td>—</td>
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<td>32.6</td>
<td>79.7</td>
<td>—</td>
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** The females did not oviposit.

Table 3. Sensitivity of metepa resistant strain (MR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

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<th>0.125</th>
<th>0.25</th>
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<tr>
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<tr>
<td>Metepa</td>
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<td>75.7</td>
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<td>Hemel</td>
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<td>6.6</td>
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** The females did not oviposit.

Table 4. Sensitivity of hempa resistant strain (HR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

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<th>Chemosterilant</th>
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<tr>
<td>Hemel</td>
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<td>45.4</td>
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** The females did not oviposit
Table 5. Sensitivity of hemel resistant strain (PR) of *M. d. nebula* to apholate, tepa, metepa, hempa and hemel.

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<td>81.4</td>
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<tr>
<td>Metepa</td>
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<td>40.9</td>
<td>73.1</td>
<td>98.2</td>
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<td>Hempa</td>
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<td></td>
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<td>8.1</td>
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<td>59.5</td>
<td>96.9</td>
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<tr>
<td>Hemel</td>
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<td></td>
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<td>29.9</td>
<td>49.4</td>
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</table>

** The females did not oviposit.

Table 6. Sc50 values of normal and resistant strains of *M. d. nebula*.

<table>
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<tr>
<th>Strain</th>
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<th>Tepa</th>
<th>Metepa</th>
<th>Hempa</th>
<th>Hemel</th>
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<tbody>
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<td>N</td>
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<td>0.0036308</td>
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<td>AR</td>
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<tr>
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<tr>
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<tr>
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<td>PR</td>
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<td>0.041687</td>
<td>0.79433</td>
<td>4.6774</td>
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</tbody>
</table>

Fig. 1. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by apholate resistant strain of *M. d. nebula*.

Fig. 2. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by tepa resistant strain of *M. d. nebula*.

Fig. 3. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by metepa resistant strain of *M. d. nebula*.

Fig. 4. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by hempa resistant strain of *M. d. nebula*.
in apholate, tepa, metepa, hempa and hemel resistant strains of *Musca domestica nebulo* by incorporating the candidate chemosterilant in the food of adults. The apholate resistant strain showed 2.6 times tolerance to hemel but was as susceptible to tepa, metepa and hemel as the laboratory strain. Another strain resistant to tepa developed considerable tolerance to metepa, hemel and hemel but remained susceptible to apholate. Similarly metepa resistant strain acquired 3.6, 3.4 and 6.5 times tolerance to tepa, hemel and hemel but none to apholate. The strain resistant to hemel developed 3.3, 2.5 and 9.1 times tolerance to tepa, metepa and hemel respectively and also showed some tolerance to apholate.

**Acknowledgments**: The author is extremely grateful to Prof. Nawab H. Khan for critically going through the manuscript and to Prof. S. M. Alam for providing necessary facilities in the department.

**References**


Patterson, R. S., *et al.*: *J. Econ. Ent.*, 60 (6), 1673 (1967).