Development of a predictive degree-day model for the Lacanobia fruitworm

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Placed newly hatched larvae individually on apple foliage in small petri dishes with a 1 cm cube of artificial diet.

Dishes were placed in growth chambers at constant temperature (10, 12.5, 15, 20, 25, 27.5, 30°C) and 16:8 L:D.

Development from oviposition to egg hatch, each larval molt, pupation and finally to adult eclosion was recorded.

If development was not complete at time of this publication estimates were made based on preliminary data.
### Threshold and degree-day development

**Days for development at constant temperature**

<table>
<thead>
<tr>
<th>Stage</th>
<th>10.0</th>
<th>12.5</th>
<th>15.0</th>
<th>20.0</th>
<th>25.0</th>
<th>27.5</th>
<th>30.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoviposition</td>
<td>24.7</td>
<td>17.6</td>
<td>11.5</td>
<td>7.9</td>
<td>7.0</td>
<td>6.3</td>
<td>5.3</td>
</tr>
<tr>
<td>Egg hatch</td>
<td>19.0</td>
<td>13.9</td>
<td>8.7</td>
<td>6.0</td>
<td>5.3</td>
<td>4.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Hatch to pups</td>
<td>9.0</td>
<td>67.0</td>
<td>43.5</td>
<td>30.0</td>
<td>26.5</td>
<td>25.1</td>
<td>23.9</td>
</tr>
<tr>
<td>Pupa to adult</td>
<td>62.0</td>
<td>44.2</td>
<td>28.5</td>
<td>19.8</td>
<td>15.4</td>
<td>13.5</td>
<td>13.7</td>
</tr>
<tr>
<td>Adult to adult</td>
<td>200.0</td>
<td>142.7</td>
<td>92.0</td>
<td>63.7</td>
<td>54.2</td>
<td>50.0</td>
<td>46.9</td>
</tr>
</tbody>
</table>

**Predicted degree days based on thresholds of 50-88**

<table>
<thead>
<tr>
<th>Time from Biofix to:</th>
<th>12.5</th>
<th>15.0</th>
<th>20.0</th>
<th>25.0</th>
<th>27.5</th>
<th>30.0</th>
<th>Estimated total DD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hatch</td>
<td>140</td>
<td>181.0</td>
<td>270.0</td>
<td>324.0</td>
<td>346.0</td>
<td>324.0</td>
<td><strong>275.0</strong></td>
</tr>
<tr>
<td>2nd flight</td>
<td>636.0</td>
<td>830.0</td>
<td>1130.0</td>
<td>1650.0</td>
<td>1575.0</td>
<td>1692.0</td>
<td><strong>1250.0</strong></td>
</tr>
<tr>
<td>2nd hatch</td>
<td>779.0</td>
<td>1011.0</td>
<td>1400.0</td>
<td>1975.0</td>
<td>1921.0</td>
<td>2016.0</td>
<td><strong>1525.0</strong></td>
</tr>
</tbody>
</table>

*Completed development test indicated with black ink, estimates based on preliminary data in red.
Threshold and degree-day development

- Predicted lower and upper thresholds of 48-50°F and 88-90°F
1999 L. Phenology, and Model Predictions of Critical Stages

Avg moths/ trap/ week

Egg hatch
Lacanobia larvae
2nd flight
2nd Egg hatch

* 1999 flight started at 215 DD from Mar 1
1998 Lacanobia Phenology, and Model Predictions of Critical Stages

* 1998 flight started at approximately 210 DD from Mar 1
Rearing of all stages of Lacanobia at constant temperatures nearly complete

Preliminary data suggests thresholds for development similar to codling moth at 50-88°F

– It appears that lacanobia has one more larval instar and a longer preoviposition period than codling moth

Predictions of critical stages of phenology roughly set at

– First flight- 200-225 DD from Mar 1
– First egg hatch- 275 DD from Biofix
– 2nd flight- 1300 DD from Biofix
– 2nd egg hatch- 1525 DD from Biofix

Egg hatch prediction seems to be early, this may change as more is learned about preoviposition behavior

CAUTION- Data is preliminary, therefore thresholds and stage predictions will likely change as data collection is completed
**Goals for year 2000**

- Complete rearing of all life stages at constant temperature to pinpoint threshold temperatures
- Intensely monitor high pressure orchards for oviposition and egg hatch as well as adult phenology
- Observe mating behavior in laboratory as well as ovarian development in field to enhance understanding of preoviposition behavior
- Monitor temperatures at individual test sites to reduce variability in data
- Validate model
  - 1999 preliminary data based on “pooled” or averaged data
  - Model validation will entail analysis of individual orchards