Detecting Varroa Mite Resistance To Apistan®, Apitraz® Apivar® And Bayvarol®

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Chemical resistance

Resistance to synthetic varroa controls occurs in every country varroa exists (Jack and Ellis, 2021). Knowing how to conduct resistance tests can help beekeepers detect future resistance issues early and avoid wasting money on a product that is no longer effective.

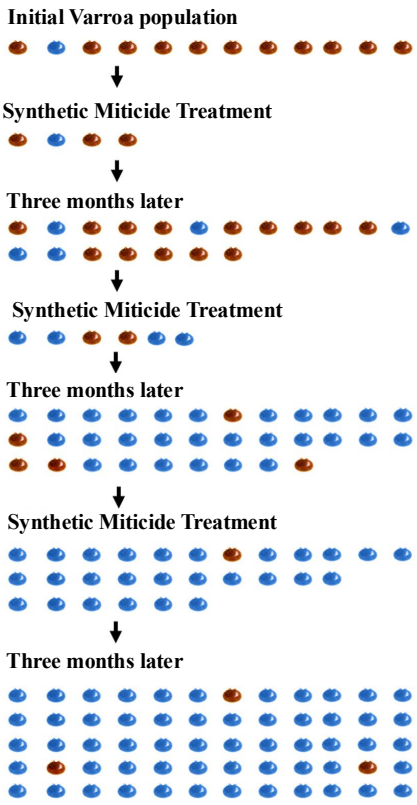

Figure 1: Diagram of how resistance to synthetic miticides can occur over time. Adapted from Goodwin & Taylor, 2007.

Synthetic varroa controls are efficacious, but they don't kill 100% of mites. The mites that survive (e.g. those in blue in Figure 1) are better at tolerating the chemical being used, and these mites go on to reproduce. In time, more and more mites exist which are unaffected by the treatment being used.

By the time a colony does not appear to respond to a synthetic chemical mite control, resistance issues are likely problematic. This crude but useful field test can be used by beekeepers to determine whether varroa are resistant to miticide controls. This test cannot indicate the exact level of resistance; further laboratory work is needed to determine this.

Materials needed:

- 500 ml jar with lid – e.g. Sugar shake jar
- Metal mesh cover for the jar
- 75 x 125 mm index card or similar
- 9 x 12.5 mm piece of a new miticide strip (e.g. Apistan®)
- ¼ cup (to scoop up 150 bees)
- Methylated spirits
- Nitrile gloves (to handle strips)
- Stapler (to staple the miticide strip to)
- Sugar cubes (so bees don't get hungry)
- Marking pen
- Sheet of white paper
- Paint straining material

Instructions:

Step 1

- Cut miticide strips (e.g. Apistan®) and staple the strips to the centre of the index card. The card is used so the strip doesn't lay flat on the bottom of the jar.

- Place the card in the jar with the section of the Apistan® strip facing inwards so it comes into contact with the bees.
- Place a sugar cube in the jar.

Step 2

- Shake bees from a brood comb into an upturned hive lid or a tray.
- Scoop up **1/4 of a cup bees** (about 150 bees) and put them in the jar, being careful not to damage the bees.
- Record (e.g. label the jar) the time the test started so you know once 24hrs has passed.

Step 3

- Place the wire mesh lid over the jar to stop the bees from escaping.
- The holes in the mesh should be large enough to easily let varroa through.
- Place the jar in a warm dark place for 24 hours. Try to look after the bees if in transit (e.g. not in a hot vehicle or in the sun).
  Make sure the lid is not covered so the bees can breathe.

Pic courtesy British Colombia Ministry of Agriculture

Step 4

- After 24 hours, hold the jar above a piece of white paper and turn it so the mesh lid is facing downwards.
- Hit the jar with the palm of the hand ten times.
- Ensure no dead mites are stuck on the walls of the jar.
- Count the number of mites that fall on the paper (and include any dead mites on wall of the jar). This is the 'initial kill' figure used in Step 8. The initial kill represents the varroa that died due to the miticide.

Step 5

- Fill the jar halfway with methylated spirits, then once the bees are dead, remove the card and chemical strip.
- Remove the mesh lid and replace with a solid lid for the jar. Shake the jar vigorously for five minutes.

Step 6

- Remove the solid lid and fit the mesh lid.
- Pour out the methylated spirits with any mites into a small bucket with a paint straining cloth fixed.
- Refill the jar with methylated spirits, swirl the bees around and pour the spirits into the lined funnel or container again.
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Step 7

- Count the number of mites recovered in the strainer. This is the ‘final kill’ which represents those mites that did not die from the miticide, but were recovered from the bees using the alcohol wash.

- Work out the total number of mites killed:

Total mite kill = the initial kill + the final kill

- **If the total mite kill is less than 5 mites per sample then you will need to carry out the test again.**

Step 8

To calculate the percentage of mites killed, divide the initial kill by the total mite kill. Multiply this number by 100 to get the % of mites killed by the Apistan®

% kill by Apistan® = initial kill / (initial kill + final kill) x 100

For example:

Initial kill = 6 mites
Final kill = 1 mites
6 / (6+1) x 100 = 85.7% of mites in the hive killed by Apistan®.

If less than 50% of the mites were killed by Apistan®, **the mites may be resistant** and should be tested with a more sensitive laboratory test.

Critical factors for the success of the above resistance test

- Pre-screen hives using an alcohol wash or sugar shake (300 bees) and only run the resistance test on colonies where you find 5 or more mites.
- Expect levels of resistance to be different among hives.
- This test is not designed to identify individual hives showing resistance. Therefore, use apiary averages to assess the results: select 12 hives per apiary. More hives are better.
- Perform the test exactly as described above; jar size, size of strips sampling bees from brood frames, the number of bees (use a measuring scoop), and temperature are important.
- Ensure that bees are mobile in the jars so they contact the strips. Cool temperatures may cause the bees to cluster away from the strips so ensure fresh air to encourage bee movement.
- Do not reuse strip pieces or index cards. Wash jars between tests.
- Do not expose jars with miticide sections to sunlight.

Slowing resistance

Beekeepers can slow the resistance process by:

- Following the instructions on the label.
- Only using synthetic miticides when they are needed and do not re-use strips.
- Using the recommended dose so that mites are not exposed to low concentrations.
- Removing the miticide when recommended so varroa are not exposed to low concentrations of the chemical. Mark hives with the date of application and the number of strips in the hive so it is obvious when the strips need to be removed.
- Encourage other beekeepers to use techniques that will delay resistance. Any resistant mites they produce will eventually find their way into other beekeepers' hives.
- Don't rely on just one product or chemical. Rotate different chemical classes to reduce the chance of cross-resistance (Figure 2).

Bayvarol + Apitraz : Yes
Bayvarol + Apivar : Yes
Bayvarol + Apistan: No
(both synthetic pyrethroids)
Apitraz + Bayvarol: Yes
Apitraz + Apistan: Yes
Apitraz + Apivar: No
(both amitraz)

Figure 2: Examples of chemical class rotation of synthetic miticides for varroa control.

Further reading and references used to develop this fact sheet:

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