Precocene II is no Anti-Juvenile Hormone in the Honey Bee, Apis mellifera

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Precocene II, Anti-Juvenile Hormone, Honey Bee, Apis mellifera, Anti-Feedant

The effect of precocene II on development of the honey bee, Apis mellifera, was studied in vitro. One- to two-day-old worker larvae (body weight 0.5 – 1.0 mg) were removed from the colonies, reared on royal jelly-yeast extract, and after 24 h were topically applied with different amounts (5 – 75 µg/larva) of precocene II. Toxicity was observed only with precocene doses of 50 µg/larva and more. The larval weight-gains declined with the increase of doses. The acetone-treated control had better survival and weight-gain as compared to the no-treatment control. The larval and pupal periods in the treated larvae remained unchanged as compared to the controls. The possibility of precocene acting as an antifeedant is discussed.

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Materials and Methods

One- to two-day-old worker larvae (body weight 0.5 – 1.0 mg) were taken from bee flight room colonies of A. mellifera for in vitro tests and were reared on royal jelly-yeast extract as described earlier [10]. Twenty-four hours after removal from the colony, the larvae (body weight approximately 8 mg) were topically applied with 1 µl acetone containing 5 – 75 µg of precocene II (a generous gift from Zoecoon Corp.). Two controls were kept, one with acetone (1 µl) and the other without any treatment. Every experiment consisted of three replicates, each with at least 35 individuals.

Results and Discussion

Figure 1 gives the percentage of larval survival after precocene II treatment, recorded daily till the fifth larval instar. Lethality becomes progressively higher with increased dose. However, there is not much difference in the doses from 5 to 25 µg/larva (86.6 – 82.8% survival to L5); toxicity is only high at 50 and 75 µg precocene. Maximum survival to pupal and adult stages, of all the tests, is observed with dose of 5 µg/larva (64.7 and 58.0%; Table I). As also observed in earlier experiments [11], acetone treatment results in higher increase of larval weight as compared to no-treatment (741 vs. 706%).

There is a progressive decline in larval weight-gains as the dose is increased, except in the 10 µg treatment. Pupal mortality was not high in controls as well as in treatments; no morphological abnormalities were seen in the dead pupae. We did not observe...
Table I. Effect of precocene II on the development of honey bee larvae

<table>
<thead>
<tr>
<th>Treatment (per larva)</th>
<th>Number of larvae*</th>
<th>Percentage survival to L5**</th>
<th>Pupa</th>
<th>Adult</th>
<th>Larval weight-gain*** %</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>105</td>
<td>92.3</td>
<td>57.1</td>
<td>51.4</td>
<td>706</td>
</tr>
<tr>
<td>Acetone</td>
<td>105</td>
<td>90.4</td>
<td>60.0</td>
<td>55.2</td>
<td>741</td>
</tr>
<tr>
<td>5 µg Precocene II</td>
<td>105</td>
<td>86.6</td>
<td>64.7</td>
<td>58.0</td>
<td>638</td>
</tr>
<tr>
<td>10 µg Precocene II</td>
<td>105</td>
<td>85.7</td>
<td>57.1</td>
<td>56.1</td>
<td>688</td>
</tr>
<tr>
<td>25 µg Precocene II</td>
<td>105</td>
<td>82.8</td>
<td>52.3</td>
<td>45.7</td>
<td>629</td>
</tr>
<tr>
<td>50 µg Precocene II</td>
<td>107</td>
<td>59.8</td>
<td>19.6</td>
<td>16.8</td>
<td>597</td>
</tr>
<tr>
<td>75 µg Precocene II</td>
<td>105</td>
<td>54.2</td>
<td>20.0</td>
<td>20.0</td>
<td>563</td>
</tr>
</tbody>
</table>

* Approximate weight 8 mg.
** Fifth larval instar.
*** Increase in 48 h after treatment.

disruption in insects, possibly by interfering with normal hormone balance [12]. The earlier reports [3, 4, 6] of precocous adult formation in precocene treated hemimetabolous insects could possibly be due to its antifeeding action. However, this hormonal disturbance was not observed in the honey bee, a holometabolous insect. The observation that precocene had no effect on the development of Graphosoma italicum, which is resistant to a large number of antifeeding compounds due to its adaptation for feeding on aromatic seeds of Umbelliferous plants [8], also supports that antifeeding effect is the primary mode of action of precocene. In the present study, the decreased weight-gains of the treated honey bee larvae are also indicative of antifeeding action of precocene.

Precocenes were called anti-juvenile hormones because subsequent JH treatment reversed the precocene effect. A specific anti-juvenile hormone should suppress or prevent the action of exogenous JH [8], or the simultaneous application of both to an insect should result in its normal development. However, according to Bowers [13] mixed application of precocene and JH will only show JH effects. Precocene, like in the present study, caused only a general toxic effect in A. aegypti [9], a holometabolous insect. However, this toxic effect was observed in honey bee only at a very high dose (50 µg/larva, approximate larval weight 8 mg). Based on our results it can be interpreted that precocene acts as an antifeedant at lower doses and possibly through this disturbs the endocrine processes. At higher doses precocene is a general toxicant.