THE BEE LINE

The Newsletter of the Oregon State Beekeepers Association

Volume 26, Number 2
March 2001

The Use of Semiochemicals for Control of *Varroa jacobsoni*

By Dr. Stephen F. Pernal

(a summary of comments from his presentation at the OSBA Fall Conference)

Varroa jacobsoni is one of the most serious pests of honey bees throughout most beekeeping areas of the world, and also threatens the production of many bee-pollinated crops. Sustained use of the limited number of products registered for controlling this pest has accelerated the development of resistance to chemicals such as fluvalinate, both in Europe and the United States. Increased tolerance of varroa to several other active substances, including acrinathrin, amitraz, bromopropylate, chlordimeform, coumaphos and flumethrin, has also been documented. The contamination of honey and wax with synthetic acaricides pose additional liabilities that could deleteriously affect the market for bee products. Therefore, sustainable control strategies for varroa based on the use of natural products are in great need of development.

One alternative for controlling varroa is by the use of semiochemicals - chemicals naturally produced by bees that evoke specific behavioral responses in varroa. Such substances could be used to attract and trap out a portion of the mite population within a colony, or repel them from the brood. The high degree of host specificity exhibited by varroa suggests that mites use semiochemicals to locate and parasitize larval and adult bees. For example, varroa selectively parasitize larvae within a very narrow window of time before brood cells are capped for pupation: 15 - 20 hours for worker larvae, and 40 - 50 hours for drones. Varroa also prefer to infest larvae according to their sex, as drone brood cells are parasitized 8 - 12 times more readily than worker brood cells. In addition, phoretic mites exhibit preferences for adult bees of a specific age, whereby mites readily abandon newly-emerged bees and selectively transfer onto nurse-aged workers over foragers. With no known optical system, *V. jacobsoni* must rely on non-visual stimuli for orientation to specific larval and adult hosts. Within the environment of a honey bee colony, semiochemicals appear to be likely candidates for these cues.

Host-finding by varroa appears to be a complex process by which the mite uses olfactory and tactile chemical cues to locate a bee and decide whether to parasitize it. The importance of physical cues in host-finding has also been suggested by some researchers, but their importance remains unclear. The nature of cues produced by a honey bee varies with its age and sex, and the response of the mite is influenced by its reproductive stage. Although many factors may potentially influence host-finding by varroa, my objectives were to determine what

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*** Bee School Schedules**

*** Next month: Annual Pollination Report**

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Oregon State Beekeepers Association

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

To join the OSBA, complete the membership application in this issue and send with payment to: Phyllis Shoemake, 1702 Toucan Street NW, Salem, OR 97304

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President's Notes

by Ray Varner

This issue is packed with all kinds of information, and I'd like to tell about a few more ongoing projects.

Tualatin Valley Beekeeper Dan Hiscoe designed a new screened bottom board to be used in place of the standard bottom board. It has a front landing board for bees and a rear access drawer for the beekeeper. Bees have no access to the drawer. Dan also pre-cut materials to build 30 of these new drawers for the OSU Bee Lab, and on January 27th a work party at Bill Rufener's place in Banks constructed and painted them. They will make Lynn's job much easier. I'll try to have a sample at the Field Day in April. A big THANKS to Dan and the Tualatin Valley Beekeepers for their fine efforts toward the Bee Lab.

I have news about the web page. The page designer has agreed to update the page according to our specifications and keep it updated, and he won't bill us unless we're happy. I have been sending in updates and more changes will be made in the coming months. If you have any input, let me know.
Our goal is to make the web page self-supporting.

Finally, the new season is upon us and I had some unpleasant surprises when I checked on my hives. I lost 40% of the colonies that I treated with grease patties last fall, but only 5% of the colonies that I treated with menthol. The only conclusion I can make is the menthol treatment was effective against tracheal mites and grease patties didn't do the job. Of the remaining grease-treated colonies about 30% will need a frame of brood to give them a boost. The use of menthol isn't recommended in the spring in my area because our weather isn't warm enough, but it generally is warm enough in August and September. I have heard reports of high wintering-over losses from other beekeepers as well. Guess it's time to order packages and nucs!

We're all looking forward to another busy year in the beeyard!

(cont. from page 1)
chemical cues are used by *V. jacobsoni* to locate its hosts, and whether such compounds could be used as the basis of a non-pesticidal control technique for bees.

To conduct this research, colonies of *Apis mellifera* heavily infested with *V. jacobsoni* were maintained in an isolated apiary near Simon Fraser University in Burnaby, B.C. On a weekly basis, bees with mites were collected from colonies and held in small plexiglass cages kept at 30° C, with bees being offered sugar solution. Mites for experiments were removed directly from these bees, 3 - 7 days after collection.

Preliminary tests were conducted to determine the optimal conditions for performing experiments and to establish the orientation behavior of *V. jacobsoni* to live and dead honey bee hosts. For these tests, known as bioassays, sealed petri dishes (60 mm wide by 20 mm deep) were used to examine the response of mites. Each dish contained a honey bee host and a plastic control lure, or two bee hosts. Optimum mite response was found when bioassays were performed in darkness using live honey bees, at 32°C for 60 minutes. Mites preferred to parasitize fifth-instar worker larvae over pollen foragers or adult drones, and in contrast to well-documented preferences seen within colonies, preferred worker larvae over drone larvae. Mites also preferred to parasitize adult nurse bees over worker larvae, irrespective of the age of the mite. This finding clearly indicates the potential for exploiting semiochemicals not only from larvae, but from nurse bees as well.

Additional petri dish bioassays indicated that the chemical stimuli used by varroa mites to locate their hosts could be removed from worker larvae or nurse bees by washing them with organic solvents. However I found that these extracts were not effective in enticing mites to parasitize specific hosts any more frequently than the rate at which they parasitized solvent-washed larvae or nurse bees, offered as controls. In addition, mites appeared to exhibit an aversion to nurse extracts presented at higher doses. Petri dish bioassays were also used to examine mite response to putative larval attractants identified in other studies, however these also proved unattractive over a wide range of doses.

In order to evaluate the long-range orientation of *V. jacobsoni* to honey bees, a y-tube olfactometer bioassay was constructed. The central feature of this device was a small glass y-tube (4 mm i.d.), each of its branches being 4.5 cm long. The downstream branch of the y-tube had a 2 mm hole in its upper surface, which permitted a mite to be introduced. Each upstream branch was fitted with an external heating coil, connected to a dual regulated power supply. The heating coils created a temperature gradient (monitored by thermocouples) to entice mites to move forward in the y-tube and make a choice between the two upstream branches. The end of each upstream branch was connected to a cylindrical sample-holding chamber and then to a low velocity flow meter supplied with medical grade air. The device was housed within an incubator set at 32° C. Mites were scored as having made a choice between two branches of the y-tube (control vs. treatment) when they had traveled at least 1 cm up one of the upstream arms, within 6 minutes after introduction.

Bioassays using the y-tube olfactometer clearly showed that *V. jacobsoni* exhibited a strong orientation toward the odors produced by live nurse bees and worker larvae, but had less attraction to foragers. Volatile compounds being produced by nurse bees were identified by a technique known as solid-phase microextraction, in which a fused silica rod coated with a polymer was placed into the airstream of the y-tube. A synthetic nurse odor mixture was produced based on the components identified using this technique, but these compounds were not found to be attractive to varroa.

Using the y-tube olfactometer, I further determined that the odors produced by dead nurse bees and their organic extracts elicited the same strong orientation behavior in mites as the odor of live nurse bees. Evaluation of live newly-emerged bees showed that their odors were also attractive to mites, but that varroa still preferred the odors of nurse-aged bees over newly-emerged bees, particularly when the latter were 18 hours old or less. Extracts prepared from brood nest workers indicated that mites can be attracted or repulsed by the same extract, depending on dose, and that attractants appear to be highly unstable. We are presently pursuing

the isolation of repellents for *V. jacobsoni* (cont. on page 4)

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from extracts of adult bees. These compounds appear to be stable, and we are currently in the process of identifying their discrete chemical structures. The feasibility of using attractants or repellents within hives will be the next focus of our research, in the hope that we will expand the technologies available for controlling this pest.

I gratefully acknowledge the assistance provided by several students in performing bioassays including: Anna Birmingham, Chris Lee, Shannon Apland, Mikel Lefler, Kum-Heng Poon, Monique LeDoux, Ryan Falk, Rodica Dobrescu and Hien Ngo. I would also like to thank Heather Higo and all the members of the S.F.U. "Swarm Team" for their help in other aspects of this project. This research was funded by a Natural Sciences and Engineering Research Council of Canada Collaborative Research Development Grant. Financial assistance was also provided by IPM Technologies Canada, the Canadian Bee Research Fund, and the American Queen Breeders Association.

NHB Gift Ideas for Spring

With spring around the corner, you may want to give a gift that celebrates the honeybee's importance to agriculture (and the beauty of summer backyards to come!) with this delightful combination: Purchase terra cotta pots or watering cans to load with gifts from the garden. Search local shops for bee items such as wind chimes and decorative yard stakes. Present several floral varieties or colors of honey in designer bottles. Be sure to include flower and vegetable seeds, information about pollination, a trowel, and if you desire, a spade or pruning shears. And don't forget some gifts to keep gardeners in top form – a water bottle (with instructions to add a teaspoonful of honey!) plus some recipes for summer refreshers such as "Honey Raspberry Iced Tea" or "Ginger Peach Smoothie."

For additional gift ideas, head to http://www.honey.com/recipes/gifts. Recipes for honey treats mentioned above can be found throughout the honey.com site.

Final Jeopardy

The category was "Animal Kingdom." Tension was high as contestants made their wagers. The clue: "It's also known as Nature's Confectioners." No, it wasn't a butterfly. Yes, it was Apis mellifera, more commonly know as the HONEYBEE!!! Only one contestant out of three knew that, but with his correct answer and wager the little honeybee won the day.

New Hours for Ruhl Bee Supply

Ruhl Bee Supply in Portland will have the following new hours through June:

Monday through Thursday 8am-5pm
Friday 8 am-7pm
Saturday/Sunday Closed

March in the Beeyard

By Dr. Michael Burgett, Oregon State University

If there is a single most important month for bee management in the western regions of the Pacific Northwest it would easily be March. The spring bloom has begun and it is in March when the first major nectar and pollen "income" is made by a colony. It is a period of colony growth that will spell success or failure for the oncoming honey season. It is a period of critical importance for bee management. In many ways, how you manage your colonies in March determines the success or failure of the upcoming foraging year.

Queens are now into the upward cycle of egg laying, and healthy queens have been laying since January, but up until March, brood production has been maintained by the stored honey and pollen stores in the colony. In March the influx of fresh pollen and nectar will further stimulate and accelerate the number of eggs a queen will produce.

The most serious management practices must now concentrate on swarm prevention, mite management, and structuring the colony to allow for optimized growth. Usually within the first ten days of March will come a day or two of mild weather; those days when the temperatures will exceed 60 degrees. This is the time when you should give your colonies first priority. Please keep in mind that good beekeeping is proactive, and you must plan your inputs with the thought of what the colony will be like in 60 to 90 days.

In early March 90% of the biological activity inside a colony will be concentrated in the top story (super) of the colony. It is here where you will find the queen and most of the brood nest. The colony is in a congested state. You will find the lower brood chamber nearly devoid of bees. This is the time when you make your first reversing maneuver, by placing the top brood chamber (super) on the bottom and placing the "empty" brood chamber above, with the honey super as the top unit. This will allow the queen to continue her natural upward movement in her egg laying pattern. My recommended colony configuration for wintering is two deep hive bodies and one western, which is full of honey on October 1st. Can you use a shallow or a semi-deep hive body? Certainly! By using two deeps and a honey super, you will make it much easier for the reversing maneuver in early March.

Another very worthwhile practice during this first major spring inspection is to give the colony a dry bottom board. As I have discussed previously, a bottom board that has gone through the winter is wet, and if you leave it in place, it will require unnecessary energy on the part of your worker bees to clean it up and dry it out. Save them some time and energy by replacing it; your bees will thank you and it will pay off later in the foraging season with a more productive and healthier hive.

March is also the time when colonies, left improperly managed, will begin swarming preparations. The management practice of reversing is targeted at eliminating congestion and thereby preventing swarm preparations from ever beginning. Swarm management comes in two forms: 1) **Prevention**, with reversing being your primary defense, and 2) **Control**. Swarm control is defined as those measures you will have to take once a colony has initiated swarming. Prevention is your goal. If you must take swarm control measures it means that your management program began too late. I am going to more fully discuss swarm control procedures in a later article.

Another important consideration for that first March colony inspection is food. The spring is the maximum growth period for a colony and a hive should always have, as an absolute minimum, at least ten pounds of carbohydrate (I say carbohydrate because if a colony has less than ten pounds of honey, or fresh nectar, than you must supplement this with sugar syrup.) The amount of food you leave on a colony is analogous to how much life insurance you carry on yourself. But it is always wise to error of the side of excess. Too little food and you will have a dead colony; too much food and you have a living unit that will be productive. Prior to the arrival of bee mites into the Pacific Northwest it was my observation that the leading cause of colony death was starvation. The presence of mites has **not** eliminated starvation as a mortality factor for honey bees. And you need always remember that the primary reason a colony starves is human error.

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March is also the month for mite management, concentrating primarily on *Varroa*. It is critically important to introduce miticidal strips at this time. Use either Apistan™ or Check-Mite™, but not a combination. The last thing to be done before closing up your inspected colony is the insertion of the mite strips. Please be sure to follow label instructions, especially the length of time you leave the strips in the hives. Over-exposure of mites to these acaricides is one of the surest ways to speed up the development of resistance on the part of the mites. Control measures for tracheal mites should not take place at this time as the weather is too variable in March. April is a far better time for the use of therapeutics for tracheal mites.

To maintain the health and growth of a colony, additional inspections and manipulations will be needed in March, but none is as important as that first, major inspection.

Tucson Bee Lab Closing

Dr. Lynn Royce, OSU

The Tucson Bee Lab staff was informed in January that the entire Tucson bee research program will be transferred to Weslaco, Texas. The last working day in Tucson will be March 23, 2001. All permanent employees (four scientists, two technicians) are being given directed transfers to Weslaco or separation by retirement or resignation. This brings the almost fifty year history of the Tucson Lab to an end.

Research is important now more than ever before. OSBA members might want to write letters opposing the closure. Letters can be sent to: Carl Hayden Bee Research Center, Agricultural Research Service – USDA, 2000 E. Allen Road, Tucson, AZ 85719. For additional information, contact John Edwards at edwards@tucson.ars.ag.gov or Dr. Lynn Royce at roycel@bcc.orst.edu.

Northwest Beekeeping

March: Fruit tree bloom starts mid-March through April, although this can vary about two weeks

- Swarming season starts; be observant on each inspection. Queen cell construction on the frame bottom can be seen from congested brood area, hive confinement, low quality stores, predators or queen over a year old. Remove each queen cell found on the bottom of the frames. Queen cells in the brood area (sides of frames) indicate a failing queen. Requeen.
- Dust your colonies three times at seven day intervals with a 2 Tablespoon portion of Terramycin (TM25) mixed with eight parts of powdered sugar. Sprinkle on top of the brood frames, towards the end bars, being sure not to douse the brood.
- Don't let colony stores get below 15 lbs. (3 full frames on honey). Feed light colonies sugar syrup (1 or 1 ½1 ratio) or diluted (2:1) honey (if no American Foulbrood in honey).
- To equalize stores between the colonies, rob combs of honey from colonies with excessive stores. (Put the empty replacement frames back in the strong colony next to the brood nest, to expand egg laying). When equalizing brood, do not remove over 20% of the sealed brood per colony. Give special attention to the feeding needs of colonies that donated brood and stores.
- A strong colony can also be placed over a weak colony by placing a sheet of newspaper and a double excluder between them. Use a separate entrance for each hive.
- Unite queenless colonies with those needing bees, unless there are laying workers. If so, smoke well and shake all bees from frames and supers onto the ground 50''away. Leave their hive space empty and most will unite with adjacent colonies.
- Remove mouse guard screens.
- Look for colonies with nosema/dysentery (fecal matter streaked on the hive). Treat with Fumidil B according to label instructions.
- Clean existing bottom boards.
- Place hives on stands about 12-18" above the ground where skunks are a problem.

- Check stored frames for wax moth infestation.

Meloidae in the Kings Valley Apiary

By Debbie Delaney, Alex Kroeger and Dr. Lynn Royce

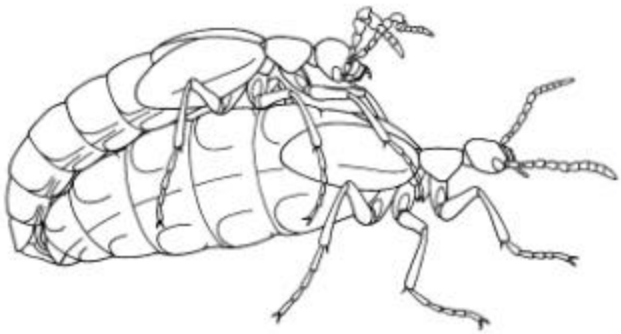
Meloids are beetles native to Oregon whose larvae parasitize solitary bees. Female beetles deposit eggs in the spring near flowering plants. Newly hatched larvae make their way up plants to flowers where they wait for a bee to visit. When a bee arrives at a flower a larva will cling to the hairs of the bee and ride back to the nest where they get off as the bee provisions cells and lays eggs. The meloid larva enters a cell where it feeds on the provisions and eventually the bee larva. When feeding is complete pupation occurs in the soil and adult beetles emerge in the spring.

The first (hatchling) larvae are very small since many potential hosts are tiny bees. Debbie found many first instar meloid larvae on the drop boards at her Kings Valley Apiary in May 2000. It appears that this larva has never been described so we cannot determine the species at this time, although it belongs to the genus *Meloe.* The larvae on the drop boards were probably groomed off the returning honey bee foragers.

Meloe larvae have been reported on honey bees but are not commonly observed, probably because of their small size. A few reports suggest damage to colonies (Pinto and Selander 1970).

We checked the drop boards from our other apiaries carefully but these beetle larvae were only found at the Kings Valley site. This observation raises some questions: What is the potential for this beetle to parasitize honey bees? Did some larvae get into honey bee brood cells this spring? What is the native bee host? What flower provided the bee/beetle contact? We do not expect this beetle to become a serious pest of honey bees but it is of interest since this is an example of how a parasite can switch to a new host.

Scanning electron micrograph of the foot of the first instar larva. Note the claws produce a trident that is used to hold onto the hairs of the bees. This trident is formed by a central piece representing the tarsungulus and fused to it basally two side pieces representing strongly modified basal setae. This structure resulted in these larvae being called 'triungulins'.



Adult beetles

Scanning electron micrograph of the first abdominal spiracle (white arrow); magnification about 500X

Calendar of Events

Bee Schools:

March 1,6 and 8 (Thursday/Tuesday/Thursday) 7-9 pm at Ruhl Bee Supply, 12713 NE Whitaker Way, **Portland** For more information contact Ed, Sheryl or Torey at 503-256-4231
Cost: $25 per person, $45 for couple
Geared to beginners through intermediate beekeepers.

March 17th (Saturday) Lane County Annual Bee School. 8am-5pm at the Glory Bee store, 120 Seneca Road, **Eugene**. For further information contact Chuck Hunt at 541-607-0106 or email at cwhunt@oregon.uoregon.edu. Cost $25 per person. The course will include a complete introduction to beekeeping in Oregon. Segments include such topics as bee equipment and use, bee disease identification, prevention and treatment; seasonal management of honey bees; honey plants and pollen sources; and honey extraction and processing. Individuals and families are welcome.

Field Day:

April 21st (Saturday) Portland Beekeepers Association presents its Annual Field Day. To be held at Foothills Honey, 30576 Oswalt Road, Colton. For more information, contact Joseph Stevens at 503-630-4020 or email at Joseph.Stevens@kp.org.

An Ode to Spring

A honey bee with trembling wings
lit gently on a crocus.
The sight, so rare for early March,
put winter out of focus.

No need to read to know it's Spring
nor taste of hocus pocus.
It only takes a honey bee
and, of course, a crocus.

Ross Yates, Yamhill County Poet