The Bee Line

Newsletter of the Oregon State Beekeepers' Association

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IN THIS ISSUE...

Image above: A whirring-winged visit to *Astragalus sinicus*. The honey flow is on! (Image from postcard published by Tamagawa University, Institute of Honey Bee Science. Courtesy of Sheryl Johnson.)

Front story: This article appeared in the June 2009 issue of *American Bee Journal* (volume 149, pages 573–575) and is reprinted here with permission from *American Bee Journal*. The authors are, respectively, Emeritus Professor of Entomology, Department of Horticulture, Oregon State University; Professor, Department of Agricultural Economics and Economics, Montana State University; and Professor, Department of Agricultural Economics, North Carolina State University.

HONEY BEE COLONY MORTALITY IN THE PACIFIC NORTHWEST (USA) WINTER 2007/2008

Michael Burgett, Randal Rucker, and Walter Thurman

Since the winter of 2006/07 there has been intense concern in the scientific community and the media regarding reports of elevated mortality of honey bee colonies in the United States, as well as internationally. This phenomenon has been termed Colony Collapse Disorder (CCD). Numerous agencies have ongoing research projects the goals of which are to discover the cause(s) of increased colony loss. Reported estimates of losses during the winter periods of 2006/07 and 2007/08 have been roughly one-third of the honey bee hives in North America (Pernal, 2008; van Engelsdorp et al., 2007; van Engelsdorp et al., 2008). Most apiculturists in the American honey bee research community agree that CCD is multi-factorial, and at least as a hemispheric phenomenon. No single causative agent has yet to be identified, although several new pathogens (not previously known to be in the United States) have been identified.

One important question related to the impacts of CCD has been largely ignored by the media: "what was a normal colony loss prior to the arrival of CCD?" This is not an easy question to answer for at least two reasons. First, there are no known published reports that directly addressed this question prior to the 1990s. Second, those within the various beekeeping communities would agree that colony losses were severely elevated following the North American arrival of two important species of honey bee mite parasites (*Acarapis woodi* and *Varroa destructor*) in the mid- to late-1980s. Starting about 1986 American beekeepers began experiencing serious colony losses at levels comparable to those being reported today for CCD. Fortunately, for both of these mite parasite species, the research community was able to develop tools (largely miticides) that allowed beekeepers to reduce mite related colony losses to acceptable levels. Research efforts for effective mite controls, (especially with reduced chemical intervention), are still on-going.

Prior to the arrival of the parasitic mites in North America, good beekeeping meant keeping your winter losses below 10% of the total hive numbers of the previous late-summer and autumn. Before the arrival of the parasitic mites, most colony losses were attributable to a combination of factors, such as starvation, queen failure, known pathogens (e.g., American foulbrood), pesticides, and problems

Continued on page 8

The Bee Line

The Bee Line is the official publication of the Oregon State Beekeepers' Association. The newsletter is published ten times a year, and subscriptions are included with membership in OSBA.

Please send news about your bees and your experiences in keeping them, as well as corrections, letters, comments, photographs and stories (old and new), interviews, and requests for advertising to: Editor, *The Bee Line*, 4803 SE Woodstock Blvd Ste 157, Portland OR 97206; e-mail: osba.newsletter@gmail.com.

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Please submit copy by the 10th of the month prior to publication. The next issue will be the August 2009 issue. Contact the Editor with any questions or concerns.

Many thanks!

MESSAGE FROM THE PRESIDENT

Last month I stated that the honey flow was a little late this year. I also wrote that by the time you read the May *Bee Line* you would be well on the way to your best honey crop ever. My wife says I am always a pessimist. I say that is why I am seldom disappointed. We may not get the best honey crop ever, but the past few weeks have given us the best start I can remember. By the first of June many beekeepers reported they already have more than half their average crop. I have also gotten reports of areas where the weather seems to have kept the bees in and the nectar out. So, as usual, the honey crop seems to be hit and miss.

One of the things hobby beekeepers don't get to experience is the annual migration from Oregon to California and back. Another less well-known experience is the migration to Central Oregon. The carrot seed industry draws over ten thousand beehives from thirteen or so beekeepers during late June through August to Madras, Oregon. Central Oregon Seeds Inc. grows the seed under contract for companies all over the world. The requirements for bee strength and exact timing are much greater than the almost leisurely pace in California. It is important to look over the fields where bees will be placed. Taking a truck loaded with bees while pulling a forklift trailer is not the time for the first look at a narrow road with a canal on one side and a five foot drop on the other. One of the things that makes it all worthwhile is getting all the beekeepers together for a great barbeque and storytelling in the middle of June. I just returned from hearing a few new tales of danger and wonder. As usual, hearing a great tale for the ninth time and acting like it was the first time it had been told was the greatest part of friendship.

Something all of us can experience happened to me this past week. We started to extract our honey crop. We had been putting on supers with foundation in all of the frames for the past week or two. With the blackberry flow just starting, we needed honey supers in a desperate way. We have a building dedicated to our extracting setup. So starting to extract should be a quick, easy job. Of course we planned to make a few changes. Just add a new six-hundred-gallon tank to the system. This had been in the planning for several years. We decided to start on Monday to be ready to extract by the end of the week. What luck, the plumber showed up one day late. (The fish were on a bite in Oregon City.) He did a great job and all we had left to do was change the pipes that move the honey from the extractor and tank to tank. This is where the frustration comes. How many times can you mismeasure, forget an elbow, or buy the wrong part? I made more than ten trips to town

on Wednesday. Good thing I don't live more than three miles from town—unlike many of you. The meadowfoam honey was all extracted when I came home from the barbeque on Thursday. It pays to have a good crew.

Is your bee equipment working for you? Come to Seaside for the Northwest Corner Beekeeping Conference this November. Many vendors will be there to show the equipment that will save you time and maybe a few dollars.

—Chuck

Northwest Corner Conference: November 19–21

FOR DONATIONS TO THE NORTHWEST APICULTURE FUND FOR HONEY BEE RESEARCH, EXTENSION AND EDUCATION

- Make your check out to: **OSU FOUNDATION**
- On the memo line, take care to write: **THE NORTHWEST APICULTURE FUND FOR HONEY BEE RESEARCH, EXTENSION AND EDUCATION**
- Mail your donation to the: Oregon State University Foundation at 850 SW 35th St, Corvallis OR 97333-4015

If you have any questions regarding details of the fund or how to donate, please contact Kenny Williams, Chairman of the OSBA's Endowment Fund, at (541) 456-2631.

IMPORTANT: Making your check out only as described above ensures that your donation is correctly applied to the appropriate Endowment and not to any other program.

NUC OBSERVATION HIVE

Dewey M. Caron

When we think observation hive, the idea of 1–3 frames behind parallel glass/plastic windows comes to mind. John Eichorn's beekeeping class at Lane Community College (Cottage Grove) has established a nuc colony for observation instead. Everyone at the college can observe it! The nuc was established in a standard Langstroth brood box, but sited within a glass-walled atrium in the center of the campus building. Students passing to and from class frequently pause to observe the entering and exiting foragers from the safety of the hallway. In addition, the staff have a prime viewing location from their break lounge.

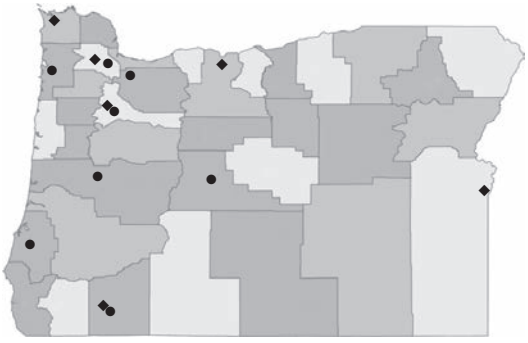
Instructor John Eichorn shows a frame of bees (upper image) and the nuc observation hive in a standard brood box (lower image) to emerging beekeepers enrolled in his class at Lane Community College (Cottage Grove).

Students in the beekeeping class, which meets every other Saturday for 3 hours, have been managing the growing nuc in the central atrium as part of their hands-on experiences. Most of the dozen enrolled are *newbees* who started with a package from GloryBee, a swarm capture, or a nuc transfer from local commercial beekeeper Larry Painter. One class participant has eleven colonies and another has several years experience.

The class is primarily hands-on. Each session includes examining the atrium nuc and colonies in nearby local apiaries. I had the opportunity to discuss bee losses and the role mites may play in the epidemic during the May 30th class. Instructor Eichorn, known as the *king bee* by class members, has many years of bee experience, the last 12 of which have been in Oregon. This is his first experience at teaching beekeeping. His current class expires June 13th, but he begins a summer beekeeping class on June 27th (Pollinator Week!). Fees are $4 per contact hour, so at $72 the course is a big bargain for Lane County beekeepers.

An interesting note is that the Lane County group, now regularly attracting over 70 to monthly meetings, began at Lane Community College 35 years ago as an outgrowth of a beekeeping class taught by Dick Turanski, owner of GloryBee Foods.

OREGON STATE BEEKEEPERS' ASSOCIATION RESOURCES



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ccbees@gmail.com

South Coast: Open

Southern Oregon: Floyd Pawlowski
415 Pompadour Dr, Ashland; (541) 482-4797

Willamette Valley: Harry Vanderpool
7128 Skyline Rd S, Salem; (503) 399–3675
shallotman@yahoo.com

OSBA REGIONAL ASSOCIATIONS

Central Oregon Beekeepers

Meets 6:30 PM, third Tuesday, Bend
Deschutes Public Library, Hutch Rm
President: Dennis Gallagher
(541) 389-4776
Secretary/Treasurer: Glenda Galaba
(541) 383-1775

Coos County Beekeepers

Meets 6:30 PM, third Saturday (except December)
Olsen Baxter Bldg, 631 Alder St, Myrtle Pt
President: Shigeo Oku; (541) 396–4016
Vice President: John Gardner; (541) 572–3847
Secretary: Bobbi Gardner; (541) 572–3847
Treasurer: Jane Oku; (541) 396–4016
jane_oku@hotmail.com

Lane County Beekeepers

Meets 7:30 PM, third Tuesday, Eugene
EWEB Meeting Rooms, 500 E 4th Ave
President: Katharine Hunt; (541) 607–0106
cwhunt@uoregon.edu
Vice President: Judy Scher; (541) 344–2114
judy_scher@catdreams.com
Secretary: Chuck and Katharine Hunt
(541) 607–0106; cwhunt@uoregon.edu
Treasurer: Nancy Ograin; (541) 935-7065
woodrt@pacinfo.com
Web site: www.lcbaor.org

Portland-Metro Beekeepers

Meets 7 PM, second Thursday, Oregon City
Clackamas Comm College, Clairmont Hall, Room 118
President: Kerry Haskins
(503) 632–8448; kh251@aol.com
Vice President: Jim Mellis; (503) 631–4622
Secretary: Paul Hardzinski; (503) 631–3927
Treasurer: Barbara Derkacht; (503) 631–3063
bderkacht@yahoo.com

Southern Oregon Beekeepers

Meets 7:30 PM, first Monday, Central Pt
So Or Res & Ext Ctr, 569 Hanley Rd
President: John Jacob; (541) 582–BEES
john@oldsolenterprises.com
Vice President: Floyd Pawlowski
415 Pompadour Dr, Ashland; (541) 482-4797
Secretary/Treasurer: Julian Lewis
(541) 535–5817; lewis_adams_00@yahoo.com
Web site: www.southernoregonbeekeepers.org

Tillamook County Beekeepers

For meeting and other information about the group, please contact:
President: Bob Allen; (503) 322–3819

Tualatin Valley Beekeepers

Meets 7:30 PM, last Friday, Beaverton
OSU Ext, #1400, 18640 SW Walker Rd
President: Herb Brasington; (503) 701–4180
herb@hwbsystems.com
Vice President: Paul Anderson
paulanderson@triteksolutions.com
Secretary: Jerry Maasdam; jmaasdam@mac.com
Co-Treasurers: Brigette and Michael Hendrickson
mdhendri@gmail.com

Willamette Valley Beekeepers

Meets 7 PM, fourth Monday, Salem
Chemeketa Comm College, Bldg 34, Rm A
President: Richard Farrier; (541) 327–2673
Vice President: Harry Vanderpool; (503) 399–3675
shallotman@yahoo.com
Secretary: Mike Rodia; (503) 364–3275
drodia@yahoo.com
Treasurer: Gordon Kroemer; (503) 538–2307
kroemer2@verizon.net

REGIONAL ASSOCIATIONS

Lane County Beekeepers

In May, Morris Ostrofsky spoke and did a slide presentation on the topic: Don't Bug Us (Beekeepers Unnecessary Gawking). He talked about different conditions for each season and indications that can be used to decide when it is appropriate to go into hives by observing what is going on at the landing board and on a sample collection board. Katharine Hunt introduced Ramesh Sagili, who is visiting all the OSBA groups and will attend the group's Field Day on June 20th at Lynn Royce's apiary. Ken Ograin notes that the Great Sunflower Project now has an expanded plant list that includes Bee Balm, Cosmos (purple), Tickseed, Rosemary, and Purple Coneflower (see: www.greatsunflower.org). The Lane County Fair will take place August 18th–23rd, though the deadline for registering entries is July 31st. At the June meeting, Morris Ostrofsky will discuss Requeening: When, Why and How.

—**Adapted from**: June 2009 *LCBA Newsletter*

Portland-Metro Beekeepers

At the May meeting, the group had 41 attend with nine new interested beekeepers. Treasurer Barbara Derkacht's report on the Bill Ruhl Memorial Bee Day was that it was the biggest yet with 120 preregistered and 41 who signed up the day of the event. Double thanks to Mr. and Mrs. George Hansen who let us all trample their property while George taught one of the events! Paul Hardzinski reported good crowds at our bee information table at the Master Gardeners Spring Garden Fair. Dr. Ramesh Sagili spoke to the group on the economic importance of honey bees and the nature of his current and past research. His most current research at OSU is just now getting started and will include honey bee nutrition, effects of chemicals on bees, studies of *Nosema* disease and *Varroa*, as well as effects of brood pheromone on bee growth and foraging habits. Dr. Dewey Caron noted that both he and Dr. Sagili have concluded that our PNW area needs more "intermediate" level instruction in beekeeping. August 15th will be the first of both upstate and downstate presentations. Information may be had at dmcaron@udel.edu. President Kerry Haskins led a discussion on preventing swarming.

Dr. Dewey Caron presented on queen management and understanding, Queens Queens Queens, at the June meeting. He also provided a handout about pollinator-friendly gardening. This enjoyable hour-long presentation ended with a "take home" message: "quality comes from quality. Locally reared queens will make a difference in your apiary." In addition, he stated, "by rearing the best queens (for your hive preferences such as gentleness or swarming tendency), in 3 to 4 years you will see a difference." A member with chalkbrood in a hive was advised that cleaning the entrance with bleach was not found to help much. "To requeen is the best treatment as it is a genetic quality." It may be gone by the end of summer/honey flow. The group's annual potluck picnic is planned for Saturday August 15th. Plan to bring chairs as it will probably be held at a park. The location will be announced at the July meeting.

—*Paul Jarrett*

Tualatin Valley Beekeepers

Paul Anderson recently discussed various channels for selling honey, the differences between local and brand-name honey, and how to identify the needs of customers. Dr. Dewey Caron will discuss late summer/fall treatments, including common chemicals and alternatives, at the June meeting. The summer barbeque potluck picnic will be on Saturday July 18th and will include a honey-harvesting demonstration. The group is asking that members please consider entering a honey exhibit at this year's Oregon State Fair, August 28–September 7.

—**Adapted from**: June 2009 *TVBA Newsletter*

Willamette Valley Beekeepers

The group had a tremendous turn-out, at least 60 present, at the May meeting. As a follow-up to the discussion on swarm control at the April meeting, Jeff Milligan brought in an excellent video on collecting swarms, and Richard Farrier helped in selecting several segments for the meeting. Jeff has donated the video to the group's library. The meeting also included a discussion of requeening, which should be considered when there is a poor (spotty, incomplete) brood pattern, a drone layer, ill-tempered bees, low production, or the queen is more than a year old. Mike Rodia notes that, when his

Continued on page 6

***Associations**—Continued from page 5*

strongest hive appeared to be swarming, he "twice used a garden hose to knock the bees out of the air, soak those surrounding the entrance and sent a couple of gallons of water down through the hive via the inner cover hole. A couple of thousand very soaked bees outside the hive and a well soaked hive interior seemed to do the trick." The group's summer picnic is set for Sunday July 26th.

—**Adapted from**: June 2009 *WVBA Newsletter*

AROUND THE REGION

Dewey M. Caron

I am a retired University of Delaware Professor of Entomology and Wildlife Ecology, and have been Appointed Affiliate Faculty in Department of Horticulture, Oregon State University. I will work with retired OSU apiculturist Mike Burgett and Assistant Professor Ramesh Sagili on beekeeping and pollination projects, and especially contribute to the beekeeping outreach (extension) program. In addition, I will continue with bee schools, association meeting attendance/talks, and contributions to the bee literature, and will lead in the development of a Pacific Northwest Beekeeping Manual. I will also organize a Western Apiculture Society (WAS) meeting in Oregon next year. This is an unpaid position that is for a 3-year duration. Familiar to those attending local meetings, I was last on the state meeting program 4 years ago and will be a speaker this fall. I have attended several WAS meetings, including the last couple in Oregon. I have written and lectured extensively on bees (extension material on bees can be found on MAAREC.psu.edu), and I welcome the opportunity to interact with Oregon beekeepers and bee groups of the Pacific Northwest.

Pollinator Week in June acknowledges more than just honey bees as pollinators, but since honey bees do the overwhelming majority of planned pollination, including that of over 100 crops we eat and depend upon, we need to keep our little fuzzy friend before the public and be sure the American consumer knows about the need for honey bee pollination. There are ongoing efforts to promote National Honey Bee Awareness Day (see: nhbad.com) on Saturday August 22nd. Are any clubs/individuals interested in a publicity event?

KEEPING BEES IN JULY

Todd Balsiger

Unless you're near a commercial crop or at higher elevations, the summer nectar dearth begins about mid-July. At this time we should be thinking about nest consolidation and honey harvest. Considerations are as follows:

- In late summer, we crowd the bees. We begin this in earnest in August along with mite treatments, but for now don't leave extra supers on colonies light on stores. Also, avoid having extra supers on colonies as the nectar flow tapers off as this leads to half-filled frames, which is an inconvenience at harvest time.
- As usual, keep an eye out for colony health. Any colony that is not keeping up with its peers needs to be inspected to make sure that it is queen-right and healthy.
- Requeen any colony with undesirable characteristics, which include poor production, European foulbrood (not American foulbrood), poor brood pattern, and mean temper.
- Queenless hives are a real problem and need to be either requeened with a nuc or retired. Typically, queenless hives have an abundance of pollen stored in multiple frames (no brood to feed). This condition often is followed by the development of laying workers. Signs of laying workers are multiple eggs per cell, eggs on the side of cells (as opposed to one egg centered on the bottom), and drone brood development in worker cells. If requeening, always place the nuc in the top brood box and to one side (so it is easier to defend). You may want to reverse brood boxes first as there may be fewer bees in the lower box (again, easier to defend). If you retire the hive, shake the bees out and share the frames with other hives. The workers will perceive the eggs as foreign and unwanted, and will eat them. After the drones hatch from the elongated worker cells, the workers will cut the cells back to their regular length.
- Keep on the lookout for American foulbrood as robbing season is imminent and AFB-infected colonies make easy targets. American foulbrood is highly infectious and early detection is important in its control.

- ❖ Remove and extract supers. Honey removed in late July will have less moisture content than honey extracted in June, which reduces the need to be as judicious about making sure that all cells are capped. Moreover, in late season the nectar flow can end, and the bees will be unable to cap the honey cells even though they are ready (sufficiently dehydrated). As a general rule, you can always check the moisture content and ripeness of honey in a given frame by shaking it hard downward and seeing if nectar falls out. If a shower of nectar falls out, then that frame is not ready.
- ❖ Be prepared to do the most important treatments of the year for your hive in early August: treating for *Varroa* mite and foulbrood, and reducing hives down to winter configuration.

SEQUENCING *Nosema*

Agricultural Research Service scientists have sequenced the genome of *Nosema ceranae*, one of many pathogens suspected of contributing to colony collapse disorder. Researchers describe the parasite's genome in a study published June 5 in the open-access journal *PLoS Pathogens*.

Researchers believe CCD may be the result of a combination of pathogens, parasites, and stress factors, but the cause remains elusive. At stake are honey bees that play a valuable part in a $15 billion industry of crop farming in the United States.

The microsporidian *Nosema* is a fungus-related microbe that produces spores that bees consume when they forage. Infection spreads from their digestive tract to other tissues. Within weeks, colonies are either wiped out or lose much of their strength. *Nosema apis* was the leading cause of microsporidia infections among domestic bee colonies until recently when *N. ceranae* jumped from Asian honey bees to the European honey bees used commercially in the United States.

Sequencing the genome should help scientists trace the parasite's migration patterns, determine how it became dominant, and help resolve the spread of infection by enabling the development of diagnostic tests and treatments.

From: "Catch the Buzz," courtesy of *Bee Culture*.

NECTAR-PRODUCING PLANTS IN OREGON DURING JULY

Common Name	Pollen	Sugar Content (%) Floral	Stipule
Bachelor Button	yes	53	
Fall Dandelion	yes	40–50	
Jim Hill Mustard	yes	44	
Flax	yes	49	
Yellow Sweet Clover	yes	52	
White Clover	yes	40–44	
Red Clover (infrequent nectar)	yes	35	
Ladino Clover (poor nectar)	yes	40	
Alsike Clover	yes	40	
White Sweet Clover	yes	25–45	
Sunflower, Wyethia	yes	46	
Annual Sunflower	yes	32	
Alfalfa	yes	40	
Salal	no	30–60	
Canadian Thistle	yes	35–50	
Milkweed	no	37	
Evergreen Blackberry	yes	35	
Himalaya Blackberry	yes	27	
Fireweed	yes	35–50	
Pearly Everlasting	yes	34	
Snowberry, early	no	29	
Snowberry, late	no	50	
Cleome (Rocky Mtn)	yes	22	
Cleome, Yellow	yes	11	
European Borage	yes	?	
Carrot	yes	?	

From: Information compiled from handouts presented to the Portland-Metro association by Anita and Lucien Alexander. Among additional resources of potential interest: *Pollination and Bee Plants* (gears.tucson.ars.ag.gov/beeclass/Pollination.pdf) and *Selecting Plants for Pollinators* (www.pollinator.org/pdfs/PacificLowlandrx8.pdf).

***Colony Losses**—Continued from page 1*

associated with what could be termed poor colony management.

Insights into the level and severity of colony losses in the Pacific Northwest during the time when the parasitic mite complex first began to affect American beekeeping can be gleaned from a study that surveyed commercial and semi-commercial beekeepers in the states of Oregon and Washington (Burgett, 1998). For the 10 years of the study period (1989 - 1998), the average annual colony loss for commercial beekeepers (defined as operating 300 or more colonies) was found to be 22.6%. For semi-commercial beekeepers (defined as operating less than 300 colonies), the average annual loss was 25.4%. Comparing these data to mortality estimates prior to the arrival of parasitic mites suggests that the intrusion of the mites caused a significant increase in colony losses.

Expected and typical losses increased after the arrival of mites, but as beekeepers in the PNW (and elsewhere) developed techniques to control mite losses, winter mortality decreased from its highest post-mite levels. In a recent report of colony losses in Canada (Pernal, 2008), it was stated that (prior to CCD), "...normal long-term overwintering mortality is regarded as being 15%." A 2007 paper (van Engelsdorp et al.) reported that during the winter of 2006/2007, beekeepers who experienced normal colony losses had an average colony mortality of 15.9%. In a recent survey of PNW beekeepers, which we will discuss in detail below, we find that normal pre-CCD (but post-mite) losses, were about 14%. From this evidence, it appears that good beekeepers have accepted as normal a winter loss of roughly 15% of their colonies.

A New Survey of Colony Mortality

To determine if colony mortality has increased regionally with the appearance of CCD, the commercial and semi-commercial beekeeping community of the PNW was surveyed again this past winter. The existence of a documented pre-CCD mortality data base (Burgett, 1998) renders the information gained from the recent survey particularly useful. This survey has added value because the PNW region was not included in previous CCD surveys conducted by the Apiary Inspectors of America (AIA) and the USDA (van Engelsdorp et al., 2008).

In September of 2008, a colony mortality survey was sent to all beekeepers in Oregon and Washington who registered more than 50 colonies. Among other questions, the survey asked for the number of living colonies on Oct. 1, 2007 and the number of colonies that survived the wintering period (October 2007 to April 2008). Additionally, the beekeepers were asked to give their opinions as to the causes for the losses, and what methods they used to replace colony numbers in the late winter and early spring of 2008. Finally, to update the mortality estimates from the 1998 study (Burgett, 1998) beekeepers were asked for their average loss for the past five to ten years (i.e., before CCD but after the arrival of mites) and whether their losses since the arrival of CCD are higher, lower, or about the same. What follows is a summary of the beekeeper responses to the PNW mortality survey.

Twenty-five PNW beekeepers responded to the survey. Collectively, this group owned 62,100 colonies on 1 October 2007. The most recent USDA/NASS estimates of the number of colonies in Oregon and Washington is 90,000, suggesting that our sample includes almost 70% of PNW colonies (USDA/NASS, 2008). Of this group, 14 are commercial operations (which reported owning 60,870 hives) and 11 are semi-commercial beekeepers (owning 1,230 colonies). When considering all responding beekeepers, the colony loss over the 2007/08 winter was 30.0% (Table 1). Commercial beekeepers lost 17,958 colonies from a population of 60,870, a loss of 29.5%. Semi-commercial beekeepers lost 677 of 1,230 colonies, a loss of 55%. Examining commercial beekeeping operations individually, the

Table 1. PNW colony mortality: winter 2007/2008.

	Living Colonies October 1, 2007	Winter Colony Mortality	% Loss
Commercial	60,870	17,968	29.5%
Semi-commercial	1,230	677	55.0%
All beekeepers	62,100	18,645	30.0%

Table 2. PNW beekeeper opinions regarding colony losses: winter 2007/2008.[1]

	Queen Failure	Mite Related	Starvation	CCD	Other
PNW survey	23.0%	25.2%	3.1%	32.7%	15.9%

[1] These numbers represent the percentage of all colonies lost attributed by beekeepers to each of the causes listed.

highest colony loss was 50%, and the lowest was 6%. In the semi-commercial class, the highest individual loss was 83% and the lowest was 10%. These results are subject to the usual sort of statistical sampling error. Under reasonable assumptions, a 90% confidence interval for the underlying proportion of colonies lost (for all responding beekeepers) is in the range of 25% to 37%.

Responding PNW beekeepers provided their opinions as to the causes for their colony losses. The responses to the question regarding the causes of winter 2007/08 losses were diverse and are summarized in Table 2. Two beekeepers attributed 100% of their losses to mites, while another attributed all of his losses to Nosema ceranae. Regarding the impacts of CCD, 10 of the 23 beekeepers who provided opinions on the causes of their winter losses indicated that they did not attribute any of their losses to CCD. At the other extreme, two beekeepers estimated that CCD caused at least 80% of their losses. Only five beekeepers believed that CCD was the largest cause of their losses. Overall, however, the responding beekeepers ranked CCD-related losses as the most significant factor, with 32.7% of the total losses in the survey being attributed to this cause. Mite-related causes and queen failures were the other two large specific causes, with 25.2% and 23.0% of losses, respectively.

The Costs of Colony Replacement

To understand the economic implications of CCD, it is important to understand how practicing beekeepers replace colonies lost during the over-wintering period. There are a number of standard methods. The PNW mortality survey addressed this question by asking beekeepers what methods they used to increase their colony numbers in response to their losses. Their replies are summarized in Table 3. By far the most common method of colony replacement was making splits (nucleus colonies, or "nucs") from surviving colonies, and this method accounted for 78% of all colonies replaced. The second most frequent method was to purchase nucs from other beekeepers (16%). The use of commercial package bees to increase colony numbers, either from U.S. or foreign (Australian) suppliers, accounted for only 3% of all colonies replaced by the survey respondents.

An interesting response to colony loss can be seen in the survey results. While the total number of reported colony losses was 18,635 (30.0% of the pre-loss colony numbers), the number of replacement hives, by all methods, totaled 22,506. On average,

Continued on page 10

Table 3. PNW colony replacement methods: winter 2007/2008.

Replacement Method	Number	% of Replacement Colonies
Splits/Nucs (own colonies)	17,612	78.3
Nucs (purchased from other beekeepers)	3,570	15.9
Packages USA source	216	1.0
Packages Outside USA	400	1.8
Mature colonies from other beekeepers	700	3.1
Other	12	0.1
	22,506	

Colony Losses—*Continued from page 9*

therefore, each lost colony was replaced by 1.21 colonies. Moreover, 11 of the 14 commercial beekeepers in the survey sample reported replacing more colonies than they lost. This is an important response when considering the impacts of CCD and other sources of colony losses on the number of honey bee colonies available for managed pollination. It is one thing for the media to point to the dire consequences of honey bee losses, which are indeed worrisome. It is also important to understand, however, that honey and pollination markets function smoothly and are capable of adjusting to changing conditions (Burgett et al., 2004). As a result, the American beekeeping community has been able to maintain sufficient colony numbers to serve the agricultural sector. The response that we observe may represent an attempt by beekeepers to adjust in advance for failures in a portion of their colony replacements. It also may indicate an attempt by PNW beekeepers to increase their colony numbers in response to the increased demand for pollination services associated with increased almond acreage in California.

An important economic issue raised by colony loss is the cost of replacement. To obtain a sense for the magnitude of these costs, consider the following scenario. Suppose a PNW beekeeper inspects her hives and finds that 100 are dead. If she decides to replace the losses by splitting 100 of the remaining healthy colonies, what costs are incurred? To begin, the beekeeper must purchase 100 queens to place with the new splits produced from the healthy parent colonies. According to recent advertisements in the American bee trade journals, these will cost about $15 each. Further, about twenty minutes of labor will be required per colony to remove the four to fives frames of brood, bees and honey stores from the parent colony to stock the nuc colony. Assuming labor costs to be $12 per hour, the labor cost is then $4 per split and the total cost of a split is $19. To put this number on a per pollination set basis, we can use data from the annual PNW survey, which suggests that on average beekeepers use each colony for about 2.5 pollination sets per year. Dividing the queen cost plus labor costs by 2.5 implies that the cost per pollination set increases by about $7.60.

Alternatively, suppose the beekeeper decides to replace the lost colonies by purchasing package bees. A delivered three-pound package with a mated queen currently costs about $50 from most suppliers. Assuming that it takes about ten minutes to install a package into an empty hive unit, the labor costs of this approach are around $2 per colony. The sum of these two components ($52) is more than two and a half times the cost of making a nuc hive. Moreover, whereas the nuc colony can approach full strength in about six weeks, the new colony created from a package will require 60 to 90 days to reach full strength. These rough calculations are consistent with the survey responses, which indicate that PNW beekeepers use nuclei colonies much more frequently than they use purchased package bees.

Beekeepers' Perceptions of Losses

The final question of the PNW survey consisted of two parts. The first asked beekeepers for an estimate of their average losses over the past five to 10 years. The second part asked whether they considered their losses since the arrival of CCD to be higher, lower, or about the same as their previous average loss. The responses to the first part of the question can be usefully viewed as a crude update of the results from the Burgett (1998) study. The average estimated pre-CCD loss over all respondents was 14.4%, while the average for commercial beekeepers was 14.3% and for semi-commercial beekeepers was 18.2%. These losses, which are considerably lower than the 22.6% reported in the 1998 report, may reflect improved techniques for dealing with mite parasitism. Note again that this estimate of pre-CCD losses is quite close to those reported in Pernal (2008) and van Engelsdorp et al. (2008).

The responses to the second part of the question are summarized in Table 4. Less than a third of the responding beekeepers reported increased losses

Table 4. PNW beekeepers assessment of changes in losses since the arrival of CCD.

	Higher	About the same	Lower	Blank
Commercial	4	8	1	1
Semi-commercial	7	3	1	0
All beekeepers	11	11	2	1

since the appearance of CCD. On the other hand, a clear majority of the semi-commercial beekeepers reported increased losses over this period.

Conclusions

In summary, the PNW beekeeping community experienced a 2007/08 colony winter loss of 30% compared to a reported loss of 35.8% (van Engelsdorp et al., 2008) for the United States and 35% (Pernal, 2008) in Canada. The 2007/8 PNW winter loss of 30% is an increase from the 20-25% losses suffered by PNW beekeepers in the 1990s and from the average losses of 14% reported by PNW beekeepers over the past few years. Insofar as the only cause of increased colony mortality is CCD, this suggests that CCD is responsible for a 16 percentage point increase in mortality. An alternative calculation is suggested by the survey results, indicating that CCD is perceived by PNW beekeepers to be responsible for 32.7% of total colony mortality. Multiplying this percentage by the 2007/08 PNW winter loss of 30% suggests that CCD has been responsible for about a 10 percentage point increase in mortality. Thus, we conclude that CCD is responsible for a 10 to 16 percentage point increase in overall colony mortality for the PNW region.

In 2008, PNW beekeepers replaced winter colony losses to a level that exceeded the colony count of the previous autumn, and the management practice of splitting colonies (nucs) was the prevalent technique for colony replacement. We speculate that this increase, which comes in spite of increased costs since the appearance of CCD, may be a response to the increasing demand for pollination services arising from increased almond acreage, and dramatically increased almond pollination fees in California.

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Continued on page 12

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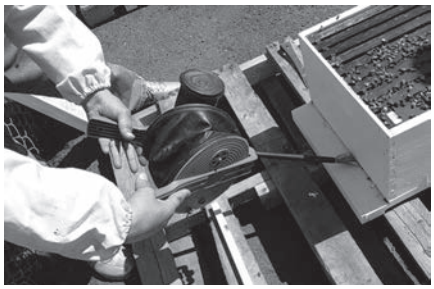

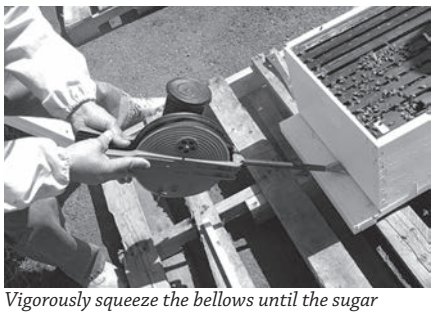

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