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Lesser Problems Still Important in California: Public Bee Schools

Africanized Honeybees Health Aspects

"Lesser" Problems Still Important

Recently, I received a call from a beekeeper who noticed that a lot of his colonies were dwindling when they should have been building up for use in almond pollination. He had fed them sugar syrup, intermittently, from late summer to February. He added pollen substitute at the end of December. They weren't consuming the substitute.

Had this just been one or two colonies, the list of possible problems would be nearly endless. However, all the queens couldn't be failing at once. All the colonies couldn't be contaminated that evenly with pesticides. But, they all could be short on pollen, short on nurse bees, or physiologically damaged enough by Nosema apis or Acarapis woodi so that they were not producing much of any royal jelly.

The beekeeper collected two apiary samples in alcohol and sent them to me for examination. His beekeeping peers told him they doubted that nosema disease or tracheal mites were involved.

The beekeeper submitted good samples. The bees had been collected "fresh", not picked up off the ground. Some of the bees had tattered wings and must have been aging foragers. Others looked young with wings that were not worn.

Each bee that was examined contributed its abdomen to a mortar (grinding bowl) containing a little distilled water. The head and fore-legs were pulled off and discarded. The thorax was pinned to the beveled side of a cork stopper and placed under a dissecting microscope.

At a low magnification, around 6X, the exoskeleton around the "neck hole" was torn open with fine tipped forceps. The thoracic tracheae were immediately visible or just behind a small amount of tissue. They were easy to find.

Normal tracheal tubes are nearly transparent. The contents of the tubes is alcohol and there should be no particulate matter in the tubes. When mites are present in the tubes, they have reacted with the alcohol to become creamy white

particles that move when the tube is squeezed.

If the mites have been feeding in the tube for months, dark brown
or black blotching develops. I refer to this as "mite damage", but it is speculated that the dark spots are accumulations of wound healing materials from the bee.

The two samples sent by the beekeeper had 50% and 70% infestations of tracheal mites. Published scientific papers report that infestation levels above 30% cause significant increases in overwintering losses in states and provinces with cold winters. In California, the queen and a handful of workers survive the winter, but the colonies are useless. Apparently, these colonies had "grease patties" in them, so it appears that grease patties are not always effective in keeping tracheal mite levels suppressed.

Returning our attention to the abdomens, they were ground in the mortars with "pestles" (glass grinding rods with a sphere-like swelling on the end). When the tissue debris in solution has been ground into really small parts, it is assumed that the midget cells have been ruptured and the Nosema spores released.

In the lab, I strain the ground bees through two layers of cheese cloth placed on the top of funnels that empty into centrifuge tubes. The tubes are spun at high speed in a clinical centrifuge for about 10 minutes. A "pellet" forms at the bottom of the tube. If there are Nosema spores, they are in the pellet. The "supernatant" (water) is "decanted" (poured off). The pellet is resuspended in an exact amount of water, depending upon how many bees went into the sample. To re-suspend the pellet, the water is sucked in and out of a fine tipped Pasteur pipette using a rubber bulb at the top.

When all the spores are evenly suspended, a very small droplet is placed on a hemacytometer (blood cell counting chamber). The chamber has a grid etched into it, and the number of spores per bee can be calculated from the number seen on the grid.

In the recent samples the average numbers of spores per bee were 22 and 25 million. Published scientific papers report that infection levels at or above 10 million spores per bee can cause queen loss, and brood loss, leading to colony death. At a level of 1 million spores per bee there is a great reduction in royal jelly production, considerable reduction in brood rearing, smaller adult bee populations and much reduced honey crops. The only "up" side to Nosema infections is that they tend to subdue population buildup enough to delay or inhibit swarming. If you want strong bees early in the year, nosema disease must be controlled.

As preachers of "treat only when necessary," extension specialists suggest that someone in each bee-keeping operation purchase and learn how to use a dissecting and

compound microscope. They aren't cheap, but you can get two functional scopes, and an illuminator for the dissecting scope, for much less than the cost of a new computer. Preventing one year of collapse in an apiary should pay for the scopes on almond pollination, alone.

If beekeepers find elevated levels of tracheal mites in their bees, what should they do? If the numbers are high, a menthol treat-ment will help, but only if daily temperatures fall within the range of 70-89° F. From 70-80°, the menthol should be placed on the frames at the top of the brood nest. From 81-89°, the menthol should be placed on the bottom board. Menthol vaporizes too quickly at temperatures above 90° F. Bees and queens are chased out of the hives and many queens do not return.

Once subdued, grease patties usually work quite well at keeping tracheal mites levels low. The patty must be positioned so that it remains in contact with the cluster all year. The extra lipid is not toxic to mites. It apparently coats the bees with extra lipid that interferes with the ability of tracheal mites to find newly emerged bees, their preferred hosts. However, as the bee samples in this example demonstrated, tracheal mites sometimes blow up right through the grease patties. Incorporation of various essential oils into the treatments have been reported to help control tracheal mites, but controlled research studies have met with variable results

Controlling nosema disease is a matter of delivering the appropriate dose of fumagillin in sugar syrup at the right time of the year. By fall, the spore load in the hive should be very low. A few bees in the population are infected all the time, but they defecate outside the hive and the disease barely persists. As fall and winter weather conditions (rain, fog, snow) confine sick bees to the hive when "they have to go", they contaminate the combs with fecal material. It doesn't take many bees to deposit millions of spores. This is not dysentery, so don't expect brown stains on the outsides of the hives.

When the days begin to lengthen (Dec. 21), the bees are stimulated to start building up the population for the next year. House bees clean up the combs. Many of them are inoculated with Nosema spores. With food sharing and deposition of more contaminated fecal material, more and more bees become infected. Then, it is down hill quickly.

The theory of control is to have fumagillin being consumed by the bees over the winter (October to March). In Minnesota, that meant feeding 2 gallons of medicated syrup in September. In California, many beekeepers feed for "stimulation" of brood rearing in late December or early January. This would be a good time to feed fumagillin to the bees. Perhaps a gallon would get

the job done, but only if the bees are not fed a successive batch of unmediated syrup. The bees will blend the syrups and dilute the chemical to a non-effective level.

Diagnoses of tracheal mite infestations and Nosema infections are not beyond the abilities of most beekeepers. If you feel uncomfortable around microscopes and dissecting equipment, let me know and we'll find someone to provide training. In the case of tracheal mites and Nosema a little knowledge goes a long way.

Microscopes and accessories are available from Ward's Biology, 800-962-2660 and from Edmund Scientific, (609)573-06250. Some-times sources of microscopes are

listed in the Yellow Pages, but often those scopes are very expensive.

California Morbidity – November 1998, Monthly Report from Prevention Services, CA Department of Health Services, 714 "P" Street, Sacramento, CA 95824, Division of Communicable Diseases (510) 540-2566.

Africanized Honeybees In California: Public Health Aspects

This report provides an update on the presence of Africanized honeybees (AHBs) in California, on clinical manifestations and medical management of bee stinging victims, and on prevention measures. In 1957, African honeybees (Apis mellifera scutellata), imported to Brazil by a research institution, became feral and mated with established European honeybees (EHBs), resulting in the hybrid AHBs[1]. The "Africanization" process has been expanding northward at a rate of 50-300 miles/year and now encompasses parts of Texas, New Mexico, Arizona, Nevada, and California. Then milder winter and greater availability of floral resources associated with El Nino has likely favored and increased the potential for further expansion of AHBs into North America. Since their arrival in October 1994, AHBs have colonized large portions of Imperial, Riverside, San Bernardino, San Diego and Los Angeles counties, almost tripling their colonized area in 1998. There have been 19 confirmed AHB stinging incidents involving 34 people in California, with no fatalities yet. Incidents occurred (one each) in 1995 and 1996, two in 1997, and fifteen in 1998.

AHBs and EHBs are grossly indistinguishable and individual bees can be differentiated only by morphometry[2] or analysis of mitochondrial DNA[3]. However, AHBs have retained many of the behavioral traits of African bees that contribute to their public health significance[4,5]. AHBs are easily agitated; even slight disturbances, such as movement, odors, or vibrations, may incite an AHB colony to attack in mass, thus distinguishing them from EHBs. AHBs are highly aggressive, and once disturbed, may pursue a victim for up to 0.6 miles and remain agitated for hours[1]. AHBs reproduce and swarm at an accelerated rate, significantly increasing their potential for range expansion. Finally, AHBs are relatively indiscriminate in their selection of nesting habitat and will establish colonies almost anyplace, including unprotected areas where they are easily disturbed.

Clinical manifestations

Both AHBs and EHBs die after stinging. The nature and potency of their venoms are similar[6]. The higher morbidity and mortality associated with AHBs is due to the greater number of multiple sting incidents[7]. The LD_{50} for honeybee venom is about 19 stings per kg[8] (e.g., 1,300 stings for a 150 pound person). The approximate median number of stings which California AHB victims received has been 15 (range: 1-500+). Children, the elderly, and individuals with severe underlying diseases are at increased risk because of their lower tolerance of toxins and/or reduced ability to escape a bee attack.

Symptoms following bee stings vary from mild to severe, and can be classified into three major categories:

1. Local – Pain, pruritus, erythema, urticaria, and angioedema may develop at the site of the sting and persist for several hours to a few days[9]. Single stings to the mouth or neck can be life threatening because of breathing impairment. Dermal necrosis has been reported in a child who had more than 1,000 stings[10].

2. Anaphylaxis[4,5,11] – Even a single sting can precipitate anaphylaxis in persons previously sensitized to bee venom – about 2% of the population[7]. Symptoms are typical and may include widespread edema and urticaria, dizziness, vomiting, and diarrhea within 10-20 minutes of exposure. More severe symptoms include bronchospasm, laryngeal edema, dyspnea, hypotension, (occasionally hypertension), arrhythmia, tachcardia, syncope, seizures, shock and death. Symptoms may exacerbate 6-24 hours after the initial reaction[12]. Also, a serum sickness-type reaction – with fever, angioedema, bronchospasm, joint swelling and arthralgia – may occur up[to 2 weeks after the attack[11,13].

3. Systemic – Multi-organ complications sometimes develop in response to large doses of venom from multiple stingings[4,9,14]. Initial toxic symptoms can resemble anaphylaxis but may also progress to myoglobinuria, hemoglobinuria, rhabdomyolysis, acute renal failure (ARF)[10,15,16], hepatic dysfunction[16], myocardial damage, cerebral and pulmonary edema[15], or acute hemorrhagic pancreatitis[17], up to 10 days after the sting[5]. Laboratory abnormalities, including elevated WBC (up to 25,000/mm^3), occasional anemia, thrombocytopenia and disseminated intravascular coagulation may signal developing systemic complications[4,15]. Serum creatine phosphokinase (CPK) levels appear to be a more sensitive marker of the amount of venom exposure, beginning to increase within hours of the stings and peaking in 2-5 days.

Medical management

Bee antivenin in not currently available, so medical management of AHB victims is entirely supportive and depends on the number of stings and clinical manifestations[4]. Attached stingers should be removed promptly, preferably within 1-2 minutes after stinging, and the affected areas cleansed with soap and water[11,18]. The method of removing stingers is less important than timeliness of their removal[18,19]. An estimate of the amount of toxin the victim received may be made by tallying the number of stingers removed[4].

In patients with a few stings and/or only a local reaction, topical and oral medications may be administered to reduce pain and swelling (e.g., ice packs, astringents, analgesics, anti-puritics)[4]. Patients with multiple stings (especially children and the elderly) as well as those with anaphylactic (or systemic toxic) reaction, should be hospitalized for observation and treatment. Most frequently, treatment includes topical medications, oral/ intravenous fluids, antihistaminics (both H_1 and H_2 blockers), oxygen supplementation, corticosteroids and epinephrine (or glucagon, for patients on beta-blockers)[4,11], with respiratory and cardiovascular support the principal objective. Other treatment occasionally recommended includes bronchodilator aerosols (e.g., albuterol solution), antiemetics, aminophylline, and/or endotracheal intubation[5,11]. Laboratory evaluation should include CBC and differential, serum chemistry (including CPK) with electrolytes, arterial blood gases, urinalysis, ECG, thoracic radiography, and prothrombin time[4].

Treatment of multiple sting victims represents a serious challenge because of limited medical information and experience, and specialty consultation is indicated. Physicians need to be particularly aware of the potential for AHB patients to experience severe allergic and toxic reactions, and for complications developing up to several days after the stinging incident[9,11]. Patients should be monitored closely for up to two weeks, or until all laboratory work normalizes, following apparent clinical recovery. The most aggressive management for severe cases is plasmapheresis (or exchange transfusion) which helps to remove circulating venom and/or mediators of inflammation[14], especially if done within 48 hours of stinging. Haemodialysis, although less effective, is an alternative modality (within the first 48 hours) if plasmapheresis is not available. Other treatment options include aggressive intravenous fluids (e.g., 0.9 normal saline as a 20 ml/kg bolus followed by mannitol 25 gm IV ((0.5 gm/kg child)), epinephrine (IV push 0.1-1.0 ml of 1:10,000 over five minutes), and urine alkalinization (in case of myoglobinuria). Diuretics may be considered in cases of pulmonary or cerebral edema[17]. Dialysis has been recommended early in treatment of ARF[14,15]. For serum sickness, treatment includes systemic corticosteroids with antihistamines and analgesics[11].

Long-term sequelae to multiple stings are in-frequent[14] but may manifest as cutaneous symptoms. Photosensitivity, fatigue, anorexia, or diarrhea. Consultation with an allergist for bee venom testing is indicated to determine the need to carry injectable epinephrine or use venom immunotherapy[4].

Prevention

Although AHBs have been associated with numerous stinging incidents in humans in Latin America and USA, fatalities remain relatively rare[5,7]. Unfortunately, earlier sensationalized media reports of massive bee attacks in Latin America have given AHBs their “killer” reputation and created unwarranted anxiety in the public[1,19]. In fact, adequate preparation and prompt response can greatly reduce the number of serious stinging incidents and fatalities[1,4]. Several measures can be taken by individuals to reduce their risk of AHBs[4,5,7].

1. Avoid direct contact with, and excessive motion or noise around, bee colonies. Never attempt to move or destroy feral beehives, but report their location to the authorities.

2. When outdoors near bee colonies, wear shoes, long pants, and long sleeves. Avoid wearing perfumes and keep pets on leash.

3. Eliminate sites for possible colonization including holes and defects in exterior walls and junk piles in yards. Inspect premises routinely to identify any new colonies.

4. Persons attacked by bees should immediately run for shelter, covering their faces to prevent airway stings. Witnesses to a bee attack should immediately contact authorities and keep other people and pets away. Only trained personnel, wearing full protective gear, should attempt to rescue a victim when bees continue to swarm.

5. Persons with potential occupational exposure to AHBs (e.g., first emergency responders, landscapers, and park rangers) should have special training on this topic. All individuals with a history of systemic reactions to bee stings

should consult an allergist to determine the need for venom immunotherapy and have continuous access to an anaphylaxis treatment kit.

To assist state and local agencies with surveillance and movement of AHBs, multiple stinging incidents should be reported to the County Agricultural Commissioner for identification.

As AHBs extend geographically in California, an increase in cases of allergic and toxic reactions to bee attacks can be expected. The future impact of AHBs on public health will depend chiefly on the frequency and intensity of contact with AHBs, the extent of public education on prevention methods and risks associated with AHBs, the availability and capacity of emergency response services and medical assistance, and the availability of trained AHB control teams to remove or destroy their hives[1,7].

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Bee Schools

The Sacramento Area Beekeepers Association offers two beekeeping workshops in the early spring of 1999. The instructor for Beginning Bee-keeping is Randy Oliver, a commercial beekeeper and queen producer from Grass Valley. Beginning Beekeeping is a one-day workshop, Saturday March 20, 1999, 8:00 a.m. to 4:30 p.m. at the Sacramento County Cooperative Agricultural Extension Auditorium, 4145 Branch Center Road, Sacramento, CA. The cost is $25 per person. A second Beginning Beekeeping workshop will be offered Saturday April 17, 1999, 8:00 a.m. to 4:30 p.m. at the same location above.

The Intermediate Beekeeping workshop instructor is Dr. Eric Mussen the Extension Apiculturist at the University of California at Davis and noted authority on beekeeping. This workshop is one day Saturday, April 24, 1999, 8:00 a.m. to 4:30 p.m. at the Sacramento County Cooperative Agricultural Extension Auditorium, 4145 Branch Center Road, Sacramento, CA. The cost is $25 per person.

Please register as soon as possible. Each class is limited to 40. Attendees are to bring a beekeeper's veil. For additional information please telephone Pam or Nancy at 916-451-2337, Tuesday through Saturday between 10:00 a.m.-4:00 p.m.

Sincerely,

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