Apiculture Factsheet

Ministry of Agriculture
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Factsheet #221

VARROA MITE CONTROLS

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The Varroa mite (*Varroa destructor,* formerly *V. jacobsoni)* parasitizes only honeybees. Its specialized mouthparts enable the mite to feed on bee brood and adult honeybees. The mite brood development is closely synchronized with bee brood development. Without the use of mite controls, the colony will die.

The interaction between honeybee and mite populations is a complex and dynamic process involving many variables. Beekeepers, who use only chemicals as their mite control strategy, will fail. Suppressing the pest population and simultaneously maximizing the bee population requires the implementation of a mite control program that involves the integrated application of management techniques and chemical controls. Such integrated management program is characterized by the following:

1. Successful mite management is accomplished through the combined application of controls, where none would offer sufficient control when applied on their own.
2. A mite control program demands ongoing beekeeper involvement through monitoring and strategizing. Frequent monitoring is essential for making management decisions based on information, instead of speculation.
3. An integrated mite management program aims at keeping mites at manageable levels. Other than killing the colony, mite eradication is not possible or sensible because the colony will be quickly re-infested.

This paper lists chemical and non-chemical Varroa mite controls. Note that physical conditions including temperature, humidity, colony size and condition, time of year, etc., all influence the effectiveness of any control method or product being used.

Adult Varroa mites (Varroa destructor), ventral and dorsal views.

Chemical Controls

Fluvalinate (Apistan strips)

- Fluvalinate is the active ingredient of Apistan strips. It is a synthetic pyrethroid applied as a contact miticide. Highly effective during the 1990s, and noted for its low toxicity and ease of application.
- Controls Varroa mites only; NOT effective against tracheal mites (*Acarapis woodi).*
- Product delivered in an impregnated plastic strip suspended between brood frames.
- Formulation is not water soluble; no danger of honey contamination. Product is fat-soluble and after prolonged use, small quantities will migrate into the wax.
- Product is applied in early spring or fall outside the period of honey production.
- Widely used throughout the world. Illegal formulations, inappropriate applications, under-dosing, reusing old strips, and un-abated use has led to the development of resistant mite strains in North America and Europe.
- Read label instructions closely before use.
- *Note: Fluvalinate-resistant Varroa mites have been confirmed in some parts of British Columbia. The efficacy of fluvalinate may vary. Contact your Apiary Inspector for details and recommendations.*

Coumaphos (CheckMite+ strips)

- Coumaphos is the active ingredient of CheckMite+ strips. The product is an organophosphate applied as a contact miticide. Highly effective in controlling Varroa mites and noted for its ease of application.
- Care must be taken during application by following label instructions closely. Organophosphates have proven highly effective pesticides, but there have been concerns about persistence in the environment, toxic residues, and applicator safety.
- Product delivered in an impregnated plastic strip suspended between brood frames.
- Formulation is not water soluble; little danger of honey contamination. However, the product's volatility during initial strip installation may cause some absorption in stored honey and wax.
- *Note: Coumaphos-resistant Varroa mites have been confirmed in some parts of British Columbia. The efficacy of coumaphos may vary. Contact your Apiary Inspector for details and recommendations.*

Formic Acid

- Effective against Varroa AND tracheal mites *(Acarapis woodi).*
- Different application methods and formulations have been developed with variable efficacy.
- Efficacy dependent on factors including size and condition of the colony, time of year, humidity, temperature, etc. Efficacy of any one method may range from low to high.
- **Formic Acid is corrosive and can cause burns! Rubber gloves and safety glasses should be worn, and inhalation of vapours must be avoided!**
- One effective method applied to two-supered colonies in the fall:

    - Remove lid and smoke bees off the top bars. Place paper napkins on the top bars and pour acid on the napkins. Prevent dripping. Close the hive.
    - Each application equals 30-45 ml (1 - 1.5 fl. oz) of 65% formic acid.
    - Apply three to four treatments, four to seven days apart.
    - Outside temperatures must be at least 12'C (55' F) in late afternoon.
    - Best results when there is no brood in the colony.
    - Mite drop can be monitored with sticky boards.
    - Formic acid treatments may increase risk of queen loss. Replace queen annually or bi-annually.

Oxalic Acid

- Oxalic acid (Oxalic acid dihydrate) should only be applied in late fall when the colony has no brood. Any open brood in the colony is likely to be killed by oxalic acid.
- Even though the product is not as volatile as formic acid, **always wear rubber gloves and safety glasses when handling the product. Avoid inhalation of vapours.**
- Oxalic acid treatment should be applied only once.
- Oxalic acid can be applied at cool temperatures, either through vapourization (crystals heated and converted directly into a gas vapour) or trickling an acid-sugar syrup solution onto the bees.

- *Acid-sugar syrup solution*:
  - Prepare 1 litre of 1:1 sugar solution.
  - Add 35 g of oxalic acid crystals to the **warm** solution and stir gently until fully dissolved. The sugar syrup solution will have an acid concentration of 3.5%.
  - With a syringe or applicator, trickle 5 ml of solution directly onto the bees in each of the occupied bee spaces between frames in each brood box.
  - The maximum dose is 50 ml of acid solution per colony whether it is a nuc single or multiple brood chambered hive.
- *Vapourizer method:*
  - Seal all upper hive entrances and cracks, and reduce the main entrance.
  - Smoke bees up from the bottom board.
  - Place 2 g of oxalic acid dihydrate into the vapourizer. Insert vapourizer through the bottom entrance. Follow manufacturer's instructions for vapourizer use.

Timing of Application

- Remember that Varroa mites may be quickly re-introduced following a mite control treatment. Timing of treatment is therefore very important. When Apistan or Coumaphos is applied too early in the fall, the end of the 6-week treatment period may be at a time when there is still good flying weather, allowing for mite reintroduction.
- For fall treatment of Apistan or Coumaphos, select the end date of the treatment when the colony has little or no brood left. In coastal B.C., the date may be in the first or second week of November. For a 6-week treatment plan, the date of strip installation should then be on or about October 01.
- For many areas, the period of surplus honey comes to an end by mid-August. Immediately after honey removal, monitor the colonies for mites. It is recommended to use formic acid as a temporary control measure until strips can be applied later in the fall.
- Alternatively, an Apistan or Coumaphos treatment can be started after honey harvest in late summer, when mite levels demand treatment. The end of the 6-week treatment period would fall on or about October 01. Mites may be re-introduced to the colony but a single oxalic acid application in the middle of November would prevent mites from wintering with the colony.
- To reduce the risk of resistance development, it is recommended to alternate between different control products. Experience has also shown that the efficacy of a product such as Apistan or Coumaphos can be re-established after a couple of years of non-use. *(Note that mites are not expected to develop resistance to formic or oxalic acid).*

Other Control Products

- Over the years, many products have been tried to control Varroa mites, including thyme oil, peppermint and wintergreen oils, clove oil, sucrocide octonoate, mineral oil, etc. None of these products have been registered for use in beehives. Do not apply any non-registered products to the colonies from which you will sell honey or other hive products.
- Some control products may have proven effective against mites but may pose a risk of honey or wax contamination, or are hazardous to the beekeeper and the bees.
- Essential oils, including thyme oil, have been reported effective in the control of Varroa. Research so far indicates that these oils are labour intensive and costly, and not consistently effective.

Non Chemical Control

- Non-chemical controls may involve management techniques that hinder the development of the mite population or reduce the risk of rapid re-infestation following chemical controls.
- The 'freezing drone brood method' offers good control but is labour intensive and may weaken the colony. The method depends on the placement of a frame with drone brood comb in the central part of the brood nest *(drone brood foundation is commercially available)*. The queen will be attracted and fill the comb with drone brood. When the drone brood has been capped (> 12 days), remove the frame after all the adult bees have been swept off. Place the frame in the freezer for 24 - 48 hours. Allow the frame to reach room temperature before scratching the drone brood caps. Return frame back to the hive; worker bees will remove all dead drone brood, including dead mites.
- Another Varroa mite control method is the 'queen arrest method' where the queen is temporarily confined to a single brood frame or portion thereof. This method is labour intensive, slows down colony development and may only be suitable for the dedicated, small time beekeeper.
- None of these management techniques offer sufficient mite control on their own but may be used as part of an *Integrated Pest Management* program where a range of controls (including chemical controls) are employed.

Physical Control (Traps and Oils)

- Varroa mites cling to their adult hosts and often lose their grip. When mites fall onto the bottom board, they will climb up again and return to the bee cluster. The placement of a sticky board on the bottom board prevents mites from returning to the cluster. Sticky boards are commercially available or re-usable sticky traps can be easily constructed at home. For directions, refer to **Factsheet #222**.
- Screened bottom boards allow mites to fall through, preventing them from crawling back up. The screened bottom board is a passive mite control device which has been reported to reduce mite levels by as much as 40 per cent. Today, most beekeepers use screened bottom boards, with the additional benefit of improved air circulation in the hive.
- It has been reported that strips of cardboard dipped in mineral oil and suspended between brood frames, similarly to Apistan strips, offer limited Varroa mite control. Vegetable oils have been reported to offer good control of tracheal mites.