

# Varroa Mite Controls

Apiculture Factsheet # 221

Updated: 12/15

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The Varroa mite (*Varroa destructor*, formerly *V. jacobsoni*) only parasitizes honeybees. Its specialized mouthparts enable the mite to feed on bee brood and adult honeybees. Its 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. Suppressing the pest population successfully and simultaneously maximizing the bee population requires the careful application of a mite control program that involves integrated management techniques and chemical controls. An integrated management program is characterized by the following:

1. The coordinated application of different controls, where none would offer sufficient control on their own.
2. Regular monitoring by using consistent detection techniques. Frequent monitoring of mites is essential for making management decisions based on information, instead of speculation.
3. Recording the monitoring results that provide key information about pest population trends.
4. An integrated mite management program aims at keeping mites at manageable levels instead of mite eradication. Mite eradication is not possible as the colony will be quickly re-infested.

This paper lists various chemical and non-chemical Varroa mite controls. Physical conditions including temperature, humidity, colony size, colony 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

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### Apistan (Impregnated strips, fluvalinate)

- 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.
  - 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.*
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### Apivar (Impregnated strips, amitraz)

- Amitraz is the active ingredient of Apivar. It is an amidine pesticide used as an insecticide and miticide in the control of fleas, ticks, spider mites and aphids.
  - Controls Varroa mites only; NOT effective against tracheal mites.
  - Product delivered in an impregnated plastic strip suspended between brood frames.
  - Formulation is NOT water soluble; no danger of honey contamination. Cattle-dip formulations are water-soluble and are prohibited for use in beehives because of risk of honey contamination and applicator safety.
  - Product is applied in early spring or fall outside the period of honey production.
  - Read label instructions before use.
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### CheckMite+ (Impregnated strips, coumaphos)

- Coumaphos is the active ingredient. It is an organophosphate applied as a contact miticide.
  - Care must be taken during application by following label instructions closely.
  - Organophosphates have proven highly effective pesticides, but are regarded as “hard” chemicals” because of their 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.*
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### Formic Acid (Liquid, 65%)

- Effective against Varroa AND tracheal mites (*Acarapis woodi*) through evaporation.
- Different application methods and formulations have been developed with variable efficacy.
- Efficacy depends on factors including size and condition of the colony, time of year, humidity, temperature, etc. The efficacy of any one method may range from low to high.
- **Formic Acid is corrosive and can cause burns! Rubber gloves and safety glasses must be worn. Avoid inhalation of vapours!**
- One effective method applied to two-supered colonies in the fall:
  - Outside temperatures must be at least 12°C (55° F) in the afternoon.
  - Remove lid and smoke bees off the top bars. Place paper towels on the top bars.
  - Apply 30-45 ml (1-1.5 fl. oz) of 65% formic acid on paper towels. Prevent dripping. Close the hive.
  - Apply three to four treatments, four to seven days apart.

- Best results when there is little brood in the colony.
  - Mite drop can be monitored with sticky boards.
  - Formic acid treatments may increase the risk of queen loss. Replace the queen every two years.
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### **Oxalic Acid**

Oxalic acid (Oxalic acid dihydrate) should only be used in late fall when the colony has little or no brood.

- 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 sublimation (crystals heated and converted directly into a 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 box where there is brood.
    - The maximum dose is 50 ml of acid solution per colony whether it is a single nucleus hive or a hive with several brood boxes.
  - *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.
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### **Thymovar (Impregnated crystal wafers, Thymol)**

- Thyme oil concentrate is the active ingredient of Thymovar.
  - The product is formulated in wafers placed on the topbars from which the volatile oils evaporate.
  - Product has shown high efficacy under the right temperatures and conditions.
  - Follow label instructions closely.
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### **Timing of Application**

- Varroa mites may be quickly re-introduced following a mite control treatment. Timing of treatment is therefore important. When a treatment is applied too early in the fall, active bee flight may still take place at the end of the treatment period that could result in reintroduction of mites from other apiaries.
- For fall treatment with strips, select the end date of the 6-week 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 period, the date of strip installation should then be on or about October 01.
- For many areas in British Columbia, the period of surplus honey comes to an end by mid-August. Immediately after honey removal, monitor the colonies for mites. Weather conditions at that time allow for effective formic acid treatments, if treatment is required. Further mite monitoring in the fall may require additional treatment using strips.
- Alternatively, a miticide strip treatment can be started promptly after honey removal 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 virtually eliminate 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 strip formulations product such as Apistan 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*).

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## Other Control Products

- Many products have been tried to control Varroa mites including peppermint and wintergreen oils, clove oil, sucroside octonate, mineral oil, etc. None of these products have been registered for use in beehives. Do not apply non-registered products to 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 contamination, or are hazardous to the beekeeper and the bees.
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## 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 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 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 non-chemical 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. Contact the Apiculture Office for details.
  - 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.
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## Physical Control (Traps, Oils and Icing Sugar)

- 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. 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 **Apiculture Bulletin #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 that may 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.