Washington State Beekeepers Association

Keep the "Bee" in Business

Publication of Washington State Beekeepers Association www.wasba.org August 2005

President's Message

Well we made it through 2 different field days and since this was a first for the association it seemed to go really well. I look forward to feedback on what we can do better. I really have to thank all of you who worked very hard on this project. We need to start thinking about next year so we can have bee yards ready and waiting for the teaching goals for the field days. Our goal is to have IEBA Sponsor the WSU Field day and the local associations around Puyallup sponsor it. We need to establish a WSU bee yard at Mt Vernon and get a group of associations to sponsor that field day. We have a long ways to go to make it all work, so be at the State meeting in October at the convention for more details as we start planning it out. Before Bob Arnold gets done we will all be raising queens.

The 8 lines of WSU queens all have someone to take them over for the winter and into the spring. Then two of the best queens will be returned to WSU for further research and development. It seems the next step is to evaluate them in production for honey and wintering. With all the problems everyone is having with queens now the idea of raising locally grown queens becomes more and more attractive. It has been difficult to get queens out of California for the last month. Many of the spring queens this year have been superceded or became drone layers. The cost of queens is getting really out of hand and shipping them every year is becoming a bigger issue.

We need a good turn out for the convention and hope many of you will attend. It should be a good time. After the Puyallup Field day, Cliff and I drove down to Salem taking the coastal route. It was very pretty and we had a good time. So enjoy the trip and plan on attending the state convention at Newport Beach Oregon.

Its getting close to fair time for many of the local associations and I wish all of you a good time and hope lots of folks visit your displays and booths.

Jerry Tate

Washington State Updates

Program Calendar for the Association.

OCTOBER 28 2005:

WSBA & OSBA joint meeting Oct. 27, 28 & 29th in Oregon Executive Board Meeting w/election of officers and presentation of Beekeeper of the Year.

JANUARY 2006:

WSBA Executive Board Meeting LOCATION TBA

Don't forget Beekeeper of the Year Nominations!

The 2005 Deadline for submissions is September 20th. Please send your candidate selection & letter of nomination to Bob Smith. Contact Bob at;
Area2@wasba.org

15525 Castle SE
Yelm, WA 98597
Phone: 360-894-2159

Master Beekeepers Committee minutes

Master Beekeepers Committee Minutes for July 8, 2005, Puyallup ,WA at 4:45 pm.

Committee Members present: Paul Lundy, Bob Smith, Jo Miller, Van Sherod, Jody Pilarski

The committee did not have a quorum so the meeting consisted of discussions on issues that were tabled until the next full meeting in October, 2005.

Minutes of the pervious meeting were read and accepted by those present.

DISCUSSION

1. WEB SITE - Several concerns were voiced regarding the web site. Current webmaster Frank Seiler is not responding to requests from the association regarding updating of information and providing the key code to get /modify information. The committee recommended that this issue be brought up at the main meeting.

2. CERTIFICATES - Work continues on researching options for certificates. Tim Bueler is looking at different formats and will bring a variety of examples to the committee for review.

(Continued on page 2)

Executive Board Meeting Minutes

July 9, 05 Minutes For WSBA Meeting at Puyallup:
Submitted by Jerry Tate, Secretary protem -

The minutes as published in the newsletter were approved as published. The Treasurer's report was offered and accepted as read at the meeting.

The Master Beekeepers report was given by Paul and they are on schedule for the test reviews. We are awaiting the web master to get items posted to the web. All the historical records are now current and Paul has them in digital format.

Paul reported on the newsletter and we are doing a lot of mailing because the web version hasn't been posted in time. Frank has been working out of town and has not been able to get it uploaded. As soon as Frank gets the web site configured so different officers can access portions of the site and update it, we will have a better opportunity to be timely in our postings.

We currently have 5 of the WSU queen lines allocated to Beekeepers to maintain for the coming year. We hope to have the rest of the lines allocated by the time the newsletter is published.

Area rep reports were not given.

Lisa gave a preliminary report of the financials for the field days; we did not lose money in fact made a small profit. Our intention for the field days is not to lose money but not make a lot either. We will have the official report during our Oct Meeting. If there is a surplus we will need to decide what to do with the money raised.

There was a general discussion of the two field days by the members. Everyone felt that they went off real well and that we filled a need. The discussion got around to how to expand it especially into the northwest associations. It was agreed that having a bee yard to work as provided by WSU was a big help. Further discussion will be held at the Oct. meeting. Jerry said he would bring a proposal on how to do that for the Oct. meeting.

A reminder was given on the state convention as information is now available.

Master Beekeepers Committee minutes, continued

(Continued from page 1)

3. TESTS - Jo Miller and Miriam are in the process of reviewing the current test materials. They are reviewing the curriculum for updating and coordinating the corrections with the test materials. Final format and changes will be brought to the committee for approval.

4. TREASURER REPORT - There were no expenses during the last period. Current balance is $ 2,279.51.
Outstanding bill to be paid is for postage totaling $ 5.32.

5. APPRENTICE vs. JOURNEYMAN - Discussion continues regarding the expectations for achieving Apprentice vs. Journeyman as it relates to previous experience and expertise. The discussion will be brought forward to the next meeting. Concerns include: Local club/community participation, verifying experience levels, prior certifications, knowledge levels and examinations. The committee discussed the possibility of meeting in Seattle before the Oregon meeting in October.

6. MASTER LEVEL CERTIFICATION - There have been some questions regarding the completion of the Master level certification process. The committee members present discussed the possibility of approaching Jim Bach to offer mentoring for Master level candidates. The committee also discussed that we need to be more clear on how to actually proceed and complete the Masters certification. The group discussed that the time factor involved in completing the course work is somewhat difficult. Discussion included developing a clear path for those interested and encouraging a progression of Apprenticeship though Master level . The committee agreed that the program needs to support interested beekeepers and that it is important to develop a core of well qualified individuals.

7. JOURNEYMAN - Jo presented the idea of local Journeyman discussion groups. She stated that in the past she had used this type of forum to share current information and practices. Jo also said that it was helpful in encouraging Journeyman level people to proceed on to the Masters program.

Meeting was adjoined at 5:34pm

Classified Ads

Quitting Business

60 frame Hubbard Extractor, "Cowen" uncapper w/conveyor, jacketed sump w/pump & motor, 1 - low pressure steam boiler, 1,000 standard hive bodies w/frames, 400 - 3/4 depth hive bodies w/frames, (plasticell), 3 - 300 gal. Stainless steel jacketed tanks, lids, bottom boards, queen excluders and more.

Contact: Gary Scott
1202 Juniper St.
Milton, WA
Phone: 253-922-7940 (8/05)

WSBA "Proudly Produced in Washington" gold labels for sale.
Rolls of 500 are $ 7 00 each. To order, Call 360-297-6743 or email treasurer@wasba.org .

Local News

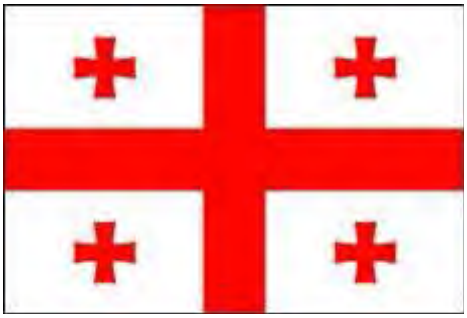
I had a great time at the July Field Day in Puyallup. Since this was the first "west side" event in a long time, I wondered if many would show. Boy, oh boy, you folks packed the Allmendinger Center at the WSU extension.

In the morning Bob Arnold had a well rounded talk on queens and introduction techniques. I discussed American Foul Brood. Jerry Tate discussed Varroa treatments. I appreciated the beekeepers who spoke up and asked questions or had suggestions, or just plain old had better ways to do things.

The field work was a wonderful experience with everybody huddled around the hives, others sneaking off to the raspber-

(Continued on page 5)

A Beekeeping Trip to the Republic of Georgia
By James Miller, IEBA



Georgian National Flag

Garmajoba (Georgian for Hello)

During the month of January 2005 my friend, John Fouts, who works for the United States Department of Agriculture (USDA) in the Republic of Georgia, asked me if I was interested in coming to Georgia to start some beekeeping classes. My immediate response was "I have a passport, my shots and I am ready". The Georgia Farmer to Farmer program is funded by the United States Agency for International Development (USAID), and implemented by Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance (ACDI/VOCA). I was contacted by Winrock International, who does the recruiting for ACDI/VOCA, and they asked for my resume. Okay, now I have committed to the task, where is the Republic of Georgia?

The first map I looked at showed the Greater and Lesser Caucus Mountains. Then the bells went off. Cau-

(Continued on page 6)

Local News, continued

(Continued from page 3)
ries for a snack and a couple who were so excited they locked themselves out of their cars.

The BBQ was just right, with ice cream for desert. I can hardly wait for another west side event.

Paul Lundy

Associate Dues Reminder

Associate Dues Reminder

The WSBA fiscal year ends September 30, 2005. The following associations have already paid Associate dues for 2005:

Mount Baker Beekeepers Association
North Olympic Beekeepers Association
Olympia Beekeepers Association
Pierce County Beekeepers Association

Associate membership is $1.00 per local association member, excepting your members who are already members in good standing of WSBA.

Local association treasurers, please send Associate Membership dues by September 20, 2005, to WSBA, PO Box 1331, Kingston, WA, 98346. Please include a list of the names and mailing addresses of the Associate members.

Thank you,
Lisa Knox, WSBA Treasurer

WSBA Officers & Exec. Committee

President:

Jerry Tate, E. 8900 Maringo Dr, Spokane, WA 98212
509-924-6669, President@wasba.org

Vice President:

Lee Massey, 2781 Hornby Rd, Grandview, WA 98930
509-882-4601

Secretary:

Linda Carney, 4511 S. Freya, Spokane, WA 99223
509-448-0417, Secretary@wasba.org

Treasurer:

Lisa Knox, P.O. Box 1331, Kingston, WA 98346
360-297-6743, Treasurer@wasba.org

Area #1 Representative:

Tim Bueler (2007), 7914 69th Ave. SE, Shohomish, WA 98290, 425-334-9684, Area1@wasba.org

Area #1b Representative:

Van Sherod (2007), 2429 2nd Ave. W, Seattle, WA 98119
206-284-1520

Area #2 Representative:

Robert Smith (2005), 15525 Castle SE, Yelm, WA 98597
360-894-2159, Area2@wasba.org

Area #3 Upper Valley Representative:

Eric Olson (2005), 93 Camfield Rd., Yakima, WA 98908
509-966-2867

Area #3 Lower Valley Representative:

Arlene Massey (2006), 2781 Hornby Rd, Grandview, WA 98930, 509-882-4601

Area #4 Representative:

Miriam Bishop (2006), 14 Shangri Lane, Twisp, WA 98856
509-997-9699, Area4@wasba.org

Area #5 Representative:

John Pettigrew (2007), 2616 N. Rd. 60, Pasco, WA 99301
509-545-3805, Area5@wasba.org

Area #6 Representative:

Robert Arnold (2007), 42615 N. Division Rd., Deer Park, WA 98006, 509-276-2399, Area6@wasba.org

For more information,
please visit us at:
www.wasba.org

A Beekeeping Trip to the Republic of Georgia, continued.

(Continued from page 4)

cus Mountains is where the Caucasian bees come from. I could not find a good reason not to go where they have been keeping bees since 4000 BC. While my search continued for information about Georgia, I learned that the Georgian language is unique to Georgia. The country of Georgia has a long history of traders and empires taking claim to a road that passes through the country. This road that connects the east with the west and is called the Silk Road.

At ten PM, April 17th I arrived in Tbilisi Georgia. I left home Friday morning at 9:00 AM and traveled 12,000 miles, halfway around the earth to meet my good friend John.Tuesday morning I was taken to the US Embassy and met with US Ambassador Miles who was very interested in beekeeping in Georgia. The Ambassador requested that I return for another meeting at the end of my tour.

John Fouts hard at work.

We left for the western office of USDA which is located in Kutaisi. I must say the driver kept the car between the white lines. The white line on the extreme right of the highway and the one on the extreme left of the highway. The center line was there just for show. The current passing laws are whatever makes you happy, so pass on curves, crest of hills, blind turns, intersections and any place in-between. This was done at 100km/hr and a steady tooting of the horn. We made the trip the 210 km in 3 hours. Which I have come to learn is standard time for this distance.

(Continued on page 7)

WSBA Beekeeper Classified Ads

Classified ads are $5 per insertion, for a maximum of 30 words. (***FREE for WSBA Members***).
To place an ad, please mail your ad, with payment, made out to:

Washington State Beekeepers Association
c/o Newsletter Editor
P.O. Box 1331
Kingston, WA 98346-9301
Fax: (425) 527-4251

Please CLEARLY PRINT your ad. Don't forget to include your contact information (phone, fax, e-mail).

Your ad will run in the next printing of the Newsletter when received by the 15th of the month prior to publication. ***The ad will run for two (2) newsletters.*** (You may email your submission to editor@wasba.org and mail your payment to the P.O. Box.)

A Beekeeping Trip to the Republic of Georgia, continued.

Living Room of the USDA office in Kutaisi

(Continued from page 6)

Our USDA driver is Nugzar Jinjikhadze of Kutaisi. Nugzar is well adapted for this position as driver, interpreter, businessman and friend. He is an outstanding driver who speaks Russian, English and his native tongue of Georgian. He has a bachelor's degree in Food Preparation and a master in Business Management.

Nugzar Jinjikhadze the USDA Driver

He has a beautiful wife, two boys, and a pure Georgian dog. From this point forward Nugzar is my driver and John is the boss.

For my first day at work, we went to the Kveda Simoneti School which is located east of Kutaisi by about 15 minutes. This is a three story building that has all of its doors and windows, walls and a roof. All of which are in need of repair. We went into a class that was in progress, the students stood when the teacher entered and left the room. I greeted the students which were in the 8th or 9th grade. They responded Good Morning in good English. I made the statement that I was pleased to see the respect that was shown and stated that this is not done in the US. I walked away from that school crying. The Georgians have so little material wealth and a great desire to improve their standing in life. Now I understand why John works here.

On the second day of work we returned to the Kveda Simoneti School. Everything went great. There were 24 students and 13 adults present. Three of them were beekeepers with 114 hives between them. They all sell retail and sell a liter for 3 or 4 lari which equals about $2.25 in US money. I was tested for my knowledge of beekeeping by two Georgian women beekeepers. I guess I passed the test because they wanted me to come back on Friday.The beekeepers and teachers that I have come in contact with in Georgian are well educated. They have graduated from schools in Georgia and Russia some with engineering degrees and other with teaching degrees. All of them are trying to improve themselves and provide for their families.

My second assignment started on Monday, April 25th. We arrived in Chiatura around noon. At 1:30 PM I met the Upper Imereti Farmers Association. Their president is Fridon Jajanidze and Mamuka Gogilava is

(Continued on page 8)

A Beekeeping Trip to the Republic of Georgia, continued.

The Kveda Simoneti School

(Continued from page 7)

the Vice-President.

Chiatura is located in a deep gorge northeast of Kutaisi. How deep is the gorge? Let me tell you. They have 52 cable cars that run from downtown to the top of the gorge. It is one of their means to get to the top. Another way, and the way we traveled is by car to the hotel at the top of the gorge. We passed this cow that was grazing and I noticed that the legs on the left side were about a foot shorter then the ones on the right side. I asked Mamuka why the difference in the length of the legs. His reply was so the cow can walk upright and won't fall over. A little further up the hill I saw several chickens with string wrapped around their bodies and the other end was attached to a stake. I had never seen this before and being a nosy American I had to ask why the string and the stake. The reply was as follows, the owner has lost chickens before. They appear to lose their footing and tumble to the bottom of the grade. The people at the bottom of the gorge were tired of eating chickens that have fallen to them. So the people at the bottom got together and came up with this idea of how to keep the chickens at home. The owner of the chickens will be required from time to time to move the stakes. There is another problem that they have not been able to correct so they have posted signs. We have them in the US "Caution falling rocks". They have signs at the bottom of the gorge that say "Caution falling eggs".

At 9:00 AM on Tuesday we left the Hotel for the movie theater down town where the class and meeting are to be held. And I use the word down town literally. We are to travel by taxi to the movie theater. The taxi appeared at the gate to the hotel and then turned around. He turned the engine off to save gas. Mamuka, the luggage and I got into the car. I picked the safest seat in the car, the back seat behind the driver. You have heard the stories about white knuckle drivers; ever see a white knuckle passenger? Picture this road, which I came up yesterday, it is paved, holes here and there, more turns than a snake on a hot tin roof, and a 3000 foot drop. My door closes and we are off just like the bobsledders at the winter games. And you guessed it, the engine is not running. Down we go, around we go, past the chickens, the cow and a brown dog that was crossing himself and saying a prayer. I could not hear who the prayer was for because we had just broken the sound barrier. Thirty seconds later we are at the bottom safe and sound.

On Wednesday at 9:00 AM we departed the Hotel and the same bobsled was waiting for us. As we shot down the hill we passed the chickens, cow, and the same dog that was crossing himself. I must be getting into a habit. The beekeepers of the area met at the theater and decided that the trip to the bee yards should be called off because of the rain.

(Continued on page 9)

A Beekeeping Trip to the Republic of Georgia, continued.

(Continued from page 8)

My time in Chiatura was shorter than planned so we started looking up beekeepers in the Kutaisi area. One beekeeper, Avto Gabelashvili, lives in Kutaisi and works about 1500 hives with his five brothers. The other beekeeper, Iuza Gigashvili, lives in the mountains northeast of Kutaisi. We went to see Iuza first. He had over 50 hives at this location. The bees are a mixture of Caucasian and Georgian Mountain Bees. Both bees are gray in color and the Caucasian has stripes while the Mountain Bee doesn't. I have never seen so many bees so calm and collected. His operation is clean, efficient and very well managed. I will call this man the Guru of Beekeepers. Before leaving Georgia I learned how they are treating their bees for Varroa mites. Because money is in short supply they have developed treatments using natural ingredients. After inspecting several hives I could not find any mites. Iuza gave me the recipes and I will have to try them here in the US.
On Wednesday, May 4, 2005, we visited with Roman Margalitadze, Director of the Laituria Agricultural Technical School. He would like a 12 week class on basic beekeeping. I have found that the people of Georgia want very much to improve themselves and their country.
The school has several projects and from time to time they are able to sell some of their produce and a portion of this goes towards teacher's salaries. The local government doesn't have the resources to help with the cost of running the school.
John Fouts, Alfred Williams, Senior Agribusiness Advisor, and I kept the appointment with Ambassador

(Continued on page 10)

October 27, 28, 29, 2005

Northwest Corner Beekeepers Fall Conference 2005

Please join us,

The next WSBA Executive Board Meeting will be held at::

Agate Beach Inn Best Western
Newport, Oregon
‹ Registration form is on page 17 ›

Time and room to be announced at the conference

Everyone is welcome.

Make your reservations at the Agate Beach Inn, (800) 547-3310 and ask for the Beekeepers Fall Conference special room rate.

Master Beekeeper Certification Committee
meets one hour prior to the board meeting.
Topics include:
Correspondence certification program.
Master Beekeepers page for the web site.
Participant database.

A Beekeeping Trip to the Republic of Georgia, continued.

John Fouts, Nugzar Jinjikhadze, Roman Margalitadze

(Continued from page 9)

Miles and Patricia N. Moller, Deputy Chief of Mission. I gave Mr. Miles the report that I had completed. The Ambassador was very interested in Beekeeping in Georgia and how honey sales might increase the monthly income of the beekeepers.

One thing I discovered is that Georgia is very much like Washington State. The east side is dry and the west side is wet and green. A mountain range separates the two. I have met some wonderful people who made me feel at home.

A young Georgian Dance Troupe

I am going to miss Georgia, the people, and the friends that I have made. I am hoping that I will return, with Jenine, and review what I have started.

Nakhvamdis (Georgian for Goodbye)
James Miller

Other News; Journal of Economic Entomology 2005, vol. 98, no. 2, pp. 274 - 278

Hemolymph Juvenile Hormone Titers in Worker Honey Bees under Normal and Preswarming Conditions

Zhijiang Zeng; Zachary Y. Huang; Yuchuan Qin; Huizhong Pang

Abstract

Swarming is an important mechanism by which honey bee, *Apis mellifera* L., colonies reproduce, yet very little is known about the physiological changes in workers that are preparing to swarm. In this study, we determined the endocrine status of worker honey bees in preswarming colonies and in normal (nonswarming) colonies. Juvenile hormone (JH) titers in worker bees were similar in both groups before queen cells were present, but they became significantly lower in preswarming colonies compared with normal colonies when queen cells occurred in preswarming colonies. The lower JH titers in the preswarming colonies suggest that behavioral development is delayed in these colonies, consistent with previous reports that preswarming colonies have reduced foraging activities. Understanding the endocrine status of bees preparing for swarming will help us to better understand the biology of swarming. The full version of this article is available through the Journal of Economic Entomology.

Evaluation of Drone Brood Removal for Management of *Varroa destructor* (Acari: Varroidae) in Colonies of *Apis mellifera* (Hymenoptera: Apidae) in the Northeastern United States

N. W. CALDERONE

Department of Entomology, Cornell University, Ithaca, NY 14853

J. Econ. Entomol. 98(3): 645–650 (2005)

ABSTRACT The efficacy of drone brood removal for the management of *Varroa destructor* Anderson & Trueman in colonies of the honey bee, *A. mellifera* L., was evaluated. Colonies were treated with CheckMite+ in the fall of 2002. The following spring, quantities of bees and brood were equalized, but colonies were not retreated. The brood nest of each colony consisted of 18 full-depth worker combs and two full-depth drone combs. Each worker comb had <12.9 cm^2 of drone cells. Standard management practices were used throughout the season. Colonies were randomly assigned to one of two groups. In the control group, drone combs remained in place throughout the season. In the treatment group, drone combs were removed on 16 June, 16 July, 16 August, and 16 September and replaced with empty drone combs (16 June) or with drone combs removed on the previous replacement date. In the early fall, the average mite-to-bee ratio in the control group was significantly greater than the corresponding ratio in the treatment group. Drone brood removal did not adversely affect colony health as measured by the size of the worker population or by honey production. Fall worker populations were similar in the two groups. Honey production in treatment colonies was greater than or similar to production in control colonies. These data demonstrate that drone brood removal can serve as a valuable component in an integrated pest management program for *V. destructor* and may reduce the need for other treatments on a colony-by-colony basis.

KEY WORDS *Varroa destructor*, *Apis mellifera*, drone removal, drone trap, IPM

THE PARASITIC MITE *Varroa destructor* Anderson & Trueman remains a major threat to honey bees and to those sectors of the agricultural community requiring honey bees for pollination services wherever beekeeping is based on the honey bee, *A. mellifera* L. Mite-resistant stocks of bees are available (Harbo and Harris 1999, 2001, 2003; Rinderer et al. 2001a, b), but their performance is variable, and it will require many years to incorporate them into the honey bee population. Consequently, colonies will require supplemental control measures for the foreseeable future.

Several chemical options are available in the United States. Apistan (fluvalinate) and CheckMite+ (coumaphos) are highly effective, whereas Sucrocide (sucrose octanoate) and Api-Life VAR (thymol) are somewhat less effective. However, pesticide resistance is a growing problem (Baxter et al. 1998; Elzen et al. 1998, 1999; Elzen and Westervelt 2002), and reinfestation also adds to colony mite loads (Greatti et al. 1992). Consequently, beekeepers continue to experience significant losses, especially during the late summer and fall when mite levels rapidly increase and end-stage symptoms known as parasitic mite syndrome occur (Shimanuki et al. 1994). A colony exhibiting early stages of this syndrome can usually be saved by the application of an effective miticide; however, in the northeastern United States, these symptoms typically occur during or just before the fall nectar flow when chemical treatments are proscribed by label restrictions. Delaying treatment until the end of the flow results in either the death of the colony or serious damage to the colony (Ritter 1981, DeJong 1990, Amdam et al. 2004). Therefore, methods that maintain low mite levels during the summer and early fall are needed to protect colonies until the end of the flow and the beginning of a legal treatment window.

The reproductive behavior of *V. destructor* suggests a nonchemical method for suppressing mite populations. Mites reproduce on their host's immature stage. Those that reproduce on drone brood average 2.2–2.6 female offspring per host, whereas those reproducing on worker brood average 1.3–1.4 female offspring per host (Schulz 1984, Fuchs and Langenbach 1989). Mites do not reproduce on queen brood (Romaniuk et al. 1988, Rehm and Ritter 1989, Harizanis 1991, Santillan-Galicia et al. 2002). Differences in fecundity are correlated with the duration of the capped stage of each host type, which is greatest in drones, intermediate in workers, and shortest in queens (Jay 1963). Host choice by female mites mirrors the reproductive opportunities afforded by the different host types. Mites are found more often on drone brood than on

worker brood, with average differences between five- and 12-fold (Grobov 1977; Sulimanovic et al. 1982; Issa and Goncalves 1984; Schulz 1984; Fuchs 1990, 1992; Boot et al. 1991; reviewed in Fries et al. 1994; Calderone and Kuenen 2001). Mites are rarely found on queen brood (Harizanis 1991, Calderone et al. 2002, Santillan-Galicia et al. 2002). Therefore, by removing capped drone brood from an infected colony, a disproportionately large number of mites is removed without adversely affecting the size of the worker population, and also mites with the greatest fecundity are removed.

In Europe, where drone brood removal has been used for many years, the practice typically involves the construction of special combs, the destruction of drone brood with the requirement that colonies build replacement drone comb, and short replacement intervals (Santas and Lazarakis 1984; Rosenkranz and Engels 1985; Marletto et al. 1990a, b; Marletto et al. 1991; Charriere et al. 2003). Others studies combine drone brood removal with additional, labor-intensive techniques such as a heat treatment (Brodsgaard and Hansen 1994), swarm control measures (Schmidt-Bailey et al. 1996), or, most commonly, a short broodless period created by temporarily caging the queen (Fries and Hansen 1993, Calis et al. 1999). Difficulties involved in implementing these methods have prevented their widespread adoption by beekeepers in the United States.

The goal of this study is to determine whether a simple application of the drone brood removal method using commonly available equipment can maintain mite populations at levels consistent with good colony health until the end of the fall flow and the beginning of a legal treatment window. In addition, because host–parasite population dynamics are highly sensitive to environmental conditions (Fries et al. 1994, Lodesani et al. 2002, Harris et al. 2003), I evaluated this method in the northeastern United States.

Materials and Methods

Experimental colonies were kept in apiaries within 10 km of Ithaca, NY. Colonies were treated with CheckMite+ during the fall of 2002 according to label instructions. The following spring, 41 colonies were each reduced to a single full-depth hive body (50.48 by 41.28 by 24.5 cm) with 10, full-depth worker combs. Combs were covered with worker bees and contained the equivalent of eight combs of brood. Colonies were not retreated. A second full-depth hive body containing eight empty worker combs and two empty drone combs was added to each hive to complete the brood nest. Each of the 18 worker combs in the brood nest had <12.9 cm^2 of drone cells. The two drone combs were maintained in the upper brood chamber in the second and ninth positions. Standard management practices were used throughout the season, including the addition of honey supers above a queen excluder.

Each colony was randomly assigned to one of three apiaries, and colonies in each apiary were randomly assigned to one of two groups. In the control group, drone combs were left in place throughout the season. In the treatment group, drone combs were removed on 16 June, 16 July, 16 August, and 16 September 2003 and replaced with empty drone combs (16 June) or with drone combs removed on the previous replacement date. When not in a colony, drone combs were kept in a freezer at -20°C. Bees were required to clean out the dead brood in the drone combs provided on the last three dates. Several variables were assayed between June and November 2003.

Mite-to-Bee Ratios. The ratio of the number of adult mites per adult bee in each colony was estimated from a sample of worker bees collected from brood combs on 7 October 2003 according to the method of Calderone and Turcotte (1998). Samples from each colony were collected after reducing colonies to two full-depth hive bodies, but before a fall application of CheckMite+.

Mite-to-bee ratios for each sample were converted to standardized 300-bee ether roll (ER) counts using the formula $ER = ((R*B)/1.783)/(B/300)$, where R is the mite-to-bee ratio, and B is the number of bees in a sample. The conversion factor (1.783) is from Calderone and Turcotte (1998). This conversion factor (reflecting 56.1% recovery of mites) is similar to the 59% recovery rate reported by Ellis and Baxendale (1994). Standardized 300-bee ether roll counts were used for comparisons with published economic thresholds.

Fall Worker Population. The fall worker populations, measured as the number of combs of adult bees at an ambient temperature of -2 to 0°C, were estimated on 14 November 2003 using the method of Nasr et al. (1990).

Weight Gain. Colony weight gain, primarily a measure of honey production (McLellan 1977), was determined by weighing colonies (± 0.23 kg) on 11 June, 18 August, and 25 September 2003 and calculating weight gains or losses after adjusting for the weights of supers added and removed. Weight gains or losses were calculated for the periods 11 June–18 August (period 1), 18 August–25 September (period 2), and 11 June–25 September (seasonal gain).

Analysis. Data for the above-mentioned variables were analyzed with PROC MIXED (SAS Institute 1996) using a complete factorial, fixed effects model with treatment and apiary as main effects. Significant interactions between main effects were further analyzed with the Tukey–Kramer test (SAS Institute 1988). Proportion data (p) for mite-to-bee ratios were transformed using the arcsine$\sqrt{p}$ function to equalize variances. Colony weight gain data were transformed with the square root function to equalize variances.

Number of Cells of Capped Drone Brood Removed from Treatment Colonies. Drone combs were photographed after being removed from treatment colonies on each replacement date, and the number of cells of capped drone brood removed from each colony was determined by counting. Data are reported for informational purposes.

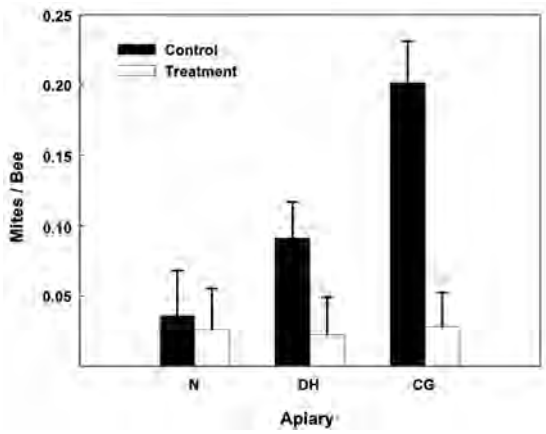


Fig. 1. Average mite-to-bee ratios in treatment and control groups in each of the three apiaries on 7 October 2003 (N, Nelson; DH, Durfee Hill; CG, Cole Grove). Average number of bees and mites per sample (AVG. and SE) and sample sizes (n) are given in Table 1. P values for comparisons of means within apiaries were determined by Tukey–Kramer tests: $P < 0.70$ for N, $P < 0.01$ for DH, and $P < 0.0001$ for CG.

Table 1. Numbers of mites and bees, mite-to-bee ratios and calculated either roll counts (mean ± SE) for samples of brood nest bees collected on 7 October

Apiary	Group	Variable	n	Mean	±SE
Cole Grove	Control	Mites	6	49.67	10.74
		Bees	6	254.83	10.83
		Ratio	6	0.20	0.051
		ER	6	33.89	8.65
	Treatment	Mites	9	6.11	1.18
		Bees	9	221.89	16.20
		Ratio	9	0.03	0.01
		ER	9	4.75	0.90
Durfee Hill	Control	Mites	8	19.00	7.49
		Bees	8	227.50	9.81
		Ratio	8	0.09	0.04
		ER	8	15.32	6.89
	Treatment	Mites	7	4.71	1.69
		Bees	7	218.86	14.11
		Ratio	7	0.02	0.01
		ER	7	3.75	1.49
Nelson	Control	Mites	5	8.60	2.25
		Bees	5	242.80	16.59
		Ratio	5	0.04	0.01
		ER	5	6.02	1.61
	Treatment	Mites	6	6.67	1.52
		Bees	6	253.33	7.26
		Ratio	6	0.03	0.01
		ER	6	4.35	0.91

n, sample size; mites, number of mites in sample; bees, number of bees in sample; ratio, mites/bees; ER, standardized 300-bee ether roll count calculated using the formula ER = ((R*B)/1.783)/(B/300), where R is ratio, B is bees, and the conversion factor (1.783) from Calderone and Turcotte (1998) and Ellis and Baxendale (1994).

Results

Mite-to-Bee Ratios. Mite-to-bee ratios in the two groups were significantly different. Colonies in the control group had an average ratio of 0.109 ± 0.017 (LSMean ± SE), compared with a ratio of 0.025 ± 0.016 in the treatment group ($F = 21.27$; df = 1, 35; $P \leq 0.0001$). The lowest and highest ratios were 0.012 and 0.441, respectively, in the control group, and 0.000 and 0.070, respectively, in the treatment group. Apiary effects were significant. The average ratio was 0.110 ± 0.019 in the Cole Grove apiary, 0.067 ± 0.019 in the Durfee Hill apiary, and 0.031 ± 0.022 in the Nelson apiary ($F = 6.23$; df = 2, 35; $P \leq 0.0049$). The interaction between treatment and apiary was significant ($F = 6.02$; df = 2, 35; $P \leq 0.0121$). Tukey–Kramer tests revealed significant treatment effects in the Cole Grove and Durfee Hill apiaries (Fig. 1). The average numbers of mites and bees, mite-to-bee ratios, and standardized 300-bee ether roll counts are given in Table 1.

Fall Worker Population. The average fall worker populations in the two groups were not significantly different. The average number of combs of bees in the control group was 6.24 ± 0.68 (LSMean ± SE), compared with 6.71 ± 0.63 in the treatment group ($F = 0.25$; df = 1, 35; $P \leq 0.6204$). Average worker populations in the three apiaries were not significantly different. The average number of combs of bees was 7.83 ± 0.77 in the Cole Grove apiary, 5.46 ± 0.75 in the Durfee Hill apiary, and 6.13 ± 0.88 in the Nelson apiary ($F = 2.55$; df = 2, 35; $P \leq 0.0925$). The interaction between treatment and apiary was not significant ($F = 0.94$; df = 2, 35; $P \leq 0.4009$).

Weight Gain in Period 1. Average weight gains in the control and treatment groups were significantly different. The average gain in the control group was 20.87 ± 3.12 kg (LSMean ± SE), compared with 30.76 ± 2.89 kg in the treatment group ($F = 6.07$; df = 1, 35; $P \leq 0.0188$). Average gains in the three apiaries were also significantly different. The average gain was 12.59 ± 0.90 kg in the Cole Grove apiary, 8.45 ± 0.92 kg in the Durfee Hill apiary, and 7.61 ± 1.03 kg in the Nelson apiary ($F = 8.85$; df = 2, 35; $P \leq 0.0008$). The interaction between treatment and apiary was not significant ($F = 0.84$; df = 2, 35; $P \leq 0.440$).

Weight Gain in Period 2. Average weight gains in the control and treatment groups were not significantly different. The average gain in the control group was 36.02 ± 2.72 kg (LSMean ± SE), compared with 38.09 ± 2.52 kg in the treatment group ($F_{1, 35} = 0.44$; df = 1, 35; $P \leq 0.5129$). Average gains in the three apiaries were not significantly different. The gain was 38.68 ± 3.07 kg in the Cole Grove apiary, 40.00 ± 3.01 kg in the Durfee Hill apiary, and 32.48 ± 3.52 kg in the Nelson apiary ($F = 1.19$; df = 2, 35; $P \leq 0.3154$). The interaction between treatment and apiary was not significant ($F = 0.05$; df = 2, 35; $P \leq 0.9543$).

Seasonal Weight Gain. The average seasonal gain in the control group was 56.89 ± 4.83 kg (LSMean ± SE), compared with 68.84 ± 4.47 kg in the treatment group ($F_{1, 35} = 3.47$; df = 1, 35; $P \leq 0.0709$). Average seasonal gains in the three apiaries were significantly different. The gain was 77.21 ± 5.45 kg in the Cole Grove apiary, 58.14 ± 5.35 kg in the Durfee Hill apiary, and 53.26 ± 6.26 kg in the Nelson apiary ($F = 4.18$; df = 2, 35; $P \leq 0.0236$). The interaction between treatment and apiary was not significant ($F = 0.17$; df = 2, 35; $P \leq 0.8421$).

Table 2. Number of cells of capped drone brood (mean ± SE) removed from colonies in the treatment group in each apiary on each replacement date

Date	Cole Grove	Durfee Hill	Nelson
16 June	2,860.56 ± 192.74	1,711.75 ± 344.75	1,587.50 ± 563.39
16 July	1,599.50 ± 270.87	2,247.29 ± 193.70	1,497.83 ± 261.11
16 Aug.	1,863.00 ± 503.34	1,965.14 ± 442.21	2,678.17 ± 270.70
16 Sept.	1,272.89 ± 250.22	1,501.14 ± 398.34	1,350.50 ± 276.99
Total[a]	7,354.50 ± 1,014.03	7,506.14 ± 762.40	7,114.00 ± 961.89

$n = 9$ for Cole Grove, $n = 7$ for Durfee Hill, and $n = 6$ for Nelson.
[a] Average number of cells of capped drone brood removed from each colony during the entire experimental period.

Number of Capped Cells of Drone Brood Removed. The average number of capped cells of drone brood removed from treatment colonies in each apiary on each replacement date is given in Table 2.

Discussion

The drone brood removal method suppressed mite levels throughout the summer and early fall. Mite-to-bee ratios in colonies that had drone combs removed four times during the spring and summer were relatively low on 7 October (average ratio ≤0.03 in each apiary) compared with ratios in colonies that did not have drone combs removed (average ratio of 0.10 for the three apiaries; Fig. 1). The lowest and highest ratios were 0.012 and 0.441, respectively, in the control group, and 0.000 and 0.070, respectively, in the treatment group. The average mite-to-bee ratios in the treatment group in the three apiaries remained ≤0.03, regardless of the mite levels in the corresponding control group. This suggests that the amount of drone brood removed was more than sufficient to trap the available mites.

Drone brood removal did not adversely affect colony health as measured by the size of worker populations or by honey production. Fall worker populations were similar in the two groups. Average honey production in the treatment group was significantly greater than production in the control group during period 1, similar to production in the control group during period 2, and perhaps greater overall when measured over the season ($P < 0.07$). This suggests some added benefit from drone brood removal in addition to the maintenance of lower mite levels. Increased honey production could be a direct result of lower mite levels, or it could be due to colonies in the treatment group not needing to support as many adult drones. Seeley (2002) suggested that this might partially explain his finding that colonies that rear and care for drones gain less weight than colonies that do not rear and care for drones. Although both groups in this experiment reared drones, only the control group cared for them as adults.

Charriere et al. (2003) also examined the effects of drone brood removal on colony health. Like the findings in this study, treatment and control colonies in their experiment had similar worker populations in the fall. However, whereas data presented here suggest greater honey production in the treatment group, production in the control and treatment groups in their study was similar. This could be a consequence of their removing drone comb by cutting it out of the frames, thereby requiring treatment colonies to invest in expensive new drone comb construction (reviewed in Seeley 1985, Winston 1987), which reduced honey production.

The results from this study have implications for the frequency of miticide applications. Colonies in this experiment were not treated in the spring, the last miticide application being made the previous fall. The low mite-to-bee ratio in the treatment colonies (LS-Mean = 0.025 ± 0.016) after a full year without chemical treatment suggests that drone brood removal may eliminate the need for a spring treatment; and, on a colony-by-colony basis, it also may permit one to skip an occasional fall treatment.

The decision-making process for determining whether to treat with a miticide is based on economic thresholds. Delaplane and Hood (1999) proposed an ether roll count between 15 and 38 as an economic threshold in the fall in the southeastern United States. A ratio of 0.025 in a sample of 229.5 bees (average ratio and sample size for samples collected from treatment colonies in this study) translates into a standardized 300-bee ether roll count (per Delaplane and Hood 1999) of four or five mites (conversion of ratios to counts based on data in Calderone and Turcotte 1998 and Ellis and Baxendale 1994), well below this recommendation. However, Strange and Sheppard (2001) recommended a 300-bee ether roll count of only three mites in the fall for the state of Washington. Conditions in the area where that study was conducted are similar to those in upstate New York and are likely to be more relevant for the northeastern United States. Therefore, on average, the colonies in the treatment group in this study would still require a fall application of a miticide. However, considered individually, several of the colonies would not require treatment. Five of the 22 treatment colonies (23%) had ratios below the recommended 3-count threshold and do not need to be treated. Had additional drone comb replacements been used, beyond the four in this study, the proportion of colonies with mite levels below the recommended 3-count threshold would likely increase. Clearly, it is necessary to estimate the mite-to-bee ratio on a colony-by-colony basis in the fall to make the appropriate decision.

An added benefit of drone brood removal was the maintenance of relatively low mite levels in those colonies in the treatment group that exceeded the recommended 3-count threshold. The average standardized 300-bee ether roll counts for colonies in the control and treatment groups that exceeded this recommendation were 21.80 ± 5.12 ($n = 16$) and 5.34 ± 0.61 ($n = 17$), respectively. The low mean and standard error in the treatment group indicate that all of the colonies in that group with counts exceeding the recommended 3-count threshold actually had mite levels very near the threshold, even if they still required a fall application of a miticide. However, most

of the colonies in the control group with counts exceeding the recommended threshold exceeded it by a wide margin.

Other issues need to be investigated to understand the limits and long-term value of this method. Paramount is a determination of the degree to which colonies will add drone cells to the worker combs in the brood nest. This could reduce the efficacy of the method by allowing drone production in nontrap combs, or it could require that worker combs be culled at an economically unacceptable rate. Seeley (2002) found that colonies provided with 20% drone combs (including both brood chambers and honey supers) added additional drone cells to significantly fewer worker combs than did colonies without any drone combs. In the present experiment, colonies were provided with only two drone combs in the brood nest (10%), and no drone combs were added to the honey supers. Therefore, the propensity of colonies to add drone cells to worker combs under these conditions needs to be determined.

These issues notwithstanding, this study suggests that drone brood removal holds significant promise as a major component in an IPM program for *V. destructor* in colonies of *A. mellifera.* The fact that it provides suppression of mite populations during the summer and early fall is significant in itself. The maintenance of low mite levels during this period will reduce the incidence of late summer and fall collapse, which is common in mite-infested colonies. This, in turn, will ensure that colonies going into the winter have healthy workers. It also may eliminate the need for a spring miticide treatment, and, on a colony-by-colony basis, reduce the frequency of annual fall treatments.

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