Life Cycle and Management of Varroa Mite (*Varroa destructor*)

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Introduction

Varroa mite is a native parasite of *A. cerana* throughout Asia, it has been reported as causing damage in both temperate and tropical Asia. The overall effect of varroa infestation is to weaken the honey bee colonies and thus decrease honey production. This parasite occasionally in *A. mellifera*, and more frequently in *A. cerana*, heavy infestation cause absconding. This mite is found all over the world, except Australia and New Zealand. In addition to causing damage through feeding upon lipids of larval and adult honey bees, Varroa mite also spread the several viruses, with deformed wing virus being most prevalent. Varroa destructor is causing of colony collapse in *A. mellifera* (L.) colony.

Symptoms

Varroa causes injuries to honey bees by direct feeding. The adult female of mite pierces the adult bees soft inter segmental membrane with their own pointed chelicerae and sucks the bee's haemolymph (blood). The adult bee and larvae are damaged if the infestation is very severe. The honeybee colony being infested with *Varroa* mites is called *varroosis*. If more than one parasitic mite infests or damaged the brood cell the brood decays or deformations occur including shortened abdomen or deformed wings symptoms. If very little quantity of mite infests a cell symptom may not be directly visible although the bee's life-span is considerably shortened as compared to healthy bees. Moreover, the bee's behavior is also disturbed, e.g. in orientation or gathering food and foraging behavior also very effected. *Varroosis* is a multi-factorial disease.

Life cycle

Varroa mite life cycle has two phases. The first phase called as the phoretic phase and second phase is called as reproductive phase. In this phase mites will ride on adult worker bees and drones also, feeding on their whole-body fluid. If there is brood for the mites to parasite, this phase lasts 5-11 days. Otherwise, it can last as long as 6 months, during which the mites will spread disease as they hop from host to host. The mites then move onto brood as they enter their second, reproductive phase. After entering the cell, they move underneath the larva to feed on prepupa. The female lays her first egg 60 hours after the cell is capped, then one every 30 hours. Up to a half dozen will reach maturity within a week, feeding on the bee, impeding its development, and exposing it to disease. They mate, then adult females will leave the cell with the damaged bee, transferring to other bees, and the cycle begins again.

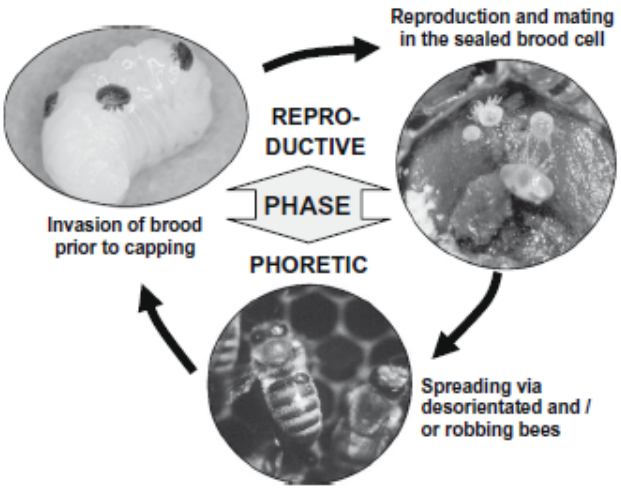

Fig. 1: Life Cycle of the Varroa mite

Management

Soft Chemicals

Organic acids, essential oils, and hop beta acids are important soft chemicals because these are naturally found in nature. These chemicals do not have chemical residues in hives like wax and etc. If these types of chemicals are used in the hive/bee's boxes, it is recommended to apply soft chemicals and less residual impact of bees.

Formic acid

Formic acid mainly found in the venom of honey bees and is a natural component of honey. This type of chemical is commonly used in India as well as across the world, because at high concentrations, they penetrate the wax capping and effectively kills reproducing mites all over the colonies. Some limitation is that the use of formic acid is mainly temperature dependent and can cause damage to the colony if temperatures higher than 85F because it can increase brood mortality and the potential for queen loss. When used below 50F, formic acid results in low efficacy.

Oxalic acid

Oxalic acid is a mostly naturally-occurring compound found in plants, such as rhubarb, kale, beets, and spinach. As a chemical for mite control, oxalic acid can be used in two formulations: vapor and dribble form. Because it does not penetrate the capping of cell, oxalic acid is most effective during brood less periods making it a useful component to an integrated varroa control program as a winter or early spring method. However, it should not be used as a stand-alone treatment. If overdose or used at regularly, oxalic acid can harm bees by crystalizing in the midgut of larvae, larval mortality also increases, and reducing brood area and reduce the egg laying of queen and nursing activity also reduced.

Lactic acid

Lactic acid is clearly better tolerated by bees and does not cause problems in warmer climatic zones. The disadvantage is that every single comb must be extracted to spray the

bees with the acid. The dosage applied per comb side is 8 ml of 15 percent acid. This treatment can be repeated two times at intervals of seven days.

Thymol

Essential oils are natural compounds distilled from plants. The most popular essential oil for varroa mite control is thymol (from a thyme plant). While thymol treatment can effectively control mites on adult bees, it cannot penetrate the cell cappings, so does not control mites in brood cells. Efficacy of thymol is dependent on colony strength as well as ambient conditions. During treatment, the workers react by emptying cells near the product so this treatment can reduce the overall area of brood in colonies when applied in the spring. In addition, thymol treatment can induce robbing behavior and increase aggressiveness of colonies.

Hops beta acids

Potassium salts of hops beta acids are derived from the hops plant and it is safe for use any time of the year, even during the honey flow. However, it is more effective as a mite control treatment when there is less brood because it does not go through the cell capping. Use during brood rearing requires multiple applications.

Hard Chemicals

Chemical control of varroa mites can be achieved through the use of various acaricides/miticides. Synthetic miticides are generally effective, killing up to 95% of the mite population. Historically, fluvalinate and coumaphos have been the most widely used mite treatments, but mites have developed resistance to these chemicals and residues persist and accumulate in wax. While these two hard chemicals are wrong impact on bees. Miticide residue in wax can harm bees directly and makes bees more susceptible to nosema disease. In addition, these residues can be found in bee products. Synthetic chemicals should be a last resort for beekeepers practicing IPM.

Amitraz

The most popular synthetic/artificial acaricide is amitraz {sold in market as Apivar (R)}. Amitraz does not, in its original form, persist as a contaminant of honey or wax. However, some metabolites of amitraz have been found to persist and there is a synergistic effect of amitraz and viruses that has been linked to increased bee mortality. In addition, resistance to amitraz has been documented, so its efficacy must be monitored closely.