BRITISH COLUMBIA | Ministry of Agriculture, Food and Fisheries

Apiculture Factsheet

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Factsheet #221

VARROA MITE CONTROLS

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The Varroa mite (*Varroa destructor,* formerly *V. jacobsoni)* is host-specific and only parasitizes honeybees. Its specialized mouthparts enable it to feed on bee brood and adult honeybees. Its success as a parasite is due to the synchronization of its brood development with honeybee 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. Successful control requires an integrated management approach. Relying solely on chemical applications will not provide long term control because of incorrect timing and the impact chemicals have on bees. An Integrated Pest Management (IPM) program involves the use of different management techniques and methodologies together with the timed application of chemical controls. An IPM program of Varroa is characterized by the following:

1. There is an implicit understanding that mites will always be present in the colony. Eradication is not a realistic option because it will demand chemical control applications at levels and frequency that jeopardize the bees' health and survival.
2. The aim is to manage the mite population below the economic threshold level.
3. IPM includes the application of cultural, mechanical, chemical and biological control methods and products.
4. Effective IPM is accomplished through the combined application of controls, where none would offer sufficient control on their own.
5. An IPM program demands regular monitoring and strategizing. Monitoring involves the collection of data essential for making management decisions, instead of speculation.

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., influence the efficacy of any control method or product used.

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

Chemical Controls

Chemical mite controls are poisons. While they may be effective against mites, chemicals also pose a risk to bees and even to beekeepers. Don't apply any chemical without first testing for mite levels confirming the need to use them. *(For testing methods, refer to Bulletin #222).*

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. Noted for its low mammalian toxicity and easy 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. Long term use may cause migration of residues into wax.
- Product is applied in early spring or fall outside the period of honey production.
- Read label instructions closely before use.
- *Note: Fluvalinate-resistant Varroa mites have been reported in some parts of British Columbia. Efficacy may vary. Contact your Apiary Inspector for details and recommendations.*

Amitraz (Apivar)

- Amitraz is the active ingredient of Apivar. Apivar strips are specifically formulated for use in beehives as they are wax-soluble, which eliminates the risk of residues in honey. Amitraz has been widely used in water-soluble formulations to control ticks, mites and fleas in livestock. These formulations must not be used in beehives because of the danger of residues and contamination of honey.
- Apivar strips have been highly effective in controlling Varroa mites (not Tracheal Mites).
- Amitraz is a contact miticide delivered through an impregnated plastic strip suspended between brood frames.

Coumaphos (CheckMite+ strips)

- Coumaphos is the active ingredient of CheckMite+ strips. The product is an organophosphate applied as a contact miticide. Effective in controlling Varroa mites and noted for ease of application.
- Organophosphates are highly effective pesticides but are called “hard chemicals” because of persistence in the environment and their broad-spectrum toxicity.
- Product is delivered through 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 application may cause some absorption in stored honey and wax.
- *Note: Coumaphos-resistant Varroa mites have been confirmed in some parts of British Columbia. Efficacy may vary. Product is steadily being taken off the market.*

Formic Acid

- Formic Acid (FA) is the simplest organic acid and a natural constituent of many honeys.
- FA is generally applied at 60 or 65% concentration (FA60).
- Effective against Varroa AND tracheal mites *(Acarapis woodi).*
- Different application methods 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.
- Outside temperatures must be at least 12’C (55’F) and not over 30’C.
- **Formic Acid is corrosive and can cause burns! Rubber gloves and safety glasses should be worn, and inhalation of vapours must be avoided!**
- A suggested control 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.
    - 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. Open brood may be injured or killed by oxalic acid vapours.
- Oxalic acid 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 vaporization 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** sugar 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 between each brood frame space of the 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 crystals on the vaporizer plate. Insert vaporizer through the bottom entrance. Follow manufacturer's instructions for operation of vaporizer.

Thymovar

- Active ingredient is Thyme oil derivatives.
- Product is applied in crystal wafers placed on the top bar. Fumes will circulate throughout the hive.
- Thymovar is a botanical miticide with low mammalian toxicity but highly toxic to mites.
- Highest efficacy between 20'C – 28'C. Don't apply when air temperatures are below 15'C or over 30'C.

Timing of Chemical Applications

- Note that Varroa mites may be quickly re-introduced following a mite control treatment. Timing of treatment is therefore very important. When Apistan / Coumaphos / Amitraz strips are applied too early in the fall, the end of the 6-week treatment period may coincide with good flying weather that could result in mite reintroduction.
- For most areas, honey production comes to an end by mid-August. Take the honey off and check for mites. Normal weather conditions in late August allow for effective formic acid treatments.
- Alternatively, an Apivar, Apistan or Coumaphos treatment can be started after honey harvest in late summer, when mite levels demand treatment.
- Warm and sunny fall conditions may extend bee foraging with increased risk of mite introduction. Always check for mite levels in the first half of October.
- For fall treatment with miticide strips, select the end date of the 6-week treatment when the colony has little or no brood left. In coastal B.C., the colony's broodless period starts around mid-November. The strip installation date of a 6-week treatment should therefore be around October 01 or later.
- Alternative to miticide strips, an oxalic acid treatment can be applied in November.
- To reduce the risk of resistance development, it is recommended to alternate between different control products. *(Note that mites are not expected to develop resistance to formic or oxalic acid).*

Other Control Products

- Many products have been tried to control Varroa mites, including peppermint and wintergreen oils, clove oil, sucrocide octonoate, mineral oil, etc. None of these products have been registered for use in beehives.
- Most of these products do not offer consistent or predictable mite control, are expensive and labor-intensive to apply.
- Do not apply non-registered products to the colonies.

Non Chemical Control

- Non-chemical controls involve management techniques that hinder the development of the mite population or reduce the risk of rapid re-infestation following chemical controls.
- The '**drone brood removal method'** offers good control when applied once or twice during the summer season. It may weaken the colony. The method involves the placement of a drone comb frame in the center 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, place the frame in a freezer for 24 - 48 hours. Allow the frame to thaw to 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 a portion thereof. This method is labor intensive, slows down colony development and must be timed carefully. For more details, contact the Apiculture office.
- These management techniques are suitable as part of an *Integrated Pest Management (IPM)* 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.