Degree Day modelling: *Cydia pomonella*

For Plant Protection Products (PPPs) which target a specific life-stage of the pest, understanding that pest and when is best to apply the product will give better product performance. There are various ways of monitoring for pests including scouting, counting traps and prediction based on computer weather models. Ideally a combination of these, along with an understanding of site history are then used as decision supporting tools to determine if and what action should be taken.

Degree Day (DD) modelling is one type of calculation which combines an understanding of how temperature affects development speed of the pest lifecycle, with weather conditions to predict what life-stage the pest is at. One example of how this is used is for the application of Madex® Top against codling moth (*Cydia pomonella*) larvae where optimal application timing requires an understanding of when eggs are expected to hatch.

Research into the pest has shown that:
- Codling moth does not develop at temperatures below 10°C.
- Females start laying eggs when evening (9pm) temperatures rise above 18°C.
- The total time from egg laying to egg laying is 520 degree days.
  - After laying, eggs take 90 degree days to mature.
  - Larval development within the fruit takes 220 degree days.
  - Leaving the fruit, pupation and hatching of the adult moth takes 200 degree days.
  - Maturation of the female moth takes 10 degree days.
- Degree Days for codling moth can be calculated with the below equation.

\[
\Sigma = \frac{T_{\text{max}} + T_{\text{min}}}{2} - 10 \, ^{\circ}\text{C}
\]

Figure 1: Life stages and development time in Degree Days (dd) of codling moth (*Cydia pomonella*). Madex® Top is best applied at 85dd as eggs are about to hatch and before caterpillars enter the fruit.
How to calculate codling moth degree days on your farm.

The following steps can be used to calculate the lifecycle of codling moth (C. pomonella) on a farm and, when combined with other pest monitoring systems, support a user to make more informed and better decisions. The below steps are designed for use in Microsoft Excel. A ready to use template can be downloaded at https://www.andermattuk.com/insecticides/madex-top.

1. Create a spreadsheet with the following column titles.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Minimum air temperature (°C)</td>
<td>Maximum air temperature (°C)</td>
<td>Madex Degree Day modelling (DD)</td>
<td>Sum Degree Days (DD)</td>
</tr>
</tbody>
</table>

2. Enter the Andermatt Sum of Degree Day calculation into square “D2”. Copy and paste D2 into every square in column D.

3. Every day in a new row enter the date, minimum and maximum temperature of that day into columns “A”, “B” and “C” respectively. The number of Degree Days for that day will be automatically calculated.

4. For the date evening (9pm) temperatures rise above 18°C, start calculating the total degree days:
   a. Enter the Degree Days for that day into column “E”.
   b. In column E for the following day, start adding up the Degree Days. Copy and paste this square into every square below in column E.

5. When new daily recordings are added, the sum of degree days will automatically be calculated. When 85dd is reached, this is optimum application timing for Madex® Top.

6. To support decision making, further columns can be added to record trap catches giving a user all their monitoring information in one location.