**Mar./Apr. 2002**

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Winter Losses, Again

Beekeepers from all over California were disappointed or devastated this early spring, as colonies that seemed so populous in the fall and early winter dwindled severely or died fairly quickly in January. This phenomenon was not restricted to hobby, sideline or commercial beekeepers. It was "global."

That suggests that the cause of the problem was not likely pesticide poisoning, and tests for tracheal mites and *Nosema* determined that only a small portion of the tested bees had enough of those parasites to be detrimental. So, what might have been the cause?

The breadth of the problem suggests that we have to look at the "big picture." In retrospect, it appeared that the colonies did fine until they reached the point in time when the summer and fall bees were dying of old age and the "winter bees" should have kept the colonies going. Where were those healthy winter bees? It doesn't look like they were around.

Backing up to last summer and fall, how were the nectar and pollen sources? Did we have a really good honey year? Did we have the right amounts and timing of rain to support good growth and bloom of late summer and fall plants? I don't think so.

Beekeepers who saw a lot of dwindling also reported having some "loads" that seemed to be OK and built up

well during almond bloom. Those bees had been moved into certain locations where the bluecurls, tarweed, etc. were pretty good (an exception last year).

Now we have to follow the nutrition story a bit further. If fall feed was nutritionally inadequate, then the late summer bees could not adequately feed the coming winter bees. Nutritional stress is extremely hard to see, because the bees look OK while the stored food reserves in their bodies just aren't there. Stressed bees are much more susceptible to diseases and parasites, as well as the vagaries of weather (like below freezing temperatures in February and March). And, what about stored pollens? If they weren't available to feed the winter bees as larvae, they could not have been stored in abundance to feed the spring brood, either. That means more stressed bees.

Although some of the colony populations appeared to die off in a manner reminiscent of *Varroa* infestations, *Varroa* mites were few and far between. I don't think that they were much of a factor in this winter's losses. That leaves tracheal mites and *Nosema*. Most beekeepers know that tracheal mites can be kept in check most of the time with "grease patties." So, I am going to skip that pest. The next article deals with *Nosema*, since so many people asked me about it this year.

## Diagnosing and Treating Nosema Disease

Causative Agent - Nosema disease is caused by a single-celled animal (protozoan) named *Nosema apis*. *Nosema* species are obligate, intracellular parasites (microsporidians) of specific animals. *Nosema apis* cannot be reared in laboratory culture, as is possible with most bacteria and fungi. It can multiply only in living honey bee midgut cells.

Life Cycle - When a bee ingests *Nosema* spores, the spores are filtered out of the honey sac by the proventricular valve and released into the midgut. The exact physical and chemical conditions of the honey bee midgut stimulate germination. The organism penetrates a midgut cell and grows by absorbing nutrients from that cell. The parasite increases in size until it is large enough to divide in half. Each new parasite continues this process until the nutrients in the cell are exhausted. That stimulus triggers sporulation. In about six to ten days, approximately 100 new spores are formed in a parasitized cell. The nutrient-depleted cell ruptures. The

spores are released into the midgut lumen to start the process, again. Heavily infected worker honey bees can contain more than 50 million spores. Damaged intestinal tissue is subject to secondary infections and "dysentery" (brown diarrhea spots on the exterior of the hive) is a common sign of this disease. Diseased bees also defecate inside the hive, contaminating combs with millions of infectious spores.

Effects on the Colony - *Nosema* infections have specific negative effects on honey bees. Worker bees that ingest spores when they are less than a week old normally do not produce royal jelly. Their life spans will be reduced up to 78%. Young queens that ingest *Nosema* spores normally are superseded within a month. In climates where winter prohibits supersedures for many months, colonies often go queenless and dwindle away in early spring. Experience in Minnesota suggests that an average of one million or more spores per bee can lead to increased winter losses. When high percentages of workers are infected and spore counts exceed ten million spores per bee, significant numbers of colonies will die or lose queens during the winter. Any level of infection leads to very slow spring build up, even when forage and temperatures are ideal. Frequently, reduced honey yields follow this poor population build up.

Diagnosis - Nosema disease is difficult to diagnose without using laboratory equipment. Decapitating a bee and pulling out the last abdominal segments usually will remove the intestinal tract intact. A healthy midgut is tan in color, with concentric constrictions. An infected midgut will become swollen, whitish and lose its visible constrictions. However, other causes of dysentery, such as ingesting honeydew, fermented syrups; indigestible sugars in cola syrups, molasses and kitchen corn syrups; can result in similar intestinal changes.

Scientists use a specific methodology to determine levels of infection. Known numbers of severed abdomens are homogenized, using a mortar and pestle. The homogenate is sieved through two layers of cheesecloth into calibrated centrifuge tubes. The tubes are spun in a clinical centrifuge at the next to the highest speed for six minutes to drive the spores to the bottoms of the tubes. The liquid (supernatant) is poured off (decanted) and the plug (pellet) at the bottom is resuspended in a specific volume of water (one ml per bee). The plug

is broken up well (resuspended) by sucking the water in and out many times through a small-tipped disposable pipette. Then a small droplet of the suspension is placed on a blood cell counting chamber (hemocytometer). The number of spores counted over certain areas of the chamber grid can be converted to millions of spores per bee. If infection levels are below 10,000 spores per bee, no spores will be seen and the diagnosis is determined to be "not detected." That does not mean that there is no infection.

Treating Infected Colonies - Medicating for *Nosema* is based on the most appropriate times to prevent comb contamination and development of disease in bees that clean up fecal deposits from combs while expanding the brood nest. Later in the summer, when bees are defecating outside the hive, *Nosema* usually cannot be detected. A few bees are infected all year, but only the diseased late season bees are of consequence. When they develop high levels of infection, they defecate on the combs in October, November and December, then die.

Brood rearing never ceases in many parts of California over the winter, but as the days begin to lengthen in late December, the bees are stimulated to pick up the pace. Availability of nectars and pollens, along with warming temperatures, accelerate brood rearing. It is at this time that many bees "cleaning and polishing" cells, in anticipation of egg laying, become infected. How severe the disease will get in the colony population depends upon the initial spore load (amount of contamination) and how much of the time the bees are confined to the hive by non-flight weather. So, *Nosema* levels can vary significantly from year to year.

In order to "cover the bases" in Minnesota, if a colony population had one million or more spores per bee in April, we fed it two gallons of fumagillin-medicated, heavy (two parts sugar : one part water) syrup in September. If we had to "feed for weight," that was done earlier, so that the early syrup could be "ripened" and stored before the medicated syrup was applied. If the medicated syrup is mixed with other, unripened syrup, it can be diluted to ineffective concentrations. We anticipated that the medicated syrup would be consumed throughout the winter. Spore deposition on combs in early winter would be reduced and the parasite could not reproduce in medicated bees that became inoculated in the spring. The syrup would be

consumed, totally, long before the bees produced any honey.

Although we have not conducted the experiments, it is likely that two gallons of medicated syrup may not be required in most of California. *Nosema* levels are not as high in California as they are in Minnesota. Combs should not be so badly contaminated during the winter months, since intermittent flight is possible. Therefore, first treatments with medicated syrup should coincide well with the normal practice of providing colonies with "stimulative" syrup and pollen substitute feeding in late December and January. A gallon, or so, of medicated syrup probably will provide protection until the bees are flying well in March and April. Heavy nectar flows from *Manzanita*, *Eucalyptus*, mustard and radish might dilute the medication significantly, as would later feeding with non-medicated syrup.

Expected Results of Treatment - Beekeepers who have fed fumagillin to field colonies in the past have noted significant differences in colony build up. In fact, many of them stopped using fumagillin. The colonies built up too quickly and swarm control became nearly impossible.

I am happy to discuss *Nosema*, its consequences in colonies, and treatments. I can be reached by telephone at: (530) 752-0472 or by email at: ecmussen@ucdavis.edu. Copies of this "Bee Brief" can be down-loaded at: http://entomology.ucdavis.edu/faculty/mussen/beebriefs/index.cfm.

## NHB Still Here, Barely

The national referendum on the continuation of the National Honey Board kept the organization in effect by a really close margin. Producers and packers voted 51.47% to continue the program. That vote also represented 50.77% of the honey volume produced and imported in the U.S.

Please take a good look at what the Board offers to do and take advantage of those parts of the program that are of most value to you. You are paying for those services!

## Native Plants and Honey Bees

Conservationists and beekeepers are interested in the interactions of honey bees with nectar and pollen producing plants in California. One polar view is that honey bees are non-native, pollinate mostly introduced

"weed" species, and eliminate native pollinators through competition for food. At the other end of the spectrum is the knowledge that honey bees will visit most blooming plants for food and, if nectar is abundant, will produce a honey crop. While honeys vary in color and taste depending upon floral source, any native or introduced nectar and pollen sources that will preserve honey bees throughout the year are likely to be acceptable to the beekeeper.

A number of agencies and organizations are cooperating in an effort to "restore" regions of the California Central Valley to its "original state." The major emphases are 1. replacing non-native vegetation with native plants and 2. encouraging native animals to return to their former ranges. The result has been eviction of beekeepers from apiary locations that have been used for decades as seasonal spots for rebuilding populations following the stresses of commercial pollination or for producing honey.

While removing this non-native pollinator from an environment may sound rational at first, it may not be the best idea. In most cases, it is not the presence of honey bees that has depressed or eliminated the populations of native pollinators. In fact, no studies have shown that honey bees eliminate native pollinators. In some cases the populations of native pollinators have been reduced by honey bee competition, but following removal of honey bees the native bees built back to usual levels in a couple years.

Coincidental with the introduction of non-native plants and honey bees into the environment, natural habitats were altered in many other ways. With honey bees, if we provide them with an adequate hive and food sources, they are likely to survive. However, native pollinators can be very particular about the environment in which they can exist. If their nesting habitat is disturbed, modified or destroyed, they cannot live in the area, despite an abundance of food plants. In many California locations, it is habitat alteration or destruction, not lack of food, which eliminated the native pollinators.

In cases where habitats are so degraded that some native bee populations have been reduced or eliminated, honey bees may be essential to foster initial re-establishment of native plant populations. Those plants provide food and shelter for wildlife and assist significantly in erosion control.

Until the habitat is restored adequately to meet the requirements of native pollinators, it is likely that the presence of honey bees will be much more beneficial than detrimental in keeping the California native plants pollinated and reproducing. Thus, honey bees should be solicited for, not banned from, restoration areas. A list of over 130 native California plants visited, and likely pollinated, by honey bees follows.

## California Native Plants Visited (and Probably Pollinated) by Honey Bees

Excerpted from Nectar and Pollen Plants of California (Bulletin 517) by G.H. Vansell (1941), UC Berkeley, plus personal observations of Dr. Robbin W. Thorp, Emeritus Professor, UC Davis
Updated according to the CalFlora web site – June, 2001 and the Jepson Manual of Higher Plants of California, 1993, edited by James C. Hickman

Alder – *Alnus* spp.

Antelope brush - *Purshia tridentata* (Pursch.) DC.

Arrow-weed – *Pluchea sericea* (Nutt.) Cov.

Asters – *Aster* spp.

Azalea – *Rhododendron* spp.

Barberry – *Berberis* spp.

Beardtongue - *Penstemon* spp.

Blackbrush – *Coleogyne ramosissma* Torr.

Black sage – *Salvia mellifera* Greene

Blue palo verde - *Cercidium floridum* A. Gray

Bluecurls – *Trichostema lanceolatum* Benth.

Box elder – *Acer negundo* L. var. *californicum* Sarg.

Buckwheats – *Eriogonum* spp.

Buffalo berry – *Shepherdia argentea* Nutt.

Burnet – *Sanguisorba* spp.

Button bush – *Cephalanthus occidentalis* L.

Cactus - *Opuntia* spp.

California bay – *Umbellularia californica* Nutt.

California broom – *Lotus scoparius* (Nutt.) Ottley

California buckeye – *Aesculus californica* Nutt.

California coffeeberry – *Rhamnus californica* Esch.

California corn lily – *Veratrum californicum* Durand

California figwort – *Scrophularia californica* Cham. & Schldl.

California hazelnut – *Corylus cornuta* var. *californica* (A. DC.) Sharp

California scale-broom - *Lepidospartum squamatum* Gray

Camas – *Camassia* spp.

Carpet grass – *Phyla* spp.

Cascara sagrada – *Rhamnus purshiana* DC.

Catclaw - *Acacia greggii* A. Gray

Chamise - *Adenostoma fasciculatum* Hook. and Arn.

Checker mallow – *Sidalcea malvaeflora* (DC.) Benth.

Chia - *Salvia columbariae* Benth.

Chinquapin – *Chrysolepis chrysophylla* (Hook) Hjeluq.

Cinquefoil – *Potentilla* spp.

Coffee weed - *Sesbania exalata* (Raf.) Cory

Common cocklebur - *Xanthium stumarium* L.

Common meadowfoam – *Limnathes douglasii* R. Br.

Common rabbit brush – *Chrysothamnus nauseosus* (Pall.) Britt.

Cotton-thorn - *Tetradymia spinosa* Hook. and Arn.

Cottonwood – *Populus* spp.

Coyote brush – *Baccharis pilularis* DC.

Coyote mint – *Monardella villosa* Benth.

Creeping sage – *Salvia sonomensis* Greene

Creosote bush – *Larrea tridentata* (DC.) Cov.

Dalea – *Dalea* spp.

Death-camas – *Zigadenus venenosus* Wats.

Desert peach – *Prunus andersonii* Gray

Dodder – *Cuscuta* spp.

Douglas hawthorn – *Crataegus douglasii* Lindl.

Elderberry – *Sambucus* spp.

Fiddleneck – *Amsinckia* spp.

Fireweed – *Epilobium angustifolium* L.

Flax – *Linum* spp.

Forest clover – *Trifolium breweri* Wats.

Gilia – *Gilia* spp.

Golden fleece – *Ericameria arborescens* (Gray) Greene

Goldenrod – *Solidago* spp.

Grape – *Vitis* spp.

Honey mesquite – *Prosopis glandulosa* Torr.

Honeysuckle – *Lonicera* spp.

Horsemint – *Agastache urticifolia* (Benth.) Ktze.

Hound's tongue – *Cynoglossum* spp.

Jackass clover – *Wislizenia refracta* Englem.

Keckiella - *Keckiella* spp.

Laurel sumac – *Malosma laurina* (Nutt.) Abrams

Lemonadeberry - *Rhus integrifolia* (Nutt.) Brewer and S. Watson

Lily - *Lilium* spp.

Locoweed – *Astragalus* spp.

Lupines – *Lupinus* spp.

Manzanita – *Arctostaphylos* spp.

Maples - *Acer* spp.

Mexican devilweed - *Chlorocantha spinosa* (Benth.) G. Nesom

Milkweed – *Asclepias* spp.
Mistletoe – *Phoradendron* spp.

Mojave stinkweed – *Cleomella obtusifolia* Torr. & Frem.

Mountain misery – *Chamaebatia foliolosa* Benth.

Mule fat - *Baccharis salicifolia* (Ruiz Lopez and Pacon) Pers.

Nightshade (some) – *Solanum* spp.

Oak – *Quercus* spp.

Onion – *Allium* spp.

Our Lord's Candle – *Yucca whipplei* Torr.

Pacific madrone – *Arbutus menziesii* Pursh

Peak rush-rose – *Helianthemum scoparium* Nutt.

Phacelia – *Phacelia* spp.

Poison oak – *Toxicodendron diversilobum* (T. & G.) Greene

Poppy – *Eschscholzia* spp.

Purple sage – *Salvia leucophylla* Greene

Raspberry – *Rubus* spp.

Red maids – *Calandrinia caulescens* H.B. K. var *mensiesii* Gray

Red shank - *Adenostoma sparsifolium* Torrey

Redwood – *Sequoia sempervirens* (Lamb. Endl.

Rocky mountain bee plant – *Cleome serrulata* Pursh.

Sage – *Salvia* spp.

Sagebrush – *Artemisia* spp.

Screw bean mesquite - *Prosopsis pubescens* Benth.

Sea dandelion - *Agoseris* spp.

Serviceberry – *Amelanchier* spp.

Sierra coffeeberry - *Rhamnus rubra* E. Greene

Sierra milkwort – *Polygala cornuta* Kell.
Smartweed – *Polygonum* spp.

Smoke tree - *Psorothamnus spinosus* (A. Gray) Barneby

Snowberry – *Symphoricarpos albus* Blake

Soap plant – *Chlorogalum pomeridianum* (Ker) Kunth

Spanish clover – *Lotus purshianus* (Benth.) Clem. & Clem.

Spikeweed – *Hemizonia* spp.

Spiny cocklebur – *Xanthium spinosum* L.

Spiny redberry – *Rhamnus crocea* Nutt.

Strawberry – *Fragaria* spp.

Sugar bush - *Rhus ovata* S. Watson

Sunflower – *Helianthus* spp.

Tan oak - *Lithocarpus densiflorus* (Hook and Arn.) Rehder.

Tarweed – *Hemizonia* spp.

Toyon – *Heteromeles arbutifolia* (Lindl.) Roemer

Tule mint - *Mentha arvensis* L.

Turkey mullein – *Eremocarpus setigerus* Benth.

Turpentine weed - *Trichostema laxum* A. Gray

Vetch – *Vicia* spp.

Virginia creeper – *Parthenocissus vitacea* (Knerr.) Hitchc.

Wallflower – *Erysimum* spp.

Walnut – *Juglans* spp.

Wax myrtle – *Myrica californica* Cham. & Schldl.

Western false-indigo – *Amorpha fruticosa* L.

Western goldenrod - *Euthamia occidentalis* Nutt.

Western redbud – *Cercis occidentalis* Torr.

White sage – *Salvia apiana* Jepson

Wild lilac – *Ceanothus* spp.
Willow – *Salix* spp.

Wood sorrel – *Oxalis* spp.

Yerba santa – *Eriodictyon californicum* (H. & A.) Torr.

Yellow bee plant - *Cleome lutea* Hook.

Yellow palo verde – *Cercidium microphyllum* (Torr.) Rose & Johnston

If you wish to obtain a copy of this article for your own use or distribution, I suggest that you go to my Web page and print it from there. That url is: http://entomology.ucdavis.edu/faculty/mussen/beebriefs/index.cfm.

## Organic Beekeeping Conference

Organizers will be conducting a two-day conference on organic beekeeping at the Pfeiffer Center, in Chestnut Ridge, New York, on Friday and Saturday, May 3rd and 4th, 2002.

The sessions deal with "meeting the intrinsic needs" of honey bees. Presenters are Thomas Radetzki, a bee inspector and "bee illness" consultant in Germany, and Gunther Hauk, founder of the Pfeiffer Center for Biodynamics and Environmental Studies. Gunther has kept honey bees for 20 years and his colonies survive "without medication."

Many of the lecture topics will deal with the generic question, "Are the things that me do to manage honey bee colonies counter-productive?" Organic solutions to mite problems will be discussed.

Conference fees are $135 ($150, late). That includes lectures, snacks, and six organic/biodynamic, mostly vegetarian meals. Accommodations are in nearby hotels.

For more information and registration, call (845) 352-5020, Ext. 20, or email: info@pfeiffercenter.org.

## Installation of Packages

Years ago the California Bee Breeders wrote up "instructions" for installing and taking care of package bees. That text was revised and I am including it here for those who may be installing packages in the near future.

"Your packages of bees will usually be shaken the day of shipping. Request your postmaster to call when packages arrive at the post office; your phone number will be added to the address label. Beekeepers usually go to the post office to pick up packages first thing in the morning.

Until installation, keep the packages in a cool, shady, protected area with good ventilation and some air movement. The ideal condition for packages is to have all bees clustered near the queen, who is in her cage at the top of the package. If the bees become too warm, they will run on the screens. To create the cluster effect again, spray a fine mist of water through the screen onto the bees. They not only will re-cluster but also get a drink.

Generally, packages are installed into the hives during early evening hours or at sunset. If it is necessary to install earlier in the day, however, select a densely shaded area. For the protection of new colonies and to prevent robbing, the entrances of the hives should be mostly closed with grass or burlap, except for about two inches. Continue to use the Apistan® strip from the package to help with *Varroa* mite control.

To install the package, remove three center frames from the hive. Remove the package feed can and the queen from the package. To reduce flying, lightly spray the package and hive with water mist before shaking the bees from the cage. Shake the bees into the hive. In approximately three to five minutes, the bees will have crawled up sufficiently so that you can carefully replace the three frames. Small puffs from the smoker drifting across the bees will calm them and make them quite manageable.

Check the queen. Remove the cork from the queen cage. Carefully keeping the queen inside the cage, place a very small amount of candy or granulated honey into the hole (Editor's note - **soft** mini-marshmallows work OK). Place the queen cage horizontally between the two center frames, one inch from the top, with the screen side down, so that the bees can continue to care for the queen through the screen until she releases.

If bees start crawling over the top edges of the super, use a small amount of smoke and brush them back inside the hive and away from the edges of the super. Replace the lid and feed with sugar syrup, even if there is sufficient honey in the hive. The bees will settle and become established before flying the next morning.

In five to seven days, check the colony for eggs and larvae, and remove the empty queen cage. Keep well fed for rapid buildup. As colony size increases, remove the entrance blockage. It is possible to work with bees and get no stings when you

are attired in properly fitted beekeeping clothing along with veil, gloves, and sleeves.

**Enjoy your hive!"**

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