Mid-Atlantic Apiculture Research and Extension Consortium

Delaware, Maryland, New Jersey, Pennsylvania and West Virginia cooperating

Bee AWARE

MAAREC

Notes and News on Bees and Beekeeping

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WHAT'S INSIDE:

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Prepared by
Dewey M. Caron
Extension Entomologist
Univ. of Delaware
Newark, DE 19717-1303
302-831-8883

Focus on: Integrated Pest Management (IPM)

Beekeepers prior to the 90's identified pesticides as a problem and considered pesticides detrimental to bees. Beekeepers today have a different relationship with pesticides. In ten years, beekeepers have learned to rely on pesticides to keep healthy, productive honey bee colonies. Bee mite and small hive beetle control includes placement of a pesticide directly into the bee colony to avoid unacceptably large losses in number of hives.

Are there alternatives to maintaining a relatively pest-free and healthy bee colony without the use of pesticides? For hobbyists and professional beekeepers the answer is an emerging yes – it is adoption of IPM.

IPM or *INTEGRATED PEST MANAGEMENT* is an effective and environmentally sensitive approach to pest management that utilizes a combination of common-sense practices. A goal of IPM is to manage pest populations by keeping their populations below an economic injury level. IPM means not relying on a single pest control scheme. A good IPM program involves selection, integration and implementation of a mixture of biological, cultural and chemical pest control strategies.

IPM is not biological control, although biological control is a useful tactic. IPM is not an organic program although we may integrate organic materials into our control tactic. Nor is IPM anti-pesticide, but generally it attempts to reduce chemical dependency with a mix of control tactics. IPM allows beekeepers to adopt a more balanced approach to mite and disease control that is safer for the beekeeper, bees, hive products and the environment.

The success of an IPM program hinges on good monitoring of pest levels. If we are to reduce our chemical dependency for bee mite control, survey methods must be developed that allow us to determine the proper threshold levels on which to base control decisions. The ether roll method is not reliable as all the mites in our sample of adult bees, which can vary from as few as 100 to more than 500 bees, do not show up on the glass container. Washing the sample with alcohol or soapy water and then filtering through two meshes to trap mites is time consuming but a bit more reliable. Opening and examining drone brood (pupae) cells, like the ether roll technique, tells us if mites are present but we do know what numbers should indicate the need for control. All these methods are destructive resulting in dead bees/brood.

MAAREC research programs are focusing on sticky boards as a more reliable method of monitoring populations of Varroa mites. A Georgia/S. Carolina study reported a treatment threshold of 117 mites/day (natural fall) using sticky boards to monitor mite fall. MAAREC studies (at Delaware) reveal 40 mites/day of natural mite fall might be a better threshold basis.

Once threshold levels have been exceeded, IPM measures should be taken to lower numbers below that injury level. Pesticides can do this rapidly. One IPM strategy is to utilize pesticides with more specificity and lower toxicity. Fluvalinate (Apistan) is such a chemical relative to Coumaphos. Although resistance is present, and spreading, Apistan, used as directed on the label, should still be considered the best chemical treatment to ensure colony survival if threshold numbers are exceeded. Another chemical, formic acid gel, is nearing registration and it should prove useful for bee mite control. A number of essential oils (biospecticides) have been tested by Penn State, the MAAREC project and by other researchers such as Jim Amrine of West Virginia. Several have been found that may be effective but delivery and dosage levels have yet to be determined.

Use of other techniques might help keep mite levels from reaching injury (threshold) levels. The sticky board technique, useful to monitor mite numbers, may also be a means of reducing bee mite numbers when sticky boards are used continuously. Modification of the bottom board may also be a means of reducing mite numbers to reduce dependency on chemical pesticides. A promising area of study points to management of bee colonies that involve removal of drone brood or an interruption in the brood cycle via caging of the queen. One variation is to place all colony brood in a select few colonies for treatment with Apistan and then redistribution to colonies. This limits the number of colonies exposed to the pesticide.

Drone brood trapping is an IPM technique that shows some promise though it is labor-intensive. This technique requires that brood in bee colonies be removed and only combs with drone brood cells used for a period of two weeks. Mites invade preferred drone brood cells during this broodless period. The drone brood combs are removed at the end of the period and put in a freezer to kill all mites. Another useful IPM technique is to use bee stock resistant to or tolerant of Varroa mites. The Baton Rouge USDA lab has tested bees from Russia which show some real promise and stock will be released this year. Scientists at the USDA Tucson Lab and some larger beekeepers have been selecting for colonies with fewer mites using only natural selection. Working with a commercial beekeeper, colony populations of Varroa mites initially at 120 mites/100 bees have decreased to 6 mites/100 bees in the Tucson project. One problem is the bee stock is at least partially Africanized, so exporting these to other parts of the country seems unlikely. Hygienic bee populations that are more diligent house cleaners, may also be useful stock.

Beekeepers need not “reinvent the wheel” – it is still possible to forsake the “pesticide treadmill” of more and more and stronger and stronger chemicals leading to mite resistance of legally available pesticides. Spot pesticide treatments, only when and where mite populations exceed threshold numbers, and vigorous use of the entire arsenal of control tactics in an integrated pest management approach will best serve beekeepers, our bees, and our clientele in the long run.

D.M. Caron

The Effects of Varroa in North America

Dr. James E. Tew, Wooster Ohio (excerpt from Apimondia talk)

The arrival and establishment of Varroa mites in North America has been the biggest catastrophe to befall apiculture since its establishment on this continent in the 1600's. Honey bees and the beekeeper have been through a terrible ordeal in having to learn to coexist with Varroa mites. In only a few years the Varroa mite redesigned nearly 300 years of North American apiculture in ways akin to the dramatic way the boll weevil restructured the cotton-producing industry in the Southeastern US in the early 1920's.

By most estimates, the feral honey bee population within the contiguous US is now ineffective as a provider of pollination. Home gardeners and commercial producers alike have witnessed the devastation of the wild honey bee, once dependable providers of free pollination services, with interest – in many cases alarm. Estimates of losses have ranged from hundreds of thousands to millions of colonies lost. For the foreseeable future, it is expected that the feral population of honey bees will stay extremely suppressed.

One of the eternal mysteries of Varroa becoming established within the US is how long it went undiscovered. It could have been here undetected for several years. Due to migratory operations and package shipments, the mites were scattered quickly across the US. States with a high degree of migratory activity were infected first. Canadian agricultural authorities, rightly concerned about picking up Varroa, closed the Canadian border to shipments of packages and queens and spread has been slower there.

For a while, various individuals kept numbers and statistics concerning the arrival and establishment of Varroa mites. The time needed for Varroa to invade every state, except Hawaii, was nine years, 1987-1995 (all but AL, DE, NM and WY had Varroa mites by 1991). These were tumultuous beekeeping years in the US. For a while a crazy patchwork of quarantines was established between, and sometimes even within, various states that were essentially unenforceable. At bee meetings of all levels, there was an air of absolute urgency. Bee operations that were several generations old were dying out completely. A national newspaper put the "Common Honey Bee" on a list of threatened beneficial animals. For a while, we all wondered if there would be anything left to the beekeeping industry after the Varroa experience.

Although beekeeping specialists touted the dangers of Varroa infestations, beekeepers at first felt that somehow Varroa mites would not affect them. The harsh realization seemed to come in four phases: (1) It won't happen to me, (2) It has happened to me, (3) Treatment frenzy, and finally (4) Acceptance. After passing through phase one, newly affected beekeepers seemed hurt, shocked, and even angry. If they had never moved their colonies, how did they pick up mites? The final aspect of phase two, saw the attitude that, even though they did have Varroa, it was not permanent and they could still rid themselves of the problem. That attitude lead, headlong, into phase three – treatment frenzy. After surviving for a few seasons, much like one surviving a serious personal illness, beekeepers became resigned to the finality of mite infestation. Significantly, new beekeepers, never having known life without Varroa, did not go through these phases. Beekeeping groups today are made up of pre- and post-Varroa beekeepers. I suspect that most pre-Varroa beekeepers will always harbor the notion that we will one day once again be rid of Varroa.

A major change that has been forced onto beekeepers by mites is the use of pesticides within the colony. Until Varroa, the North American beekeeping industry saw archenemies in all pesticide companies. Now we are much more selective. Some pesticide companies are good while others are not. Since our beekeeping industry has no history of using pesticides as extensively as our food commodity cousins, all too often beekeepers are driven to recklessness in their use of chemical control agents. If we lose the respect honey has as a wholesome food, it could very well be the ultimate loss caused by Varroa.

As I see it here are some **negative effects** of Varroa parasitism:

1. Varroa mites have significantly diminished the availability of the wild (feral) honey bee as a common pollinator.

2. Varroa mites have required beekeepers to become "pest control operators." The risk of contamination of honey and wax with pesticide residues is a serious one.

3. Varroa mite infestations drove many beekeepers – both hobbyists and commercial – from the beekeeping industry. With their departure went the hives that they were managing. In addition to bees, we have lost beekeeper friends of past years.

4. Varroa mite research has taken priority over most other research topics during past years. That has stunted our industry's development to some unknown degree.

5. Reduced pollination services has forced commercial growers to look elsewhere for ways to meet their pollination needs. Other pollination techniques being explored include experimenting with other species of bees, exploring mechanical pollination devices and future genetic cloning.

6. The steep number of losses of wild (feral) honey bees have resulted in a pronounced loss of variation within the honey bees' gene pool.

The list of good things Varroa has provided is woefully short, but a major point must be made – Varroa mites have done more to show the services of the honey bee in a positive light than any publicity campaign that our industry has ever attempted. Though still concerned about stinging incidents, the public is much more tolerant of honey bees now than just a few years ago. It took the decimating effects of Varroa infestations to convince the public that honey bees were not just stinging insects but they performed a positive service. **Some other positives** are:

1. Varroa mites have made the public more appreciative of the pollination services of honey bees, a radical change from the early 1990s when the public was deeply concerned about the Africanized honey bee.

2. Though looking at other pollination options, most growers readily accept the pollination value of honey bees and are more eager to engage in pollination contracts.

3. The decline in the feral honey bee population has spawned interest from gardeners, growers, and ecologists who probably otherwise would not have gotten involved in beekeeping.

4. The package & queen aspect of the industry is healthy. While not considered a "growth" component of the industry, individuals who are in it earn a comfortable income.

It is difficult to effectively estimate the loss of honey bees to human society, agriculture, and the environment. Arrival of mites has overwhelmingly consumed research efforts and funds as it has become the most important challenge to solve. Beekeepers today are trained better than beekeepers of a few years ago because of the mites and the public understands and appreciates pollination to a greater degree. Mites, both positively and negatively have completely dominated US beekeeping – it would be hard to visualize our industry in a different light.

Research Priority Statement

BEE RESEARCH LABORATORY, Beltsville, Maryland

Mission: The mission of the Bee Research Laboratory (BRL) in Beltsville is to conduct research on the biology and control of honey bee parasites, diseases, and pests to ensure an adequate supply of bees for pollination and honey production. Using biological, molecular, chemical and non-chemical approaches, scientists are developing new, cost-effective strategies for controlling parasitic mites like *Varroa jacobsoni*, bacterial diseases like American foulbrood, and emergent pests like the small hive beetle. An additional focus of the Laboratory is to develop preservation techniques for honey bee germplasm to maintain genetic diversity and superior honey bee stock. Bee Research Laboratory staff also provides authoritative identification of Africanized honey bees and diagnosis of bee diseases and pests for Federal and State regulatory agencies and beekeepers on a worldwide basis.

Problems Being Investigated: The BRL has several major research thrusts that include the integrated pest management of parasitic mites of honey bees (focusing primarily on *Varroa*); viral and bacterial diseases of honey bees (research on the biology of the small hive beetle *Aethina tumida*, a recently introduced pest, is being investigated under this thrust); and preservation of honey bee germplasm. Smaller projects like control of the greater waxmoth are in progress. As mentioned in the mission statement, biological, molecular, chemical and bee management approaches are used to investigate these problems.

Major Accomplishments: ***Parasitic mites:*** a) A modified hive bottom/screened insert was developed to reduce the impact of *Varroa*. This physical barrier prevents fallen and dislodged mites from re-attaching to bees, and contributes to an overall *Varroa* control program. Descriptions and illustrations of the screened insert have been released to trade journals and are currently available to beekeepers. b) An EPA registration has been issued and a patent has been granted for formic acid gel. The gel will hopefully contribute to a *Varroa* and tracheal mite control program. ***Viral and bacterial diseases:*** a) Oxytetracycline (OTC)-resistant forms of the bacterium that causes American foulbrood disease have been detected in the US and in samples from Canada. b) Analyses of "extender patties" showed OTC content variable and content decreased over time (4.5% per year). ***Small hive beetle*:** a) Specimens of small hive beetles collected in the US and in South Africa were shown to be genetically similar, indicating research on parasites and pathogens in South Africa will be applicable to US populations. b) Temperature/moisture studies indicate eggs will not hatch when the temperature is below 10 degrees centigrade (50F); larvae fail to develop when soil moisture is less than 5% or greater than 25%. c) Sterol inhibitor IPL-12 (N,N-dimethyldodecamine) prevents ovarian development in adult females when supplied in a pollen:honey (3:1) mixture. ***Germplasm preservation:*** a) A dual fluorescent staining technique was developed to assess the viability of honey bee sperm; allows direct determination of sperm survival after experimental treatment, eliminating need for artificial insemination of queens to determine treatment effects. b) Determined that queens artificially inseminated with semen containing only 50% live sperm can achieve normal brood numbers and patterns.

Future Directions: Combine thrusts on parasitic mites and viral/bacterial diseases to consolidate the research effort. Use molecular markers (microsatellite DNA loci) to determine the seasonal movement of *Varroa* infestations. Develop molecular markers to identify bee stock of Russian origin and identify the gene(s) that confer resistance (in collaboration with Baton Rouge). Expand research on the biology/control of the small hive beetle. Continue research effort to preserve honey bee germplasm (eggs and semen). Examine the underlying nutritional component of winter bee losses in an effort to reduce the impact of parasites and diseases.

Honey Bees at Risk this Winter, says UD Entomologist

by Pat McAdams, Univ. of Del.

An increase in the number of bee mites in a recent sampling, coupled with the effects of the drought, may lead to a difficult winter ahead for honey bees, says Dr. Dewey Caron, University of Delaware professor of entomology and Extension specialist for bees. Caron and the Mid-Atlantic Apicultural Research and Extension Consortium (MAAREC) suggest that beekeepers be prepared.

"A combination of the stress from mites and disease, along with the low stores of honey because of reduced flower production, may spell trouble," says Caron. "Beekeepers may need to feed sugar syrup to their colonies this winter so the honey bees can survive."

Not so many years ago, raising honey bees was a relatively straightforward task requiring some understanding of bees and management strategies, along with a certain amount of vigilance. Apiary management, however, was not the challenge it has become today. According to Caron, the catalyst for the change was the arrival of two bee mites in America in the 1980s. Before long, the tracheal mite and the varroa mite had infected large numbers of honey bees throughout the country.

"By 1985, the tracheal mite was discovered in Delaware, with the varroa mite identified in 1992. Since then, feral or unmanaged colonies of bees have all but disappeared from the state, and even managed colonies have taken huge losses," he says. "The winter of 1995-1996 was particularly severe in Delaware," says Caron. "Colony numbers managed by beekeepers fell from an estimated 3,000 to 4,000 a decade earlier to only 1,500 colonies by the end of the winter. For the first time, the number of bee colonies available for agricultural pollination in Delaware was judged to be insufficient to meet the minimum crop needs."

According to Caron, the numbers of colonies have been inching up slowly over the past few years to a high of 2,000 colonies in Delaware today. Because these numbers are insufficient to meet pollination needs, an additional 1,500 to 2,000 colonies are brought in on wagons each summer.

Caron says the University of Delaware and the other institutions in the MAAREC network are searching for solutions. There are medications recommended for protecting honey bees from the mites, he notes, but while the medications are used regularly by most beekeepers, they apparently did little to prevent the major losses over the winter of 1995-1996. A concern is that the routine application of medications may promote resistance in the mite population, and such resistance has already been documented for varroa mites.

"We are comparing different methods of estimating the size of the mite populations in colonies of honey bees with an eye toward treatment thresholds," says Caron. "We also are trying to identify safe alternatives – such as the use of plant essential oils or formic acid gel – that may be effective in fighting varroa mites. The hope is that some integrated pest management (IPM) strategies will control the mites so there is less reliance on chemical controls." Some MAAREC researchers are looking at the role of mites in transmitting honeybee viruses, while others are examining the effects of tracheal mites on honey bee flight metabolism and the role of the honeybee immune system in dealing with pathogens. Other areas of research include attempts to understand the biochemistry of mite resistance to pesticides, non-chemical methods to control varroa mites and the effects of bee mites on the pollination of fruit and vegetable crops. "Any of these studies may provide clues as to how best to help maximize bee survival and keep beekeepers in business."

From Newsy Bee

NOTE: this press release was developed from MAAREC produced template newsletter.

With this **Bee Aware** issue you will find a 4-page survey. Please take a few minutes and **COMPLETE THE SURVEY** now. We value your input and hope to have a large return to validate opinion.

At the USDA, ARS National Bees and Pollination workshop, **MAAREC had a good presence**. This workshop of customers/partners/stakeholders was an effort to help federal (USDA) bee research develop priorities for a 5-year research program. Your editor presented 10 minutes as a representative of University research partners along with other industry leaders and customers. Helping develop priorities in 3 major research areas of pollination – bee management and bee pests/diseases were MAAREC task force members Diana Sammataro and Nancy Ostiguy (PA), Bart Smith and Dave Simmons and several other beekeepers (MD), Grant Stiles and Bob Harvey (NJ) along with Bruce Black (Am. Cyanamid). Jim Amrine (WV) sent Dewey ideas to help with his presentation. Your editor has prepared an article for BEE CULTURE on the workshop and would be glad to send a pre-publication copy for anyone who would like one.

In the last BEE AWARE the efforts to achieve funding for **bee research in NJ** were presented. The NJ Senate did approve the appropriation with a few minor changes and a joint senate-house committee worked out the differences (major one was a change of effective date) and it is expected to be sent to the Governor for her signature (which is anticipated). It looks like the hard work of the NJ beekeepers is paying off. A related bit of news to this update is that Joerg Schmidt-Bailey (whose article on mites on swarming bees was included in last BEE AWARE) will relocate with his wife to the Chicago, IL area and unfortunately will be terminating his association with Rutgers. He has been guiding some student research while following up his Ph.D. research on non-chemical Varroa mite controls, along with teaching beekeeping at Rutgers. We will miss Joerg and wish him continued success as a bee scientist.

Did **Hurricane Floyd floods** or **mosquito spray programs** following the excessive rainfall brought by the Hurricane adversely affect your beekeeping? One NJ beekeeper lost about 300 colonies to the flood itself – on Delmarva only a couple of colonies were lost. Delaware and NJ used ULV malathion and resmethrin to spray for adult mosquitoes but no beekeeper has yet come forward to report bee losses. Your editor has prepared an article for beekeepers on the effects of adult mosquito sprays and will be glad to send a pre-publication copy to those interested. The proactive N. Carolina programs following Hurricane Fran in 1996 (only 2 bee hives were killed) and the advice of a large S. Carolina beekeeper on what to do about large-scale spray programs such as those used from New York to Florida to combat the high fall mosquito outbreak populations are included in this article.

The **MAAREC task force** had a **fall meeting** at Wye Institute (MD) in mid-October. Both MAAREC research and extension efforts were discussed (Maryann has prepared minutes –contact her for a copy or view them on the MAAREC web site http://MAAREC.cas.psu.edu). Extension leaflets, news releases templates, and BEE AWARE computer program were distributed for review. We elected the MD representatives (Dave Simmons and Barton Smith) as conveeners of next meeting scheduled March 8 in Beltsville, MD. We will present our research and extension results to the University administrators and seek their guidance for future funding.

A Simplified Technique for Counting Varroa Sticky Boards

by NANCY OSTIGUY, DIANA SAMMATARO and SCOTT CAMAZINE

In Press *Apidologie*

Summary

The most common method used to assess the level of mite infestation in a bee colony is to count all the mites that fall onto sticky boards placed on the bottom of a colony. Unfortunately, this is a laborious and boring task. Therefore, a stratified sampling technique was devised to accurately estimate the number of mites on sticky boards. The technique, when compared to a census count of all mites, resulted in a coefficient of determination of 0.97 or greater. The stratified sampling protocol in which we randomly selected 33% of the cells on a sticky board and did not choose new random numbers for each sticky board resulted in an accurate estimate of the number of Varroa mites. This technique gave a mean percent error of 0.4% $\pm$ 9.5% for any one estimate of a sticky board.

Visit the MAAREC web site http://MAAREC.cas.psu.edu. This site includes a glossary (http://MAAREC.cas.psu.edu/bkCD/glossary.html that should be consulted to define terms used in this newsletter.

Upcoming Events

Maryland MSBA Winter Meeting
Feb. 19, 2000. Harford Co. Fairgrounds
Contact Dave Simmons 410-734-4188

Beekeeping Short Courses
Jan. 15, 2000. Wye Res. & Educ. Ctr., MD
Feb. 19/Apr. 15, 2000. Dover, Delaware
Mar. 3 & 4, 2000. Rutgers

NJBA Meeting
Mar. 5, 2000. Mt. Holly
Contact Ray Mankley 609-261-1638
RAMBeeman@aol.com

Delaware Beekeepers Annual Meeting
Mar. 18, 2000. Kent County
Contact Warren Seaver 302-674-8969

MAAREC, the Mid-Atlantic Apiculture Research and Extension Consortium, is an official activity of five land grant universities and the U.S. Department of Agriculture. The following are cooperating members:

University of Delaware, Newark, DE
University of Maryland, College Park, MD
Rutgers University, New Brunswick, NJ
Penn State University, University Park, PA
West Virginia University, Morgantown, WV
USDA/ARS, Bee Research Lab, Beltsville, MD

Requests for information or publications should be sent to: MAAREC, 501 ASI Building, University Park, PA 16802 Phone: (814) 865-1896 Fax: (814) 865-3048 Web site: http://MAAREC.cas.psu.edu. This publication is available in alternative media on request.