Mating Disruption/SIR

Effect of Low Temperature on the Relative Release of Codlemone from Various Commercial Mating Disruption Products

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Abstract: Laboratory tests were performed to evaluate how low temperature affects the release rates of several codling moth (CM) mating disruption products. The relative release of codlemone was determined for five commercial CM products and one prototype CM Puffer. The samples were exposed in an environmental chamber at 59°F (15°C) with an air turnover rate of once every 1.5 minutes. Results indicate that all mating disruption products tested release codlemone at 59°F.

Introduction

In the western US, codling moth mating disruption products are typically applied to orchards in the early spring. In March in California and April in Washington, average daily temperatures for apple growing regions are in the mid 50s°F, while average maximum temperatures reach the mid 60s°F (http://www.wrcc.dri.edu/climsum.html). The melting point of codlemone (E,E-8,10-dodecadienol), the primary active ingredient in codling moth mating disruption products, is 83.3°F (28.5°C). Therefore, we wanted to test the effects of springtime temperatures on the relative release of codlemone from various mating disruption products for codling moth. Six controlled-release codling moth products listed in Table 1 were tested in the laboratory including CheckMate® CM-F microcapsules, CheckMate® CM-XL1000 dispensers, CheckMate® CM-Puffer, Isomate®-C Plus ropes, Isomate®-C TT twin tubes and NoMate® CM spirals.

Materials and Methods

Puffer. An accelerated test to simulate a 56-day period was performed at 15°C. CheckMate CM prototype puffer cans and cabinets were prepared in duplicate. For the accelerated test, the cans were set to puff the equivalent of one week in one day. The puffers were weighed on day zero, placed in an environmental chamber set at 15°C and were only removed for subsequent weighing on days 1, 2, 3, 4, 6 and 8. For analysis, the amount of codlemone was calculated by multiplying the total weight loss by the percent of active ingredient (17.625%) on the label.

Dispensers and Flowable. Seven time-points consisting of four replicates for each product were prepared. Each dispenser including CheckMate CM-XL1000 dispensers, NoMate CM spirals, and Isomate-C Plus ropes and TT twin tubes were equipped with a hook and labeled. Hooks were used so that each dispenser would hang from the racks in the environmental chamber. The Checkmate CM-F product was loaded onto filter papers and prepared with a hook
similar to the dispensers. All weights were recorded for day zero and each sample was hooked to the racks and placed in the 15°C environmental chamber. The racks were rotated inside the chamber five days a week. The air turnover rate in the chamber was measured with a thermal anemometer as once every 1.5 minutes and the velocity of the air was approximately 14 mph. Four samples for each product were randomly removed at each time-point on days 7, 14, 21, 28, 42, 56. These samples were weighed, placed in a labeled scotch pack bag that was sealed and then placed in the freezer until extraction and analysis were performed. All remaining samples for each time-point were also weighed.

**Analysis.** Each sample was extracted with solvent containing an internal standard and the codlemone was quantified by gas chromatography using the following parameters.

- **Equipment:** Gas Chromatograph (GC) Hewlett Packard 5890 with FID detector
- **Column:** HP Ultra-2 (25 m; 0.20 mm. i.d.; 0.33µm film thickness)
- **Phase:** Crosslinked 5% phenylmethylsiloxane
- **Operating Parameters:**
  - Injection Port - 250°C; Detection Port - 300°C
  - Oven Program - 130°C for 20 min, ramp 30°C/min to 300°C, hold 15 min
  - Head Pressure - 25 psi; Column Flow - 1.2 ml/min at 130°C
  - Split Ratio - ~150:1; Injection - 1µl

**Results and Discussion**

Figure 1 shows the release of codlemone over time (8 weeks) for samples exposed in the environmental chamber. The primary Y-axis represents the amount of codlemone for the dispensers, while the secondary Y-axis represents codlemone for the flowable. The results in Figure 1 indicate that all tested commercial CM products release codlemone over time.

Figure 2 was generated from the numbers in Figure 1 to compare the release rates of the products on a per acre basis (mg/acre/day). In this graph, all the time points are subtracted from day zero, so the first relevant time point is day seven. Each point was then multiplied by the recommended use rate per acre on the label (Table 1). From Figure 2, the most consistent product is the puffer, while the spirals showed an increase in release rate over the course of the testing. Average rates (mg/acre/day) for Figure 2 shown in Table 1 are 355 ±1, 200 ±77, 141 ±40, 319 ±142, 296 ±110, and 124 ±31 for the puffers, twin tubes, dispensers, spirals, ropes and flowable, respectively.

CheckMate® is a registered trademark of Suterra, Isomate® is a registered trademark of Pacific Biocontrol and NoMate® is a registered trademark of Scentry.
Table 1. Six controlled-release codling moth products tested in the laboratory.

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer</th>
<th>Label use rate</th>
<th>Ave. release rate (mg/acre/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CheckMate CM-F</td>
<td>Suterra</td>
<td>10 grams/acre</td>
<td>124 ±31</td>
</tr>
<tr>
<td>CheckMate CM-Puffer</td>
<td>Suterra</td>
<td>1 puffer/acre</td>
<td>355 ±1</td>
</tr>
<tr>
<td>CheckMate CM-XL1000</td>
<td>Suterra</td>
<td>200 dispensers/acre</td>
<td>141 ±40</td>
</tr>
<tr>
<td>Isomate-C Plus</td>
<td>Pacific Biocontrol</td>
<td>400 dispensers/acre</td>
<td>296 ±110</td>
</tr>
<tr>
<td>Isomate-C TT</td>
<td>Pacific Biocontrol</td>
<td>200 dispensers/acre</td>
<td>200 ±77</td>
</tr>
<tr>
<td>NoMate CM</td>
<td>Scentry</td>
<td>400 dispensers/acre</td>
<td>319 ±142</td>
</tr>
</tbody>
</table>
Figure 1. Residual codlemone measured over time.

Figure 2. Codlemone release rates (mg/acre/day).