Oxalic Acid in Varroa Management

By Phyllis Martin

A significant amount of this material was liberated from Randy Oliver and Marion Ellis
MY NAME IS DESTRUCTOR... VARROA DESTRUCTOR.
Structure of Presentation

• What is Varroa?
• Varroa biology
• Varroa Management
  • Detection methods
  • When to treat
  • How to apply oxalic acid
• Safety considerations of oxalic acid
What is Varroa?
If you know the enemy and you know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle.
The Varroa mite is an external parasitic mite that attacks the honey bees *Apis cerana* and *Apis mellifera*. The disease caused by the mites is called varroosis.
Varroa Biology

The Life Cycle of Varroa
Understand the timing!
Varroa Management

- How to detect and assess mite populations
- How to know when mite populations suppression is needed
- How to suppress mite populations with oxalic acid
Detecting and Assessing Mite Populations
Dead Colony Method
Detecting and Assessing Mite Populations
Live Colony Method
When to Treat

• *In the late winter, take action to reduce mite populations if they are detectable using the sugar roll technique.*

• *Sample again in mid-September. If you detect 3 or more mites per 100 bees (9 mites on a 300 bee sample), remove crop and suppress mite populations.*

• *If you detect less than 3 mites per 100 bees in mid-September you can delay suppression measures until colonies are “broodless.”*
Suppressing Mite Populations

Why Oxalic Acid?

- Approved in Europe for over 20 years
- Used in Canada since 2010
Acids are much more toxic to mites than to bees.
Oxalic is the strongest organic acid.
There are speculative hypotheses as to why acids kill varroa, but no definitive study.
There are speculative hypotheses as to why acids kill varroa, but no definitive study.
Safety to Humans
Oxalis
Table I: Oxalic acid content in selected vegetables. These are ballpark numbers, actual content depends on many variables. See note at the end of the article.

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Oxalic acid (g/100 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>0.13</td>
</tr>
<tr>
<td>Broccoli</td>
<td>0.19</td>
</tr>
<tr>
<td>Lettuce</td>
<td>0.33</td>
</tr>
<tr>
<td>Brussels sprouts</td>
<td>0.36</td>
</tr>
<tr>
<td>Collards</td>
<td>0.45</td>
</tr>
<tr>
<td>Beet leaves</td>
<td>0.61</td>
</tr>
<tr>
<td>Spinach</td>
<td>0.97 (0.32-1.26)</td>
</tr>
<tr>
<td>Purslane</td>
<td>1.31</td>
</tr>
<tr>
<td>Parsley</td>
<td>1.70</td>
</tr>
<tr>
<td>Rhubarb</td>
<td>0.3-1.5</td>
</tr>
<tr>
<td>leaf</td>
<td>0.59 - 0.72</td>
</tr>
<tr>
<td>stalk</td>
<td>0.39 - 0.54</td>
</tr>
</tbody>
</table>

http://helios.hampshire.edu/~nlNS/mompdfs/oxalica.pdf
Tastes like strong lemonade
Purchasing Oxalic Acid
APPLICATION DIRECTIONS:

Oxalic acid is used to treat colonies during low brood periods, packages, or swarms. This product can also be used as a "clean up" Varroa treatment following the application of a different acaricide where Varroa infestations continue to be problematic.

SOLUTION METHOD:

NOTE: To completely dissolve Oxalic Acid Dihydrate, use warm syrup.

Dissolve 35 g of Oxalic Acid Dihydrate in 1 liter of 1:1 sugar: water (weight:volume). Smoke bees down from the top bars. With a syringe or an applicator, trickle 5 ml of this solution directly onto the bees in each occupied bee space in each brood box. The maximum dose is 50 ml per colony whether bees are in nucs, single, or multiple brood chambers. Under certain unfavorable conditions (e.g., weak colonies, unfavorable overwintering conditions), this application method may cause some bee mortality or overwintering bee loss.

VAPORIZER METHOD:

Apply only to outdoor colonies with a restricted lower hive entrance. Seal all upper hive entrances and cracks with tape to avoid escape of Oxalic Acid vapor. Smoke bees up from the bottom board. Place 1.0 g Oxalic Acid Dihydrate powder into vaporizer. Follow the vaporizer manufacturer's directions for use. Insert the vaporizer apparatus through the bottom entrance. Apply heat until all Oxalic Acid has sublimated.

SPRAYING PACKAGE BEES

Ensure bees are clustered before applying oxalic acid (for example store in cool dark location 24 hours before application).

Spray broodless package bees with a 1:1 sugar:water solution at least 2 hours before spraying with oxalic acid. This allows bees to fill honey stomachs with sugar water reducing ingestion of oxalic acid.

Mix a 2.8% oxalic acid solution by dissolving 35 g of Oxalic Acid Dihydrate in 1 liter of 1:1 sugar: water (weight:volume). Evenly apply 3.0 mL of 2.8% oxalic acid solution per 1,000 bees using a pump sprayer or battery powered sprayer (for example, a typical 2 lb package contains approximately 7,000 bees which requires 21 ml of solution). Apply solution evenly on both sides of the package.

Store bees in a cool darkened room for 72 hours before hiving.

RESISTANCE MANAGEMENT: Oxalic acid’s mechanism of action is unknown at this time. Any Varroa mite population has the potential to become resistant to acaricides. Resistance development is affected by both the frequency of application and rate/dose of application. Continued reliance on a single class of miticide or single miticide with the same mode of action will select for resistant individuals which may dominate the mite population in subsequent generations. In order to prevent resistance development and to maintain the usefulness of individual insecticides it is important to adopt appropriate resistant management strategies.

To delay resistance:

- When possible, rotate the use of miticides to reduce selection pressure as compared to repeatedly using the same product, mode or action or chemical class. If multiple applications are required, use a different mode of action each time before returning to a previously-used one.
- Base miticide use on Integrated Pest Management (IPM). This includes proper pest identification, monitoring for locality specific economic threshold and economic injury levels, record keeping, and utilizing all available control practices (cultural, biological and chemical).
- Maximize efficacy by following all label instructions including dosage and timing of application.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

PESTICIDE STORAGE: Store only in original container, in a dry place inaccessible to children, pets, and domestic animals.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER HANDLING: Nonrefillable container. Do not reuse or refill this container.

PLASTIC CONTAINER DISPOSAL: Triple rinse container (or equivalent) promptly after use. Offer for recycling, if available. Otherwise, puncture and dispose of in a sanitary landfill, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.
Application Methods
Directions for Use - Trickling

- Prepare a solution by dissolving 35 grams of oxalic acid in 1 liter of lukewarm sugar water (1:1 solution)
- Treat in autumn or early spring (when little or no brood is present)
  - Most effective in broodless colonies
  - Treat when temperature is between 35-55 F (when bees are in a loose cluster)
- Wear protective equipment
Break the Brood Cycle

1. Cage the queen on day 1
2. Release the queen on day 14
3. Treat on day 21
Treatment Considerations

- Mix fresh
- Do not treat weak or starving colonies
- Do not use thick syrup. Use 1:1
- Treatments when brood is present are significantly less effective
- Treat when temperatures are above freezing and below 55 F
- Do not mix and store for more than a week
- Do not treat when honey supers are in place
Store in the ‘fridge
Trickle Treatment Application
Recommended Amount of Solution

- *Five frame nucleus* – 30 ml
- *Single story colony* – 40 ml
- *Double story colony* – 50 ml
~5 mL per “seam” of bees
Dribble, not spray
Protect your eyes
Vaporizer Application
Vaporizer Application

- 1 gram singles, 2 grams doubles
- ¼ teaspoon = 1 gram
- Seal entrances while treating and for 15 minutes post treatment
- Allow 2.5 minutes to evaporate (be sure to disconnect power when done)
- Cool thoroughly before reloading
Vaporizer Application
Vaporizer Application
Summary
Oxalic won’t kill mites in the sealed brood.
Oxalic drops mites for about 4 days.
Doesn’t appear to harm queens
# Dribble vs. Sublimation

<table>
<thead>
<tr>
<th></th>
<th>Dribble</th>
<th>Sublimation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros:</strong></td>
<td>High efficacy</td>
<td>Perhaps higher efficacy</td>
</tr>
<tr>
<td></td>
<td>Very safe to apply</td>
<td>No opening of the hive</td>
</tr>
<tr>
<td></td>
<td>Quick</td>
<td>Can do in freezing weather</td>
</tr>
<tr>
<td></td>
<td>Little equip needed</td>
<td>Perhaps gentler to the bees</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No syrup mixing</td>
</tr>
<tr>
<td><strong>Cons:</strong></td>
<td>Requires opening hive</td>
<td>Vapor fog is hazardous</td>
</tr>
<tr>
<td></td>
<td>May be problematic in freezing weather</td>
<td>Requires specialized vaporizer and energy source</td>
</tr>
<tr>
<td></td>
<td>Easier with helper</td>
<td>Problems with hot tip</td>
</tr>
</tbody>
</table>
You must not fight too often with one enemy, or you will teach him all your art of war.

Napoleon Bonaparte