Controlling Nosema Disease in Honey Bees

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Nosema is a disease of the honey bee caused by a single-celled microsporidian parasite that lives in adult honey bees. This disease, called a “silent” killer, has caused serious economic damage in honey-producing regions around the world.

The level of infection varies from colony to colony, apiary to apiary, region to region, and season to season. Money losses are difficult to estimate. On a national basis, however, honey production is diminished by millions of pounds annually.

A survey conducted in the mid-1970's revealed that more than 66% of the apiaries sampled in 43 of the lower 48 States were infected with nosema. The same survey showed that the highest incidence of nosema found in Oregon was on the west side of the Cascade Mountains.

Nosema is the most widespread of all adult honey bee diseases. All adults in a colony can become infected with the parasite. Newly emerged adults are always free of infection, but they are susceptible to inoculation. Nosema is an infection of adult bees and does not infect bee brood.

Spores of the parasite are microscopic. Once eaten, the adult bee, new germinate in the gut. Infection occurs in the cell lining of the intestine and expands rapidly. Other organs of infection include the ovaries, fat bodies, and hypopharyngeal glands.

Infected adults may contain as many as 180 million spores per bee. When infection levels are at their peak, an adult bee produces symptoms that most beekeepers can easily recognize. The best way to confirm the disease is microscopic examination of the midgut for the presence of spores.

Effects on honey bees

The primary effect of nosema infections is to shorten the life span of worker bees. Obviously, this reduces the seasonal efficiency of the colony. Additionally, young workers, whose hypopharyngeal glands are infected with the parasite, don't produce normal amounts of royal jelly. This reduces the ability of a colony to rear brood.

The phenomenon of “spring dwindling,” observed in overwintered colonies and frequently with newly installed packages, can be the result of nosema infection during the critical spring buildup period. Finally, infected queens are often replaced (superseded), further retarding colony growth.

Control methods

Chemotherapy. The most successful, and also the easiest, method of controlling nosema is with the antibiotic fumagillin. This generic bicyclohexlammonium fumagillin is presently

Figure 1.—Feeding recommendations for fumagillin

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sold in the U.S. under the trade name Fumidil-B.

Fumagillin is the only drug approved by the U.S. Food and Drug Administration for the control of nosema disease in honey bees. It most effectively represses nosema when it's fed to bees in sugar syrup. Two less effective means of control are dusting brood combs and feeding antibiotic extender patties that contain fumagillin.

Fumagillin is most effective when administered in two separate feedings: one in the late summer/early fall and another in the early spring. The dosage for a single colony should consist of 4.5 grams of formulated product (2 rounded teaspoons) in 1 gallon of sugar syrup (see figure 1). This amount of formulated product will contain 200 milligrams of fumagillin.

Make up your sugar syrup 2:1 sugar to water (by volume) for fall feedings and 1:1 for spring feedings. First mix the formulated product containing fumagillin in 1 pint of hot water (no more than 120°F); then add it to the sugar syrup.

Newly installed package bees should receive 1 gallon of medicated syrup at installation. However, if inclement weather confines bees to the hive for long periods after installation, administer a second gallon of medicated syrup.

**Thermal sterilization.** Heat treatment of contaminated equipment is also an effective way to decontaminate a potential source of nosema infection. If you uniformly heat contaminated equipment at 120°F (49°C), at 50% relative humidity for 24 hours, it will greatly decrease nosema spore viability without damaging equipment.

Heat-treated combs should contain little or no honey or pollen; keep them in their normal, upright position; and remove any excess comb containing surplus. Don't let the temperature exceed 120°F; higher temperatures could melt combs or cause them to sag within the frames.

After treatment, cool the combs to outside temperatures before removing them from the treatment room. After you install bees on heat-treated equipment, they should receive an initial treatment of 1 gallon of sugar syrup medicated with fumagillin.

**Fumigation.** Acetic acid and ethylene oxide fumigation render spores of nosema nonviable. Remove all bees from the equipment to be fumigated.

When you use acetic acid, place the hive bodies with comb on a floor board outdoors or in an open shed. Place a pad of cotton or other absorbent material, soaked with 1/4 pint (118 ml) of 80% acetic acid, on the top of each super of comb to be treated. Then stack the hive bodies. Seal them with tape if there are gaps between them. Leave them undisturbed for 1 week.

Before you install bees in equipment that's been fumigated with acetic acid, let the supers and combs air for at least 48 hours. For maximum effectiveness, new, bees installed on fumigated equipment should be fed 1 gallon of sugar syrup medicated with fumagillin.

Ethylene oxide is also very effective against nosema spores. This restricted use pesticide can only be used by a licensed pesticide applicator, and only with a fumigator approved by the Oregon Department of Agriculture.

**Nosema spores are completely inactivated when exposed to ethylene oxide at a rate of 100 milligrams per liter for 24 hours at 100°F. Although ethylene oxide is extremely effective, it's neither a practical nor an economic method for nosema control.**

In summary, beekeepers can control nosema infections through good management, using any of the methods described to protect their colonies against almost unseen destruction of the nosema parasite.

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