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JULY/AUGUST 2017

W.A.S. Journal

Journal of the Western Apicultural Society of North America

Western Apicultural Society of North America

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July/August 2017

W.A.S. Journal

Journal of the Western Apicultural Society of North America

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PRESIDENT'S MESSAGE ...

Summer 2017

2017 President Dr. Eric Mussen

We are about two months away from our conference. I hope that you have submitted your registration materials to our Treasurer. The sooner we know how many are coming, the better we can plan for food, in particular. You also should get your reservations made in one of our motels, since we do not have a convention center or convention hotel in Davis. I have prepared a separate article on traveling to and driving around the campus, to reach the conference facility. Parking permits are going to be at the registration desk in ARC near Ballrooms A&B. You will be liable for a parking ticket if the ticket person spots your vehicle before you can get into ARC and return with your permit. I begged for a bit of leniency. If you get a ticket, it could be "fixed" if I submit your license plate number and your permit number on an appropriate list. But, I'm only going to do that for "best efforts." If you are going to be around Davis for a day or two extra, and you are wondering about what you might wish to do locally, our little Davis paper, The Davis Enterprise, just published and distributed a 24-page (including significant advertising) "Summer 2017 Davis Visitor's Guide." You can find that publication on the Internet at:

http://www.davisenterprise.com/special-publications/davis-visitors-guide-2017/.

I have prepared two other lists: Davis Restaurants and Davis Fast Food Places that might be in this journal if there is adequate space.

This WAS Journal contains the schedule for the conference, as it stands today. Of course, things are subject to change, but this is how it appears to be going: see conference schedule beginning on page 13. As you can see, the entire on-campus meeting is going to take place in the ARC Ballroom. That very large hall has a retractile wall that we will use to separate the space into two rooms. The larger room will seat the audience for presentations. The smaller room will house the vendors and the silent auction, and then on Friday afternoon will be set up for the banquet. The tours will leave in private vehicles from parking lots #25 and #35 (campus map page 19).

We are getting close to the closing date (July 31st) for submitting names and supporting information for the candidates for the "Outstanding Service to Beekeeping Award" (U.S. or Canada) and "Thurber Award for Inventiveness" (local award, probably from California). The Awards Committee has to have time to make the selection, contact the recipients, make arrangements for them to be present at the awards banquet, and have their plaques engraved. So, if you have one or more candidates, get that information to Awards Committee chair, Archie Mitchell, at: Archibald_178@hotmail.com by July 31st.

Looking forward to seeing you at this special 40th Anniversary WAS Conference.

Eric Mussen, President

WAS Presidents to date

1978 Norman Gary (California)
1979 Lucien Alexander (Oregon)
1980 Randy Barker (Br. Columbia)
1981 Charles Duncan (California)
1982 William P. Nye (Utah)
1983 John Edwards (Washington)
1984 Eric Mussen (California)
1985 Mike Burgett (Oregon)
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1988 Dan Mayer (Washington)
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2000 Fletcher Miller (Alaska)
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2002 Eric Mussen (California)
2003 Jaquie Bunse (British Columbia)
2004 Jerry Bromenshenk (Montana)
2005 Steve Sheppard (Washington)
2006 Adrian Wenner (California)
2007 Diana Sammataro (Arizona)
2008 Mark Pitcher (British Columbia)
2009 Eric Mussen (California)
2010 Dewey Caron (Oregon)
2011 Jenny Bach (Hawaii)
2012 James K. Smith (Washington)
2013 Melanie Kirby (New Mexico)
2014 Jerry Bromenshenk (Montana)
2015 Beth Conrey (Colorado)
2016 Ethel Villalobos (Hawaii)
2017 Eric Mussen (California)

Getting to Davis and the UC Davis Activities and Recreation Center (ARC)

Downtown Davis is serviced by both Amtrak and Greyhound. They share a terminal building on the southeastern edge of the city, at Second and G. The central city isn't terribly large, spanning about 6 blocks on the east-west lettered streets by 5 blocks on the north-south numbered streets. You could walk to the downtown motels from the transit center, or take a taxi.

We have busses in the city, but they are driven by, and operated for the convenience of students. They are not really downtown busses. Then the city begins to become residential and eventually covers 10.5 square miles. Squeezed into that area are 65,600 residents and about 30,000 students during the academic year. The UC campus runs along the western edge of downtown. The ARC building is about 3 miles from the transit center on the western side of the main campus.

Davis is divided into quarters by Interstate 80 (I-80) passing east to west and State Route 113 (SR 113) that runs north and south. I-80 actually is south of the city and the campus, while 113 is well west of central Davis. UC Davis is wedged into the north-eastern intersection of the two freeways. If you are driving, you'll be using one or both of those roadways. If you wish to rent a car with GPS or have one in your car, the address is UC Davis Activities and Recreation Center (it is along the edge of La Rue Road, **NOT** at 232 Shields, which is their office address).

Many of you are apt to be flying to the meeting. The closest airport is Sacramento International. The airport is north-west of Sacramento, off Interstate 5 (I-5). You will be using the portion of I-5 that runs north toward Redding for about eight miles, when you will come to the city of Woodland. In Woodland you exit I-5 at the Main Street/113 south exit to go to Davis. You have to drive west along Main Street for a few blocks, passing under 113, before reaching the 113 entry ramp. Stay in the left lane on Main. Take 113 south toward Davis. In about nine miles you will be seeing a number of Davis exits. From the north, the Russell Boulevard exit is the best one to choose for proceeding directly to the ARC or to continue downtown. Russell becomes 5th Street when it crosses B Street at the eastern edge of campus.

To get to the ARC from the north, take the Russell Boulevard exit from 113. Turn left toward the campus (east from 113) and stay in the right lane. Follow Russell east through the signal lights at Trader Joe's corner, then be ready to merge right (onto La Rue Road) at the next set of signal lights. You will be turning onto La Rue Road, but in the right hand lane that leads to lot #35. To get to the closer ARC lot, you must cross into the left lane, first, then from there into the dedicated left turn lane. The turn to lot #25 (Orchard Road) is signal light controlled.

From the east or west on I-80, choose the Woodland/113 north exit. Right at the end of that ramp stay way right and exit up the Hutchison ramp and proceed to the right toward central campus, away from the farm fields. Try to make your way into the left (not left turn this early) lane of the two straight-ahead lanes of Hutchison. At the second set of traffic lights, you will be crossing La Rue Road. Turn left (dedicated left turn lane) onto La Rue Road and travel to the next set of lights (Orchard Road). At the lights, a turn from the left lane of La Rue will get you into parking lot #35. A turn from the right lane will take you to lot #25, which is right outside the ARC. Either lot is apt to be pretty full of cars, if you don't come rather early in the morning.

Parking Permits

Remember that campus parking is by permit only. I decided it was not a good idea to send the permits to you ahead and hope that you don't forget them. So, the permits will be available at the registration desk in ARC beginning 8 a.m. Tuesday morning. Move quickly to get the permit and return to your vehicle. I can "fix parking tickets" if you get one, but only if you can prove that you moved quickly in and out of ARC with your permit. Most white-lined parking spaces are acceptable in visitors ("C") lots, but look carefully to avoid "Diamond E," handicapped, car pool, or other restricted designations on signs facing a specific space. You can find a map of campus parking lots at: http://taps.ucdavis.edu/sites/taps.ucdavis.edu/files/attachments/parking_map.pdf. Our acceptable permit lots are colored yellow.

Restaurants in Davis, CA

Burgers and Brew $$	4.4 stars	403 3rd Street	Brew pub, burgers, sandwiches
Crepeville $$	4.1 stars	330 3rd Street	French sweet and savory crepes
Taqueria Guadalajara $	4.1 stars	640 W. Covell Blvd.	Hearty Mexican standards
Café Bernardo $$	3.7 stars	234 D Street	Comfort food and locally roasted coffee
The Mustard Seed $$	3.6 stars	222 D Street	American Rustic-chic bistro
Seasons $$	4.1 stars	102 F Street	Locally sourced American fare; craft cocktails
Sophia's Thai kitchen $$	4.2 stars	129 E Street	Country-style Thai fare and live folk music
Sam's Restaurant $$	4.7 stars	301 B Street	Mediterranean kebabs and shawarmas
Thai Nakorn $$	3.8 stars	424 G Street	Curries and other Thai dishes
Osteria Fasulo $$	4.6 stars	2657 Portage Bay E #8	Traditional Italian cuisine
Taste of Thai $$	4.2 stars	301 G Street	Traditional Thai food
Taqueria Davis $	4.5 stars	505 1/2 L Street	Tacos, burritos, seafood and combo plates
Chick Peas $$	4.7 stars	640 W. Covell Blvd.	Middle Eastern: hummus, falafel, shawarmas
Ding How Restaurant $$	4.1 stars	640 W. Covell Blvd.	Familiar Chinese dishes, including vegetarian
Ketmoree Thai Rest/Bar $$	3.5 stars	238 G Street	Thai eatery and nightclub, live music, cocktails
Davis Noodle City $	4.1 stars	129 E Street #1D	Soups, homemade noodles, Chinese dishes
Woodstocks' Pizza Davis $$	4.1 stars	219 G Street	Pizza, gourmet pies, salads, sandwiches
Symposium Restaurant $$	4.6 stars	1620 E 8th Street	Traditional Greek dishes, various pizzas
El Toro Bravo $	3.8 stars	231 D Street	Mexican
Preethi Indian Cuisine $$	4.1 stars	715 2nd Street	Familiar Indian food, plus lunch buffet
Panera Bread $	4.0 stars	609 3rd Street	Sandwiches, salads, and more

Fast Food in Davis

Burger King $	3.3 stars	2026 Lyndell Terrace	Grilled burgers, fries and shakes, breakfast
Jack in the Box $	3.5 stars	337 G street	Burgers, chicken, tacos and breakfast
Redrum Burger $	4.0 stars	978 Olive Drive	Burgers, other classic American eats
Taco Bell $	3.7 stars	425 G Street	Mexican: tacos, quesadillas, nachos
McDonalds $	2.7 stars	4444 Chiles Road	Burgers, fries and shakes
Del Taco $	3.7 stars	1649 Research Pk Dr	Mexican: tacos, burritos, breakfast
Subway $		2014 Lyndell Terrace	Build-your-own sandwiches and salads
Togo's Sandwiches $	4.0 stars	1411 W. Covell Blvd. #105	Made-to-order sandwiches
Subway $	3.6 stars	1300 E. Covell Blvd.	Build-your-own sandwiches and salads
Subway $	3.8 stars	757 Russell Blvd. A-3	Build-your-own sandwiches and salads
Ali Baba $$	4.0 stars	220 3rd Street	Kebabs, burgers, sandwiches, breakfast
Carl's Jr. $	3.3 stars	1616 E. Covell Blvd.	Piled-high burgers, meal combos, shakes
Subway $	3.8 stars	130 G Street	Build-your-own sandwiches and salads
KFC $	2.7 stars	1617 Research Pk Dr #149	Fried chicken, plus wings and sides
Taco Bell $	3.6 stars	4811 Chiles Road	Mexican, tacos, quesadillas and nachos
Noah's Bagels $	4.1 stars	1411 W. Covell #114A	Bagels, salads, soup, sandwiches, breakfast
Carl's Jr. $		146 Hutchison Dr (campus)	Burgers and meal combos, shakes
Carl's Jr. $	3.9 stars	1701 Cowell Blvd.	Piled-high burgers, meal combos, shakes
Subway $		4748 Chiles Road	Build-your-own sandwiches and salads

Accommodations

According to tripadvisor for each night of September 5-8:

Hyatt Place (on campus edge)	$199	Free Kitchen Skillet breakfast	530-756-9500
La Quinta Inn & Suites	$115	Free BrightSide breakfast	530-758-2600
Hallmark Inn at UC Davis	$140	Free warm breakfast	530-753-3600
Best Western University Lodge	$132	Black Bear Restaurant next door	530-756-7890
Best Western Plus Palm Court Hotel	$149	"Restaurant on site"	530-753-7100
Holiday Inn Express & Suites Davis	$158	Free breakfast	530-297-1500
~~University Park Inn & Suites~~	~~$149~~	~~Free continental breakfast~~	~~530-756-0910 SOLD~~
Days Inn Davis	$159	Free breakfast	530-792-0800
Aggie Inn (Ascend Member)	$165	Free deluxe continental breakfast	530-756-0352
Econolodge	$ 82	Free continental breakfast	530-756-1040

If for some reason you don't find a motel in Davis to your liking, there are more in the town of Dixon, five miles away to the south, and Woodland, 11 miles away to the north.

WESTERN APICULTURAL SOCIETY OF NORTH AMERICA
40TH ANNUAL CONFERENCE
Davis, California – September 5-8, 2017
REGISTRATION FORM

Name(s) _____
As desired on name tag(s)

Mailing Address _____
Street / Box Number

City, State or Provence _____ Zip/Postal Code _____

Phone Cell/Mobile _____ Home _____ Email _____

CONFERENCE RATES	Cost per person	No. of persons		Total
Full Conference Package				
(Bee Buzz, speaker sessions, beverage breaks, honey tasting, and two buffet lunches)				
Full pre-registration (by July 31st, 2017)	$ 175.00	x _____	=	$ _____
Delayed registration (after July 31st)	$ 225.00	x _____	=	$ _____
Single day registration(s) – provide number(s)	$ 60.00	x _____	=	$ _____
Tues _____ Wed _____ Thurs _____ Friday _____				
Intending to be at the **Bee Buzz?** _____ "Yes" How many? _____		_____ "No"		
Optional 4-day **Parking Permit(s)**	$ 40.00	x _____	=	$ _____

Buffet Lunches – show lunch numbers and select beverages, simultaneously

Wednesday: *Sandwich Buffet: Various breads, cold cuts, cheeses, salads, fruits and dessert*
Beverage (#): _____ water; _____ lemonade; _____ mixed canned sodas; _____ coffee; _____ tea

Thursday: *Salad Buffet: Four salads, bread sticks, fruit, and dessert*
Beverage (#): _____ water; _____ lemonade; _____ mixed canned sodas; _____ coffee; _____ tea

Optional Event

Banquet Buffet - $50.00 per person
Choice (show number): Chicken Marsala _____ Fresh-cooked Veggie Lasagna _____ $ _____

Optional Event – At $50 per person

Dr. Larry Connor: "Keeping Your Bees Alive and Growing" x _____ = $ _____

Crew neck **T-Shirts** (see design example on page 8 in May WAS Journal)

Size: Small _____, Medium _____, Large _____, XLarge _____, XXL _____ = $ _____
$ 18 $ 20 $ 20 $ 22 $ 25

WAS ANNUAL DUES (U.S. funds) – membership not required for attendance at conference

Individual	$ 20 _____	Junior (age under 21)	$ 15 _____	
Couple	$ 30 _____	Senior (65 or over)	$ 15 _____	= $ _____
Individual 10 year	$200 _____	Senior Couple (one over 65)	$ 20 _____	
Couple 10 year	$300 _____	Association/Club	$ 20 _____	
Commercial	$100 _____	Benefactor	$500 _____	
Patron	$1,000 _____	*Please attach membership form from WAS website.*		

TOTAL PAYMENT $ _____

Early registration forms and payments must be postmarked no later than July 31, 2017.
Payments in U.S. funds only. Check or money order made out to Western Apicultural Society.
***MAIL TO:** WAS Treasurer, Sherry Olsen-Frank, P.O. Box 5274, Twin Falls, ID 83303-5274.*
OR register online at www.westernapiculturalsociety/conference via Paypal with a credit card.
Full refund if cancellations received by August 15,2017. No refunds after that date or for no-shows.

40th Anniversary
Western Apicultural Society Annual Conference
September 5 - 8, 2017

Prepared by Eric Mussen

Venues: UC Davis Campus – ARC Ballrooms A&B, Bee Biology Facility, and Bee Haven Garden

Parking: University parking east (#25) and west (#35) of ARC, or garage near fire station (further east of ARC)
: Be sure to arrive earlier than the students. The lots become filled!

Daily Schedule

TUESDAY (September 5)

8:00 am Tuesday Morning	Vendors set up; Silent auction set up
8:00 am Tuesday morning	Parking Passes Available & Registration in ballroom hallway begins
1:30 pm Tuesday Afternoon	Board of Director's Meeting – corner of ballroom
Tuesday Evening:	Dinner on your own in Davis
7:00-8:30 pmTuesday Evening:	"Bee Buzz" Social – in ballroom

WAS 2017 - 40th Anniversary Conference

WEDNESDAY (September 6) MORNING

Breakfast	On your own
7:00 am	Wednesday morning: Doors unlocked, exhibits available Registration in ballroom hallway
8:30 am	Wednesday morning: Welcome and introductions; local announcements
8:45 am	Original WAS Founders' Comments: Norman Gary, Becky Westerdahl, and Eric Mussen
9:30 am	Introduction to tours Mann Lake representative Z Specialty Food LLC representative Native bee habitat restoration representative Häagen Dazs Bee Garden
10:00 am	Beverage Break – tour signups
10:25 am	Door prizes
10:30 am	"Seasonal Honey Bee Colony Population Cycle" – Serge Labesque (Glen Ellen, CA)
11:00 am	"Moderated Honey Tasting" – Amina Harris, Director UC Davis Honey and Pollination Center
12 noon	Lunch: Sandwich Buffet – Catered: breads, cold cuts, cheeses, salads, fruits, beverages, cookies

WAS 2017 - 40th Anniversary Conference

WEDNESDAY (September 6) AFTERNOON

1:00 pm	Alternative afternoon short course "Keeping Your Bees Alive and Growing" – ($50 extra fee) session with Dr. Larry Connor (Kalamazoo, MI)
1:00 pm	Load up vehicle caravans (four distinct groups) for tour to Woodland
1:15 pm	Depart for Mann Lake and Z Specialty Food in Woodland
1:35 pm	Arrive at Mann Lake (three groups) or Z Specialty Food (1 group)
1:40 pm	Mann Lake and Z Specialty Food Tours – 30 min stay each spot – 10 min commute between Mann Lake and Z Specialty Food or to Mann Lake sugar processing plant
2:10 pm	Move to second stop
2:50 pm	Move to third stop
3:30 pm	Move to fourth stop
4:10 pm	Return to campus
	Dinner on your own – Multiple offerings (foods and music at the Davis Farmers' Market – 3rd & C Streets)

WAS 2017 - 40th Anniversary Conference

THURSDAY (September 7) MORNING

Breakfast	On your own
8:00 am	Registration in ballroom hallway
8:25 am	Door prizes
8:30 am	Honey Bee Queens or Varroa Control – Elina Niño (UC Davis)
9:00 am	Honey Bee Behavior or Distribution of AHBs in CA – Brian Johnson (UC Davis)
9:30 am	Major Considerations in Top-bar Hive Management – Les Crowder (Austin, TX)
10:00 am	Beverage Break
10:25 am	Door Prizes
10:30 am	Life Cycles of Commonly Encountered Native Bee Genera – Robbin Thorp (UC Davis)
11:00 am	Known and Potential Value of Native Bees in Crop Pollination – Neal Williams (UC Davis)
11:30 am	Beekeeping Topics of Interest from Canada – Rod Scarlet, Executive Director, Canadian Honey Council
12 noon	Lunch: Salad Buffet – Catered: Salads and fruits-oriented, breads, cookies, beverages

WAS 2017 - 40th Anniversary Conference

THURSDAY (September 7) AFTERNOON

1:00 pm	Load up vehicles for caravan to the UC Davis Bee Biology Facility
1:30 pm	Subgroups (about 30 each) will cycle through stations around BBF and Häagen Dazs Garden – ≈30 minutes per station:
	A) Various beehive iterations – Bernardo Niño – UC Davis)
	B) Determining levels of Nosema or Varroa infestation – Randy Oliver (Grass Valley, CA)
	C) Studying native bee foraging in screen houses – William's group
	D) Studying plant flower selection in open field plots south of Bee Garden - Williams' group
	E) Preparing honey bees for molecular (AHB) or behavioral studies – Brian Johnson (UC Davis)
	F) Selecting plants for, and maintaining, a bee garden – Christine Casey (UC Davis)
4:00 pm	Return to campus or lodging locations – "Bee" sure to bring car pool riders back!
Meal time	Dinner: On your own
7:00 pm	"Next Generation Beekeepers" (If they plan their own meeting)

WAS 2017 - 40th Anniversary Conference

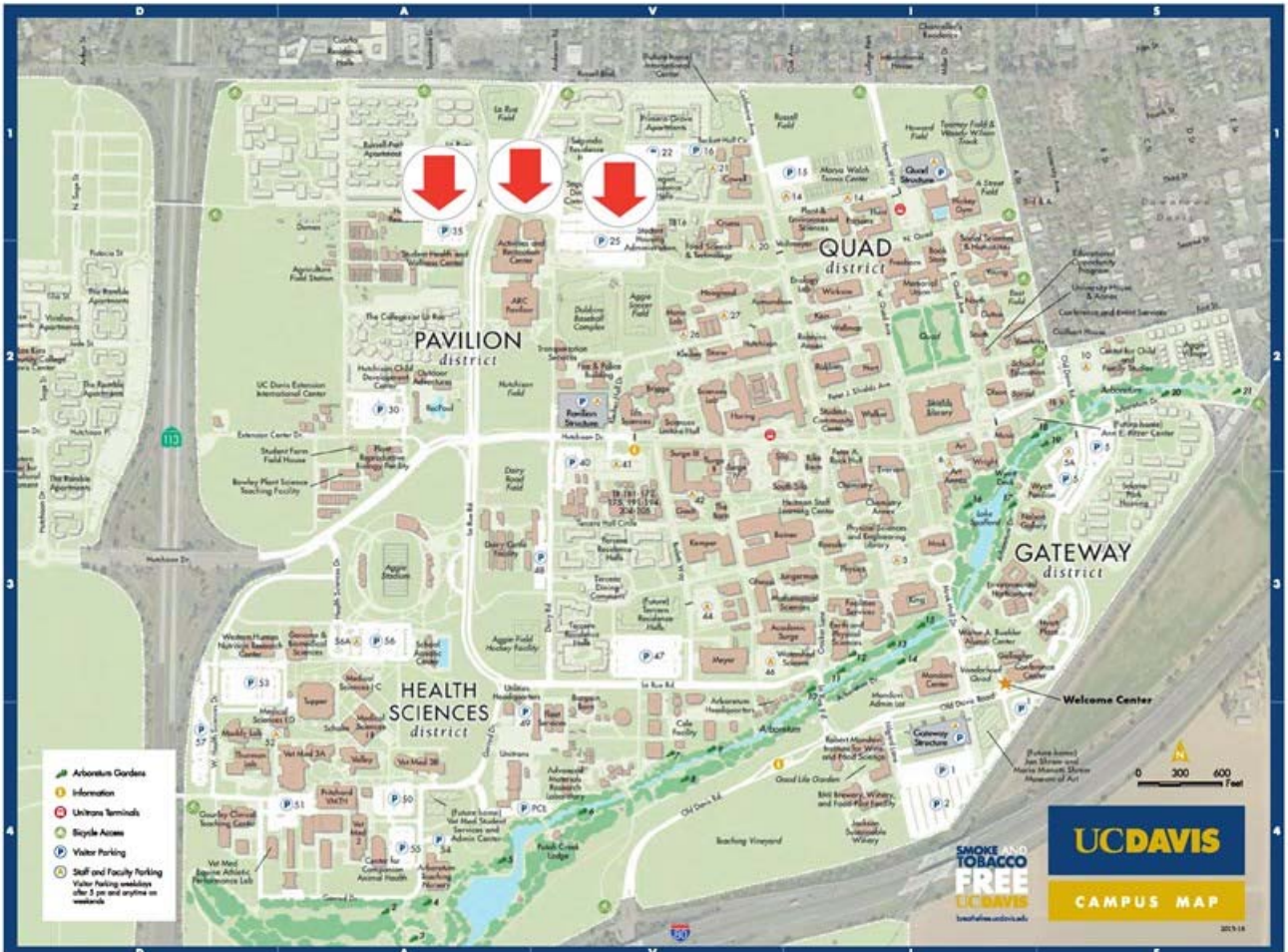
FRIDAY (September 8) MORNING

Breakfast	On your own
8:00 am	Registration in ballroom hallway
8:25 am	Door Prizes
8:30 am	"Microbes Associated with Honey Bee Health" – Slava Strogolov (Milwaukee, WI)
9:15 am	"Pesticide Toxicity Testing with Adult and Immature Honey Bees." – Eric Mussen, Moderator
10:00 am	Beverage Break
10:30 am	WAS Annual Business Meeting
12:00 noon	Lunch on your own (UC Davis Segundo Cafeteria nearby, University Mall a few blocks north)

FRIDAY (September 8) AFTERNOON

Vendors close down and move out by 3:00 pm (to make space for banquet tables and chairs)

1:20 pm	Door Prizes
1:30 pm	"Changes in Nectar Affecting Foraging" – Rachel Vannette (UC Davis)
2:15 pm	"Rapidly Changing Bee Scene" – Kim Flottum (Medina, OH)
3:00 pm	End Silent Auction – pick up items and pay in next half hour
3:30 pm	Vacate Ballroom B
3:30 pm	Post-business Meeting Board of Directors Meeting – place TBA
5:00 pm	Pre-banquet socializing; no-host bar
6:00 pm	Annual Awards Banquet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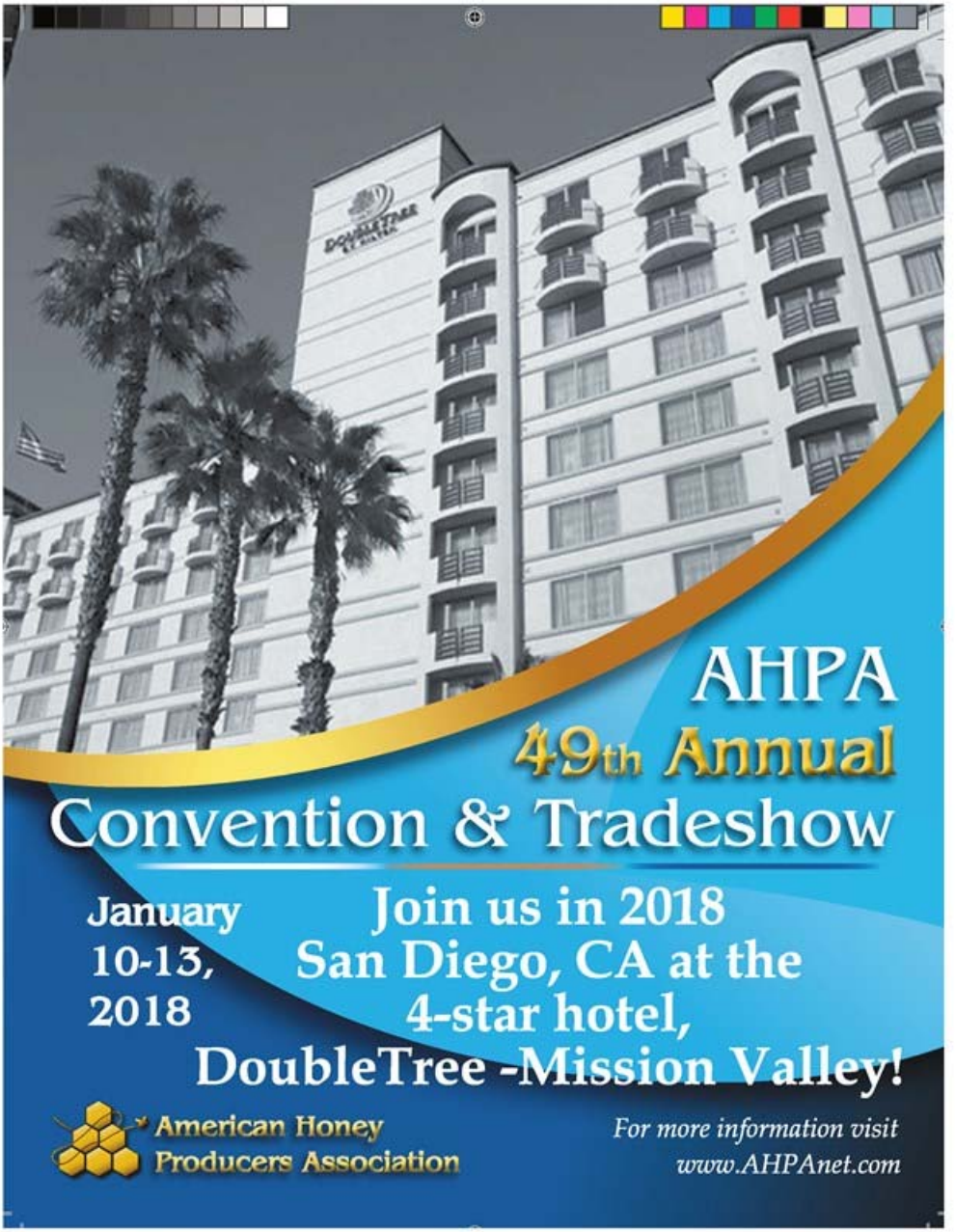
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Convention & Tradeshow
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BEE ONE WITH US!

Discover the many facets of the ABF at the 2018 American Beekeeping Federation Conference & Tradeshow in Reno, Nevada. Join us, as we celebrate our 75th Diamond Anniversary with four days of spectacular educational sessions, networking and fun.

Honey Bee Nutrition (Part 2)

Dale Hill, PhD, PAS, Quincy, IL

In Part 1 of this series, general nutrition of honey bees was presented, along with a focus on what is known about vitamin and mineral needs of the honey bee. This discussion will focus on the protein, or more correctly, the amino acids, needs of the honey bee, and pollens.

As noted in Part 1, pollens will vary from 4% crude protein to 60% crude protein. The term "crude protein" indicates laboratory methods of analysis – it tells us very little about the quality, digestibility and potential biological utilization of the protein. These laboratory methods provide an estimate of the nitrogen content of the sample being analyzed. Once determined, the nitrogen content is multiplied by a conversion factor (% nitrogen X 6.25 for most products) to estimate crude protein content. From a nutritionist point of view, crude protein analysis is done to verify compliance with State and Federal laws regarding product labeling. Diets and supplements need to be formulated on amino acids levels and ratios as these are the building blocks of protein.

This is where reality sets in - amino acid analysis is about 15-20X higher cost per sample analysis than protein analysis. For many common ingredients, we either have the samples analyzed for amino acids, or use reference book values for amino acid content. For less common ingredients or those used at low levels, we may spend the dollars for amino acid analysis for the best accuracy in product development, you may be able to find reference books with this information, or in some instances, we have to work with incomplete information and "educated guess" values based on similar ingredients.

DeGroot, in 1953, published a paper establishing that the same 10 amino acids considered essential for mammals are also essential for honey bees. This is considered a "classic" publication as it is still as applicable today as it was in 1953, and is the basis for much of the current thinking about amino acid needs of the honey bee. By essential, we mean that these amino acids cannot be synthesized in adequate amounts in the body and/or by intestinal bacteria, and must be supplied in the diet. There are another 10-12 amino acids that can be synthesized in adequate amounts, either in the body or by intestinal bacteria, that are considered non-essential in the diet.

In the honey bee, digestible amino acids must be provided by pollens or supplements to the bee's body in adequate amounts to be used by the bee to make body tissue, muscle, enzymes and other specific protein-based products. Young bees start consuming pollen within the first few hours after emergence, and must consume large amounts of pollen in the first two weeks of life. Within the first 5 days, there are major increases in body nitrogen (amino acids) in the head, thorax and abdomen. During this time, the hypopharyngeal glands, fat bodies and other internal organs develop.

As a very general statement, pollens are divided into 4 groups based on bee longevity and development of the hypopharyngeal glands, ovaries and fat bodies: 1 - pollens from fruit trees, legumes (especially clovers), and willow provide highly nutritious sources of pollen; 2 - lesser nutritious pollens coming from elm, cottonwood and dandelions; 3 - pollens from alder and hazelnut are fair sources; and 4 - pollens from various species of pines are considered poor quality. This is a reflection of the adequacy of amino acid content of these pollens. If a single essential amino acid is not present in an adequate amount, excesses of other amino acids cannot make up this difference, and the rate of protein-amino acid metabolism (growth and other body functions) will be limited by the amino acid that is in shortest supply (or deficient).

The amino acid content of the honey bee's hemolymph (similar to our blood) will vary based on amino acid intake. Hemolymph amino acids increases after worker and drone emergence and peaks at about 5 days of age based on pollen and bee bread consumption, then decreases as the bees age. Queens, on the other hand, reach peak hemolymph amino acid levels with the onset of egg laying (about 10 days of age). Amino acid levels in the queen are about 2.5X greater than amino

acid levels in worker bees, and is likely a reflection of the high amino acid needs associated with high egg-laying activity.

Pollen stored in a freezer loses nutritive value for bees over time due to the oxidation of essential amino acids. The general recommendation would be to use pollen within 2-3 years after collection, with a rough estimate of about 10-20% decrease in biological value per year. Pollen odor may be an important attractant, with color being secondary, but pH does not appear to have a significant influence on pollen preference. Many of the odors are due to amino acids and fatty acids, and these compounds degrade over time. Freezing will slow down the degradation process, but will not stop it.

Bee bread is pollen packed into wax cells, then covered with a small amount of honey and glandular secretions (mostly digestive enzymes and intestinal bacteria). Stored pollen loses its germination capability within about a week due to chemical changes resulting from these digestive enzymes and bacterial fermentation. Fermentation serves to increase the stability, and improve the digestibility and nutritive value of the stored pollen for the bees. The fermentation process produces organic acids, which helps preserve the pollens - this process is similar to sauerkraut, kimchi and similar foods that use fermentation preservation.

Entombed pollen has been described as sunken, capped cells among "normal" uncapped pollen cells, and is typically a brick red color. This may be due to inadequate acid production during fermentation. This is often found in re-used combs, and usually lead to increased colony mortality.

The criteria used to evaluate various pollens for biological potency may include 1) longevity and amount of brood reared by bees offered the test diets; 2) hemolymph protein and vitellogenin levels; 3) increase in weight and nitrogen content of bees fed the test diets; and 4) colony weights. Protein deficiency increases susceptibility to diseases (Mattila and Otis 2006). Schmickl and Crailsheim (2001) observed that 5 days of non-foraging resulted in cannibalism of larvae by worker bees. Winter bees have been found to be more efficient in pollen protein digestion than summer bees, which is likely an adaptation to less pollen being available to winter bees. This strongly suggests that any supplemental protein feeding to winter bees during broodless periods in late fall-early winter should be lower than late winter-early spring when the queen starts laying eggs. Excess protein for winter bees also increases susceptibility to Nosema when the bees cannot make cleansing flights.

Paoli et al. (2014) demonstrated that adult bees 1) prefer carbohydrates over amino acids; 2) protein (amino acids) needs are greater for young bees, but shifts toward carbohydrates as they age and become foragers; 3) workers have a shorter life span on diets high in protein, but there is no negative effect on consuming only carbohydrates; and 4) the risk of death associated with excess protein (amino acids) increases as the worker bees age – this does not appear to be the case with queens, who have a high protein requirement as long as they are laying eggs. Adult drones consume very little pollen as the activity of protein digesting enzymes drops to very low levels once they start to fly. Carbohydrates (primarily honey) are the primary food source for adult drones and foragers. Worker bees, from emergence through nurse bee stages have a relatively high protein requirement, about 18-20% crude protein, which decreases to an estimated 2-3% crude protein (or less) as foragers.

Vitellogenin is an egg-like protein produced in relatively high amounts by fat bodies in worker bees, and is about 5% of the soluble hemolymph protein during the first week after emergence (Fluri et al 1982). As vitellogenin production and levels decrease in the worker bees, the enzymes responsible for sugar digestion increases, and these changes appear to be a major biological trigger for the transition from nurse bee to foraging activity.

As DNA and gene mapping becomes more precise and our nutrition knowledge base for the honey bee expands, we will gain a better understanding of what controls genetics, and how gene expression influences digestive and metabolic enzymes. This information may help better explain in more detail how food offered to larvae influences the bee caste (queen or worker) since they both have the same genetic potential as an egg. At this time, it appears that specific fatty acid compounds in the food consumed in the egg and larval stages determines what genetic material is expressed and what is depressed. New information may also help determine the best food sources for optimal health, disease resistance, parasite resistance, improved reproduction and honey production, and help reduce the negative impact of pesticides. This expensive research will require government support, but the dollars invested will be relatively minor compared to the benefit to everyone who consumes food.

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Honey Bee Nutrition (Part 3)

Dale Hill, PhD, PAS, Quincy, IL USA

In Part 2 of this series, protein (amino acid) nutrition was presented. In Part 3, we will focus on carbohydrate nutrition and nectar. In all species, there is no true metabolic requirement for carbohydrates, but there is a true metabolic requirement for glucose and other precursors that can be metabolized via the Krebs cycle. In simplest terms, bees need honey, nectar and/or sugar for energy for all body (cellular) activities. Bees, and all other species, can use excess amino acids to make glucose, but this is a rather inefficient metabolic process for a source of energy. This is part of the reason that weight loss diets for human are usually high protein and relatively low in carbohydrates.

One criticism of the scientific literature on the topic of sugar use for honey bees is that many bee researchers use the term "sugar" to describe the carbohydrate source tested. "Sugar", "sucrose", "dextrose" and "glucose" are sometimes used interchangeably within a research report without clear definition of the actual compound they are using in their research. This is most often seen in international scientific journals. Sucrose, dextrose and glucose are well-defined chemically, but "sugar" can be a wide variety of compounds and purity, and may vary slightly in different countries.

There are several simple sugars (ribose, arabinose, xylose, fructose, glucose, mannose, and galactose are some examples). These simple sugars are often found in 2 or more simple sugar combinations, and many combinations can be utilized by a wide variety of intestinal bacteria and mammalian enzymes, but not by honey bees.

Two of these simple sugars from plants are of primary interest for honey bees – glucose and fructose. Average composition of honey is 38% fructose and 30% glucose. Composition of white granular table sugar (sucrose) is 50% glucose-50% fructose. Composition of high fructose corn syrup (HFCS) will vary slightly based on processing methods, but the most common concentration is 55% fructose-45% glucose. Sucrose, glucose and fructose are the predominant sugars in nectars, and are easily metabolized by honey bees.

Along with honey production, glucose is utilized primarily for an energy source for flight and body cellular activity. Fructose likely follows Krebs cycle metabolism (not much in the scientific literature on this topic specifically for honey bees), and would be mostly utilized for fat (lipid) production. This is important in the production of Royal Jelly for feeding the queen and eggs by young nurse bees (more on this in a later article).

There are also many compounds in Nature made up of more than 2 simple sugars (oligosaccharides, for example) that may be poorly utilized by bees, and some combinations may be toxic to bees (lactose, mannose, raffinose are examples). In most cases, the rejection and/or toxicity is because the bees lack the specific digestive enzymes needed to break down and/or convert these complex sugars to glucose. The intestinal bacteria may or may not be able to break down these complex sugars. If the bacteria can somewhat break them down, it often results in fermentation rather than digestion, with resulting production of organic acids. The bee's body tries to equalize the osmotic pressure in the intestine due to these acids, which results in extra body water being pulled into the intestinal tract. This results in diarrhea as the bee's body tries to expel the excess acids. This same concept also applies to mammalian species and ingestion of many of these complex sugars. Excessive diarrhea, from any cause, can lead to severe dehydration and death.

Nectars, either floral or extra-floral, range from 4% to 60% sugar (sucrose, glucose and fructose), depending on floral source and growing conditions. Nectar and sugar solutions containing 30%-50% sugar concentrations are strongly preferred and have the greatest attraction (taste) for honey bees, while nectars lower in sugars are visited less frequently, and nectars with 5% sugar concentration are seldom visited. The point is – bees don't waste energy to bring back a low sugar content nectar to the hive unless there is no other option available.

As the nectar is converted to honey by the bees, most of the sucrose is inverted to glucose and fructose, with 95-99.9% of the solid portion of honey being these two simple sugars. Pollen and bee bread contain 30-35% sugar in the dry material fraction. Starches and cell wall components make up about 50%. Some sugars and starches will be consumed by the bacteria during the fermentation process for making bee bread, and sugars will be more rapidly consumed during bacterial fermentation than starches.

The amount of honey that a colony needs cannot be easily estimated, as it depends on strength of the colony, brood rearing, weather and amount of available nectar. Honey stores for winter survival may vary from 50-60 lbs for the warmer southern US locations to over 100 lbs for colder northern US and Canada locations. In addition, it has been estimated that summer needs of the "average" colony for honey is 95-100 lbs. This equates to an estimated 150-200 lbs of honey production per year for normal colony activity, and does not account for any harvested honey.

For supplemental feeding, the use of sucrose (white granular table sugar) and high fructose corn syrup are recommended. Refined white table sugar (sucrose) is processed to the extent that it is very difficult to determine whether the refined

sugar is cane sugar (non-genetically modified, non-GM) or beet sugar (likely GM) without highly specialized, expensive lab equipment, so read the product label if this is a concern. HFCS, in almost all cases and unless specifically indicated otherwise on the label, will be from GM-plants. This issue is a personal preference decision as there is overwhelming evidence in the scientific literature that there are no differences in metabolism or safety for GM vs non-GM plant products.

Dextrose (glucose-glucose) is another sugar compound that is sometimes available in some areas, but usually at a higher cost since it is used for specialty applications in food processing. Excess inventory from food manufacturers is a likely source of low cost dextrose. It is thought that dextrose is toxic to bees, so to prove this to myself as a scientist, I fed dextrose syrup to several colonies in 2016. First, you must use VERY HOT water and high shear mixing to make a 1:1 syrup as dextrose solubility is lower than sucrose. Dextrose crystallizes much more readily than sucrose and sometimes blocked the jar lid holes of Boardman feeders. When bees deposit dextrose syrup into the wax cells, it forms a very hard crystalline mass (rather than true honey) that the bees may not be able to utilize (personal test observations. Dextrose is usually about 60-70% as sweet tasting as sucrose. For these reasons, dextrose is not generally used for honey bees, and I will not use dextrose in the future based on the observations during my feeding trials, but I had to prove this to myself since there is minimal information on this topic in the scientific literature.

The use of brown sugar or unprocessed sugars are discouraged due to potential negative effects on bees from the impurities that may be in the raw sugars.

High fructose corn syrup is often fed as it is usually lower cost per calorie than dry table sugar (sucrose). Due to the challenges of handling bulk liquid feed, commercial beekeepers more often use HFCS, while smaller beekeepers more often use dry sucrose. HFCS can be fed anytime that is it feasible to offer liquids, but dry sucrose is recommended when temperatures are such that bee cleansing flights are not possible. HFCS should not be fed when supers are in place as this will likely affect the glucose-fructose composition of the honey intended for harvest and sale.

HFCS has a relatively low pH which helps reduce bacterial contamination and fermentation. The formation of hydroxymethylfurfural (HMF) is a slow spontaneous reaction that may start when HFCS is stored at elevated temperatures, and rate of formation increases at the temperature increases. Storage of HFCS at temperatures below 1050F are recommended. HMF levels over 40 ppm can be toxic to bees.

Summataro and Weiss (2013) found that bees fed sucrose syrup had more wax production than bees fed HFCS, but did not find any differences in brood rearing. In the same research report, these researchers reported a second study where bee populations were greater for bees fed sucrose syrup than bees fed HFCS. This may suggest that sucrose (with its slightly greater glucose content) may be the preferred source when wax comb buildup is needed. Wax appears to be made more efficiently from glucose rather than fructose.

The winter of 2016-2017 varied across the United States, but many geographic areas experienced some degree of drought conditions during the fall of 2016. Many very experienced beekeepers lost significant numbers of colonies over the winter across large geographic areas. There is speculation of new variants of viral diseases, but I have also been asked about protein and nectar quality during drought conditions. There is not much information in the scientific literature in this regard, but in the major grain crops that I have worked with over many years, we see minor changes in amino acid content and ratios of amino acids to each other. The protein (amino acid pattern) is highly related to specific plant species and varieties (controlled by plant DNA). However, what is seen are significant differences in the starch content of drought stressed grains, with much lower starch content in drought-stressed grains. This leads to the question of whether drought conditions negatively impact the amount of nectar produced in broad leaf plants visited by honey bees – this would be a logical conclusion, but good scientific evidence is not easy to find. If this is the case, then pollen fermentation and conversion into bee bread for winter feeding and spring brood building could negatively affected. It may also be that if there is inadequate nectar for the pollen fermentation, then other end products of fermentation may result that will not provide adequate storage conditions (acidification) for the bee bread, and potential undesirable bacteria and toxins may be a factor. This is sometimes seen with fermented livestock feeds that do not undergo adequate fermentation and can negatively impact animal health. It is likely that several factors are involved and this may be only one piece of the puzzle.

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Canada's Apimondia Update

Rod Scarlett, CHC Executive Director

The Canadian Honey Council and its industry partners are proud to invite you to join the 46th Apimondia Congress, which will be held in Montréal, Canada from 8 to 12 September 2019. Apimondia 2019 Montréal proposes a theme outlining the importance of bees for our society:

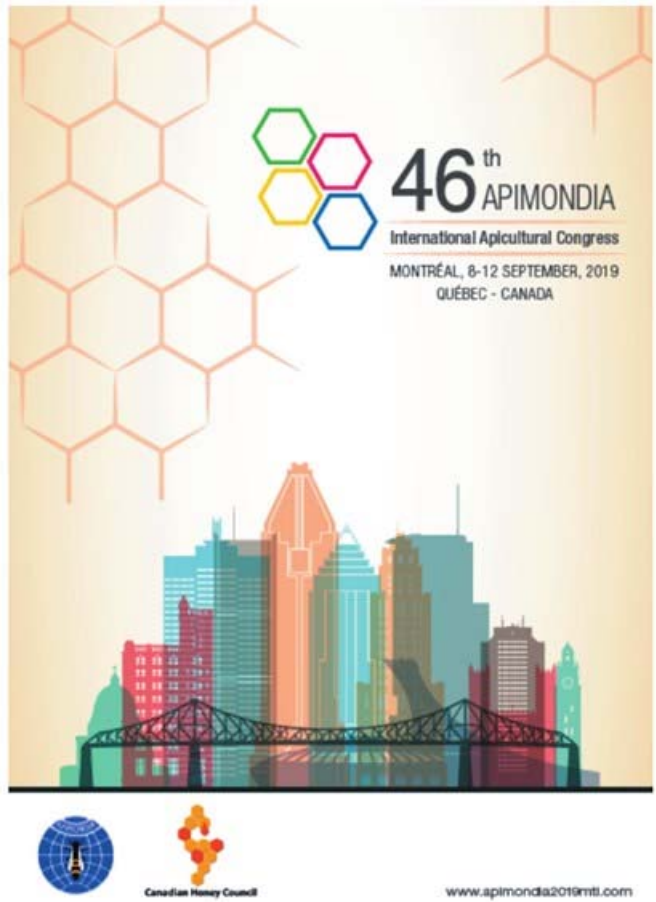
"Working together within agriculture, Canada's answer to sustainable beekeeping

Initial planning is well underway as space and hotel requirements are entering the final stages of negotiations. Montréal is internationally renowned for its hospitality, great attractions, and centrally located modern congress facilities with easy access to the Montréal Trudeau International Airport. The Canadian Honey Council has a team that is working with the City of Montréal and the Palais des congrès de Montréal Convention Center to organize the event.

Pierre Giovenazzo, a professor with the University of Laval is the conference President. Dr. Stephen Pernal is the Scientific Co-ordinator and Rod Scarlett is the Executive Secretary.

The Apimondia website www.apimondia2019mtl.com is up and running and will be updated often. Pre and post conference tours are being finalized and details will be available this fall. Honey, beer, mead, literature and art competitions are all in the planning stages. Quebec's provincial beekeeping association is planning an outdoor market highlighting their products.

The Montreal Congress will strive to showcase world-wide advancements in the science of apiculture. Emphasis will be placed on topics that are of high prominence in the beekeeping community or that challenge our concepts of modern beekeeping through roundtables and special interest group sessions. Of particular interest will be a focus of the extraordinary growth of the urban beekeeper and the benefits and issues raised as a result. We will also endeavor to use web-based streaming of all plenary sessions to allow participants a new category of virtual registration in aspects of the Congress.



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Contact .Ray or Tammy Olivarez (530) 865 0298, Email: ray@ohb.com or a.j.robertson@sasktel.net or phone (306)-373-9140; cell 306 270 6627 for prices and availability.

Beekeepers' Calendar

July 8: Colorado Professional Beekeeping Association Summer meeting, The Steam Plant, Salida CO. Conference hotel - Hampton Inn. Reserve using code BKP. Info http://coloradoprobeekeeping.org.

July 13 - 16: 16th Annual Heartland Apicultural Society Conference, Evansville, Indiana. Info www.heartlandbees.org.

July 31 - Aug 4: Eastern Apicultural Society Conference, University of Delaware, Newark. Info http://www.easternapiculture.org/conferences/eas-2017.html.

Aug 19: 4th Annual Oregon Honey Festival, Ashland OR. Exhibitors/vendors, contact oregonhoneyfestival@outlook.com or visit www.oregonhoneyfestival.com.

Sept 5 - 8: Western Apicultural Society 40th Anniversary Conference & Annual Meeting, UC-Davis Campus, Davis CA. Info www.westernapiculturalsociety.org.

Oct 27 - 29: British Columbia Honey Producers Association Annual Meeting & Conference, Coast Capri Hotel, Kelowna. Info beebetterkelowna.ca.

Nov 14 - 16: California State Beekeepers Association annual convention, Harrah's/Harveys in Lake Tahoe, CA. Info http://www.californiastatebeekeepers.com/events.html.

Jan 9 - 13: 75th Diamond American Beekeeping Conference & Trade Show, Grand Sierra Resort, Reno, Nevada. Info abfconference.com.

Jan 10 - 13: American Honey Producers Association 49th Annual Convention & Trade Show, DoubleTree-Mission Valley Hotel, San Diego CA. Info www.AHPAnet.com.

Human activity a key driver in spread of pathogens afflicting the European honey bee

Reprinted from Entomology Today

The Varroa destructor mite is a widespread parasite of European honey bees (Apis mellifera). Poor management practices have enabled the spread of V. destructor and other bee pathogens, an Australian bee researcher argues.

In the search for answers to the complex health problems and colony losses experienced by honey bees in recent years, it may be time for professionals and hobbyists in the beekeeping industry to look in the mirror.

In a research essay published in June in the Journal of Economic Entomology, Robert Owen argues that human activity is a key driver in the spread of pathogens afflicting the European honey bee (Apis mellifera) and recommends a series of collective actions necessary to stem their spread. While some research seeks a "magic bullet" solution to honey bee maladies such as Colony Collapse Disorder, "many of the problems are caused by human action and can only be mitigated by changes in human behavior," Owen says.

Owen is author of The Australian Beekeeping Handbook, owner of a beekeeping supply company, and a Ph.D. candidate at the Centre of Excellence for Biosecurity Risk Analysis at the University of Melbourne. In his essay in the Journal of Economic Entomology, he outlines an array of human-driven factors that have enabled the spread of honey bee pathogens:

• Regular, large-scale, and loosely regulated movement of bee colonies for commercial pollination. (In February 2016 alone, of the 2.66 million managed bee colonies in the US, 1.8 million were transported to California for almond crop pollination).

• Carelessness in the application of integrated pest management principles leading to overuse of pesticides and antibiotics, resulting in increased resistance to them among honey bee parasites and pathogens such as the Varroa destructor mite and the American Foul Brood bacterium (Paenibacillus larvae).

Full article at http://www.beeculture.com/catch-buzz-human-activity-key-driver-spread-pathogens-afflicting-european-honey-bee-apis-mellifera-says-oz-researcher

The Fourth Annual Oregon Honey (& Mead!) Festival supports and encourages excellence in honey crafting, beekeeping, agriculture and now, mead-making. Dewey Caron, Ph.D, noted speaker, teacher, author, entomologist and expert on all things "Bee" headlines the Festival on Saturday, August 19, 2017 with an early bird breakfast session and honey judging. Held in beautiful Ashland, Oregon, the Honey Festival is also a wonderful opportunity to experience the charm of this small town, perhaps attend the Oregon Shakespeare Festival, and maybe even fit in a visit to the award winning Rogue Creamery, Dagoba Chocolate and Scienceworks Hands-On Museum.

What began as an interest in honey varietals became a passion for learning about the lives of bees, the science of beekeeping and the sensory analysis of honey for Sharon Schmidt, the volunteer Director and founder of the non-profit Cascade Girl Organization. The small non-profit produced the first Oregon Honey Festival four years ago after its founder became captivated by the taste of local Rogue Valley Meadowfoam honey. Since that time, the Festival has come to include Mead, an ancient, healthful, fermented honey beverage as well as other hive products. Festival goers will also be treated to live music, honey samples and local, regional and internationally known speakers. Tickets are available on Eventbrite.com. Kids 8 years of age and under admitted free with parent. The website for the festival is: www.oregonhoneyfestival.com

Sharon Schmidt, Psy.D.
Cascade Girl Organization
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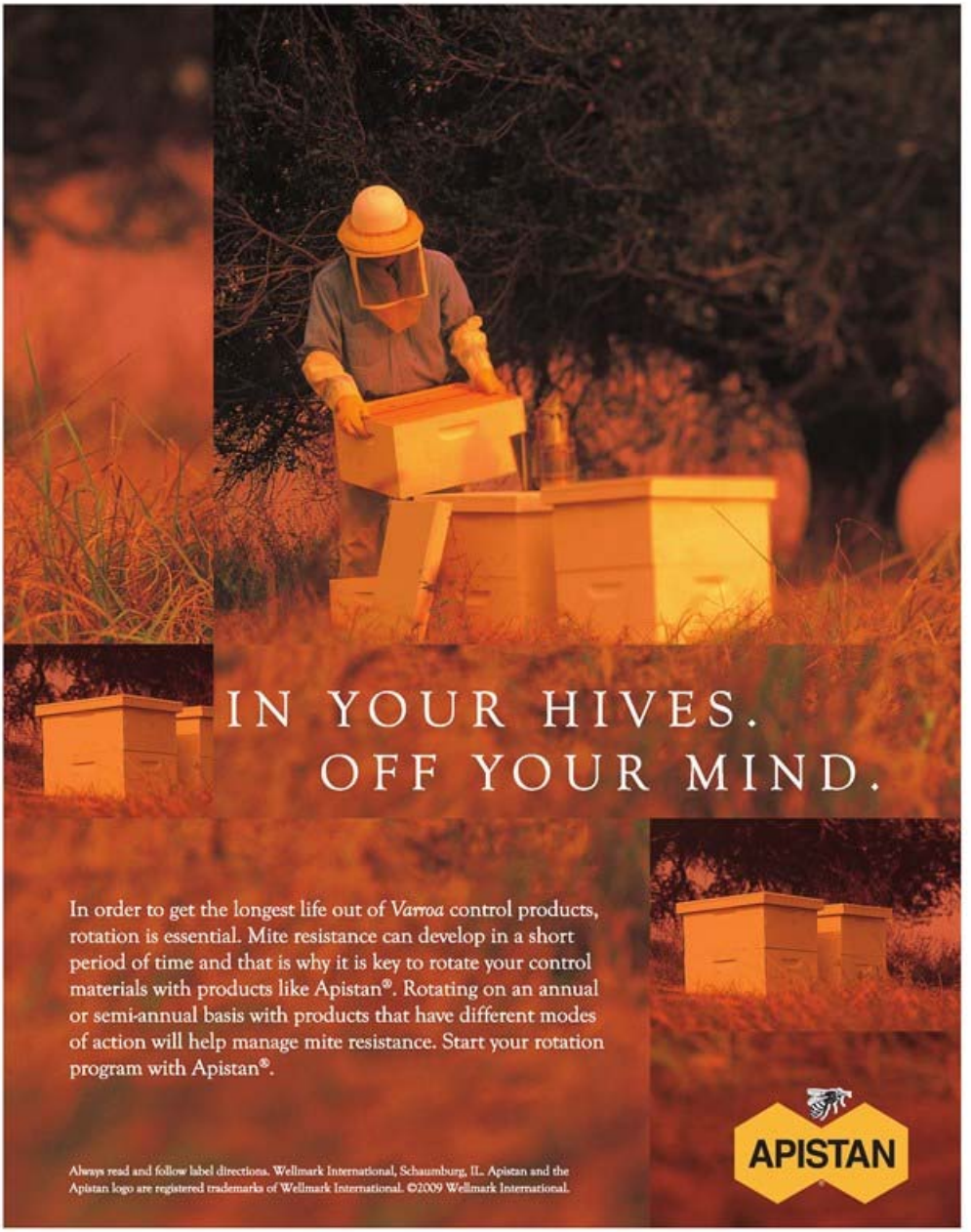
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