Bees Stop Mite Reproduction . . .34

And 2001 Who's Who

MAY 2001

Bee Culture

Bee Culture
THE MAGAZINE OF AMERICAN BEEKEEPING

MAY 2001 VOLUME 129 NUMBER 5

Dandelions are a sure sign that Summer is close at hand. (photo by Jeffrey Burdick, Florida, MA)

FEATURES

DEPARTMENTS & COLUMNS

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KEEP IN TOUCH

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MAILBOX

Keep The Wise Guy

Now I might be a bit odd, (that is a term in ME we use to describe those people that don't always see eye-to-eye with the rest of the world), but I like the Wise Guy. These people that dump on him for expressing his opinion have gotten my dander up, but I still respect their right to do that.

First off this is a guy spewing forth an opinion that is not all that different from mine. The producer of honey in this country is getting the shaft. I try to produce a good clean high quality product that I can proudly put my name on. I would hate to sell my product to a wholesale buyer that intends to bring up the quality of someone else's honey by blending it with mine. Secondly I would never even think of putting something like beet sugar or corn syrup in my honey to make it go farther. Honey comes to us from one of God's greatest creations, the honey bee, let's not ever forget that. Lastly please do not forget that this country and it's greatness is based on the fact that we, no matter who we are, are allowed to express our opinion. Those that would silence the Wise Guy are the ones that have something to hide perhaps? Just a question, no need to answer.

We can all remember things from our life that we have disliked and I too have my pet peeves. Ring around the collar, let me wash your hair right here on the sidewalk, give us your dirtiest laundry and a host of energizer bunnies. All those commercials ran for months on TV and even though I hated them, they had the right to air. If you don't like the Wise Guy, don't read him. Just select a different channel.

Wise Guy you keep working out there and I'll keep selling my honey locally til I can get a reasonable price for good U.S. honey.

Rick Cooper
Bowdoinham, ME

Hygienic Guarantee?

If we want hives that are not much bothered by AFB, then, to select we should use the hygienic test.

Most of us use hygienic queens. Hygienic bees are important to me but I would consider trying to remove AFB a hindrance to me finding the disease and eliminating it.

Do you encourage the weeds in your garden to bloom before pulling them and burning them? When planting a lawn do you deliberately choose grasses that are easily taken over by weeds?

When I was a bee inspector, I've seen hives that thrive while surrounded by serious, endemic AFB, yet these hives did not seem to have even a single infected cell. Believe me, I looked through them carefully, too. THAT is what I mean by 'hygienic' and 'AFB resistant' When I say 'hygienic' and 'AFB resistant', I am NOT referring to the unregulated, untested and widely varying product that breeders are currently selling as 'hygienic' queens to ride along on the wave. Such queens are a curiosity, but useless as a defense against disease. Afar as I know, there is no breeder that guarantees and certifies that *every* queen in *every* batch sold is hygienic even to an 80% hygienic level. Unless we have that guarantee, we are buying a leaky bucket. AFB will get through such a defense right away.

The problem with 'hygienic' bees available now is that for every 100% hygienic queen we get, we stand a good chance of getting 2 that are NOT strong enough in the hygienic characteristic to thrive in the presence of spores and eliminate the disease on their own. Any hive receiving such a *partially hygienic* queen is either marginally or totally unprotected. If we receive even one non-hygienic queen in a batch of 'hygienic' queens, and if the stock will not hold a high level of the trait through supercedure, then we are getting no real benefit. As I have said before, and will repeat here: If we want to get off the chemical and manual labor treadmill that AFB keeps us on, we will have to have some independent quality control certification that guarantees us that very batch of queens is as consistent as every pail of OTC we buy. Would you buy and trust OTC or fumigillan or Apistan if it were as variable as the queens on the market?

If you could have 100% hygienic hives like the ones I describe, and could quit medicating for AFB, would you prefer to have hives that are susceptible so you could remove the AFB by hand? Over and over again?

Our current AFB practices are equivalent to encouraging weeds to go to seed in a garden. These practices provide a steady income for the regulators and inspectors and equipment manufacturers, but do nothing for the poor beekeeper.

Allen Dick
Swalwell, Alberta, Canada

Negative Publicity

Like in years past, when U.S. honey producers supported a honey subsidy, negative publicity has reared its head. *New York Times* writer, Gail Collins, published an article in the March 14, 2001, issue of *The Denver Post.* Like most anti-subsidy writers, Ms. Collins has presented us with a bit of "Speculative Philosophy."

This negative response from the media should not be surprising, since our support of honey subsidies has always prompted a certain class of journalists to speak their piece. On occasion the News Media has enjoyed support from the bureaucracy and anti-subsidy Members of Congress.

Our first order of business is "Tell a positive story based on facts."

Continued on Next Page

MAILBOX ... Cont. From Pg. 5

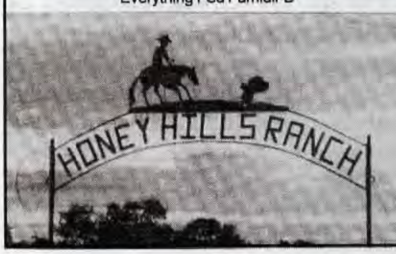
In response to the *Denver Post* news article, Jeanne Clayshulte, wrote a good letter to the editors of several papers in New Mexico. "If any New Mexico papers have published the Collins piece, I am not aware of it. In case they haven't, my letter to these editors will serve as a positive approach to good publicity. Ignoring Ms. Collins, in my view, is the proper approach" she said.

A good suggestion for counter-acting adverse publicity comes from Tom Theobald, a CO bee-keeper:

"While I think Jeanne Clayshulte has done a fine job of answering this particular column, in the long run a good offense is the best defense. Whenever possible, beekeepers should try to get their message in the press before the fact, and avoid simply responding to each foolish and ill-founded newspaper article. That's the story that needs to be getting the ink, and U.S. beekeepers need to get off their little bee butts and start doing it."

Adverse publicity, relative to honey subsidies, will likely be prominent during the coming months. Most of it will come from careless journalists like Ms. Collins. A number of anti-subsidy Members of Congress will likely express their views. The bureaucracy may participate. And maybe, we might have some opposition from honey industry people. A positive and factual response will be our best approach. Silence from producers may mean that non-producers will write our program. Let us remember Tom Theobald's suggestion: "get off our bee butts."

Glenn Gibson
Minco, OK



INNER COVER

My house was built in the mid-1920s and although the upkeep has not been neglected it shows both it's age (primarily in the style) and the technology of the age that produced it. There are shortcomings in several areas, most of which I choose to accept because the benefits of it's uniqueness and, I suppose, it's charms outweigh the faults.

One of these faults is the way the window casings were constructed. They are hollow, drafty and uninsulated and the cost of replacing two dozen windows with new high-tech, energy-efficient models has always seemed excessive. Especially when compared to the short-term economics of new storms and plastic coverings in the fall. Less than perfect I admit, but the drafts are minimal and the heat savings respectable.

My neighbors on all sides are in similar circumstances, all with old houses in good repair. Short-term economics prevail, mostly. But all of us have one peculiar problem every spring. Ladybugs. Some years lots and lots of ladybugs, other years hardly any...but this year was the all-time champion.

These small beetles overwinter as adults, in sometimes-large congregations, in protected spots. We used to find softball-sized clusters in hollow logs in Wisconsin. Here in northeast Ohio they find all those cracks and crevices under siding boards, around windows and chimneys and the like in houses like mine. They eventually find their way to the hollow places around the windows looking for warmth. Then they somehow find their way inside. They are as hard to keep out as the wind through those old windows.

Once inside they start looking for food and water. They are on the kitchen counters, the tops of honey jars, around the sink, around the garbage and the cat food. Upstairs they hang around the tub, the sink, the drinking glass...anywhere water gathers. Yes, they are a nuisance, but most years not much of one.

I tolerate them but my behavior has changed because they are here, especially this year. I always check whatever it is I'm drinking before I drink, every time, like yellow jackets at a picnic. I check the toothbrush. I check inside pans I'm going to cook in. There is no predicting where one or more will show up. And if you have ever eaten or even crushed one you know why they have no natural enemies. Few things will tolerate the smell or taste of a squished ladybug. Even my killer cat detours around one crawling on the floor.

My neighbors aren't nearly as tolerant as I am of this spring ritual however. Some tend toward the hysterical at the sight of even one, let alone a dozen in the sink in the morning. They sweep and vacuum them away with loathing and disgust. To have one fly and land on your plate during supper is considered a personal attack, rendering the meal inedible and the house uninhabitable. And these are pretty normal, rational people in most respects when it comes to the natural world. But these bugs are their undoing.

My guess is that there are way more people that feel about bugs the same way my neighbors do than there are people who gently push a lady bug off the shower handle in the morning. Way, way, way more. In fact, that's a very safe bet.

Now add to that already obnoxious, generic 'bug' a propensity to buzz loudly and to sting, and imagine the hysteria that can ensue. And there are way more people who are not tolerant of bugs that sting than there are people who do. Way, way more. That's another safe bet. Real safe.

When you're working your bees this season keep that in mind. Remember, you **want** to be there. And you have a veil, a suit, maybe gloves and some knowledge of a honey bee's behavior. And the occasional sting is part of the deal, not the best part maybe, but not a personal attack either. And by now you're pretty sure you won't actually die when you do get stung. Some people, correctly or not, are absolutely certain that a bee sting might as well be a death certificate. They are that positive.

Worse, if you have been at this awhile you begin to take some things for granted. And some chances. Bees around your truck. Bees at the water faucet. Bees, bees, bees everywhere, anywhere, anytime.

Not being considerate of your neighbors is the absolute best way there is to make sure somebody will make your bees go away. The zoning board, the police and lawyers can all get involved. All, and each will cost you money.

And it makes no difference if you have been doing things the same way for years or this is the very first time. Most people do not and will not tolerate bugs, especially those that sting, and there are way more of those people than there are of us. And it doesn't make any difference if it's fair. If your bees are pollinating gardens all over town, if you talk to kids at school, if you are insuring the natural order of things in the whole of the county or state. People just don't care when it comes to bugs. And you deal with bugs, that sting.

This season practice safe, and sane beekeeping.

What a difference a year makes. You will notice a significantly shortened Who's Who published this month. We will be moving all of the local and county association information, plus the list that's published here, to our much-visited web page, making it easier to update, much easier to find and easier to use. To find our list go to **www.BeeCulture.com** and click on Who's Who In The Beeyard. There's a message place there to send us additions or corrections. Or just comments. Keep in touch.

Lady Bugs.

MAY – REGIONAL HONEY PRICE REPORT

Second Annual Store Survey

Last year we surveyed our reporters for the first time for information on honey in grocery stores. We have done so again this year, asking the same questions. We asked how many rows, or fronts of honey of all types, brands and kinds were in their store(s), how many different brands of honey each store carries, how many are local, how many national, how many 'store' brands there are, and how many of all of these have some amount of foreign honey mixed in.

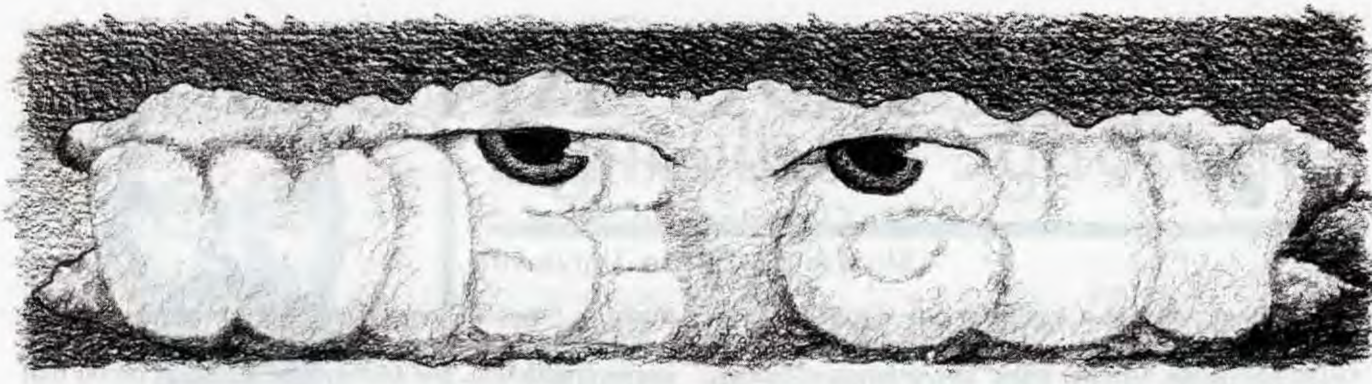
For total fronts, or rows of all types of honey products, there were on average last year 13.5, this year 12.7, about a one row drop, or 6% over all. The number ranged this year from 2 to 34. Interestingly, there were generally 2 sizes of honey displays - small with fewer than 7 rows, or large with more than a dozen. Of course there were some inbetween, but most fell in one group or the other. Last year the range was from 2 to 58, but almost all were between 8 and 12. We didn't consider the size of the store in the question, which undoubtedly has a bearing on the size of the display.

There were, on average 4.6 brands in each display, ranging from 2 to 11, but most right around the average of 4 or 5. This gives about 3 rows/brand. Of all the brands, there were on average 1.7 local brands represented compared to 3.8 last year, which amounted to only 28% of the total. There were on average 2.9 national brands this year compared to 5.2 last year. Store brands this year averaged 1.49 rows on the shelf, while last year there were 3.1 rows of these inhouse varieties.

When combining the national and store brands, 54.3% were a blend of U.S. and foreign honey. This compares to only 41% last year, a significant jump in the use of foreign honey for the retail market, from the sample we took.

Overall, honey displays are down just a bit this year compared to last year, and the ratio of national and store brands compared to local brands has changed, with fewer local brands represented. Moreover, the number of national and store brands that use a foreign honey in their blend has increased. Basically in the grocery stores we surveyed there is less honey being sold, and more of what is being sold is foreign. It will be interesting to see if this changes in the next year with the antidumping effort scheduled to go into action.

	Reporting Regions												Summary		History	
	1	2	3	4	5	6	7	8	9	10	11	12			Last	Last
Extracted honey sold bulk to Packers or Processors													**Range**	**Avg.**	**Month**	**Yr.**
Wholesale Bulk																
60# Light (retail)	69.31	69.00	76.05	72.75	75.00	64.67	58.50	71.13	75.00	77.11	97.50	63.00	48.00-140.00	70.14	70.42	68.26
60# Amber (retail)	67.17	64.92	72.75	70.75	69.00	63.00	58.60	57.60	67.50	72.68	92.50	82.72	50.00-130.00	68.15	65.82	34.32
55 gal. Light	0.59	0.61	0.61	0.65	0.60	0.57	0.57	0.61	0.61	0.60	0.69	0.70	0.49-0.72	0.63	0.62	0.65
55 gal. Amber	0.56	0.59	0.59	0.65	0.55	0.52	0.55	0.72	0.55	0.59	0.56	0.65	0.45-0.72	0.59	0.58	0.60
Wholesale - Case Lots																
1/2# 24's	28.33	30.48	29.37	32.17	29.37	30.40	28.18	29.37	29.37	29.37	24.00	29.37	21.00-37.20	29.91	29.08	29.19
1# 24's	41.13	39.49	42.25	45.16	41.09	44.50	39.68	40.20	48.23	42.25	54.00	48.00	24.10-60.00	42.65	43.53	43.34
2# 12's	38.41	39.84	40.59	43.65	40.59	36.30	37.44	42.00	39.96	40.59	46.00	39.00	29.40-52.58	39.80	40.03	39.34
12 oz. Plas. 24's	35.63	35.28	37.06	35.39	37.06	40.40	33.92	33.92	46.15	37.06	42.00	38.40	26.40-48.00	36.79	37.09	36.93
5# 6's	41.15	40.49	44.41	44.81	44.41	45.90	39.55	39.00	44.12	44.41	60.00	39.96	30.50-60.00	42.72	42.20	42.37
Retail Honey Prices																
1/2#	1.90	1.64	2.83	2.17	1.19	1.32	2.09	1.79	1.79	2.83	3.00	2.83	0.99-5.15	1.88	1.79	1.76
12 oz. Plastic	2.27	2.25	2.86	2.19	1.69	2.44	2.01	2.11	2.90	2.86	3.40	2.29	1.29-5.00	2.29	2.35	2.23
1 lb. Glass	2.86	2.52	3.83	2.86	2.15	2.99	2.92	2.69	2.99	3.83	3.96	2.79	1.50-7.15	2.85	2.77	2.68
2 lb. Glass	4.32	4.29	4.68	5.45	3.69	4.50	3.85	4.26	4.95	4.68	4.68	4.39	2.59-7.00	4.44	4.59	4.41
3 lb. Glass	6.16	6.47	6.62	7.19	6.62	5.49	5.91	5.98	7.00	6.62	6.49	5.89	3.49-10.00	6.36	6.35	6.26
4 lb. Glass	7.46	6.73	8.00	8.76	8.10	8.00	7.36	7.99	8.00	8.20	7.65	7.60	4.05-12.00	7.94	7.73	7.90
5 lb. Glass	11.05	9.70	15.73	10.71	15.73	8.00	11.93	10.99	15.73	15.73	12.10	15.73	7.79-28.50	10.89	9.69	8.66
1# Cream	3.31	3.49	3.99	3.80	3.99	2.80	2.98	2.86	3.99	3.99	5.20	3.09	2.09-6.50	3.37	3.40	3.27
1# Comb	4.21	4.31	4.60	4.40	4.60	3.67	4.08	4.99	5.00	4.60	7.50	4.60	1.95-7.50	4.36	4.46	4.22
Round Plastic	3.70	3.11	4.36	4.00	4.36	3.50	4.15	3.89	4.06	4.36	4.62	4.36	2.00-7.25	3.82	3.56	3.79
Wax (Light)	2.17	2.92	2.57	2.05	1.15	2.88	1.69	2.50	1.65	2.57	2.00	2.50	1.00-4.50	2.21	2.44	2.47
Wax (Dark)	1.85	2.05	2.40	1.27	1.00	2.85	1.60	1.95	1.30	2.40	1.50	2.00	0.85-4.50	1.86	2.24	2.18
Poll. Fee/Col.	38.04	40.40	40.46	36.50	30.00	37.33	41.00	40.00	30.00	40.46	50.00	35.00	27.00-55.00	39.38	39.05	36.87



Hoof-In-Mouth disease has hit America! Or should I say Foot-In-Mouth disease. It appeared in, of all places, Idaho. Will it spread? How do we control its movement across the country? Well, if you can read, it will be stopped.

In the January issue of *The Speedy Bee*, in a Letter To The Editor a reader states that the Wise Guy had lied in a past article saying that an Ohio packer used Chinese honey in his packing business. Let's look closer. In sworn testimony at the anti-dumping hearings that very packer said, and I quote "We primarily pack honey purchased from both domestic and imported sources, including China and Argentina and other countries."

I quoted the actual source of this information, in *MY* article, but the writer didn't or couldn't be bothered to check *his* facts.

He goes on though, and refers to how my opinions are lies that reflect a closed society. You read my quote and can find the source of the quote. The writer couldn't be bothered to do even that. But he continues that what he says is true because it is a "well known fact." He believes it is correct because he wants it to be correct. That doesn't make it so.

This Letter-To-The-Editor boils down to people who are questioning the current National Honey Board. He tells us that U.S. only promotion does not work because "research has concluded it doesn't." What research? Perhaps he got that information from the same place he found out the Ohio packer does not use Chinese honey? He later talks about direction and vision of our industry. In my opinion if you follow this writer's direction and vision it would be like being the fourth dog back in a dogsled team. The view would never change and you just follow someone blindly.

Mr. Foot-In-Mouth throws around the word 'lie' very easily. But I think he was just plain lazy because he didn't check his facts. I think he was just plain lazy because he referred to 'research' without supporting his thoughts. I think he was just plain lazy.

– Wise Guy

? DO YOU KNOW ?

Nectar Secretion

Clarence Collison
Mississippi State University

Whether you are a beginner or established beekeeper, the topic of nectar secretion should be of interest to you since it is the basic raw product of honey. Beekeepers are always speculating about an upcoming honey flow. When is it going to start? How long is it going to last? How much surplus honey are my bees going to produce? Honey production is highly dependent upon many factors that are related to floral sources, climatic conditions, bee behavior and colony strength. While success in beekeeping is usually measured in terms of honey yields, the beekeeper actually has little control over the factors that directly effect honey production. The amount and quality of nectar that is available to the bees is highly variable since it is affected by a whole complex of environmental factors. In addition, many of these same factors also affect the bee's behavior in collecting it from the flowers.

Take a few minutes and answer the following questions to determine how familiar you are with the basic principles of nectar secretion and honey production.

The first nine questions are true and false. Place a T in front of the statement if entirely true and a F if any part of the statement is incorrect.

1. ___ Bees have to work harder to make honey from dilute nectar in comparison to nectar with a high sugar concentration.
2. ___ Nectar is derived from the plant's carbohydrate supply.
3. ___ The ideal daily temperature pattern for nectar secretion (honey production) is high temperature during the day and high temperature during the night.
4. ___ Nitrogen levels in the soil have a greater impact on nectar secretion than levels of potassium and phosphorus.
5. ___ Within the plant, nectar is derived primarily from phloem sap.
6. ___ Nectaries are centers of intense metabolic activity.
7 ___ All flowering plants are attractive to honey bees.
8. ___ Nectar and honeydew are processed by honey bees into honey for storage in the comb.
9. ___ The sugar content of honeydew is more complex than that found in honey.

(Multiple Choice Questions, 1 point each)

10. ___ Nectar is primarily a solution of dissolved __________ in water.
    A. Proteins
    B. Fats (lipids)
    C. Sugars
    D. Organic Oils
    E. Amino Acids
11. ___ The sugars found in nectar are derived from the biological process known as:
    A. Transpiration
    B. Photosynthesis
    C. Metabolism
    D. Respiration
    E. Translocation
12. ___ Nectar is temporarily stored and transported back to the hive in the worker's:
    A. Ventriculus
    B. Honey Stomach (Crop)
    C. Proventriculus
    D. Oesophagus
    E. Peritrophic Membrane
13. What is the primary reason that flowers produce nectar? (1 point)
14. Describe the impact of thunderstorms on foraging behavior and availability of nectar. (2 points)
15. What two environmental factors have the greatest impact on nectar secretion? (2 points).
16. Compare the nectar secretion cycles of flowers that are pollinated by bees, butterflies, flies or birds to flowers pollinated by moths or bats. (2 points)
17. Name the environmental factor that affects the sugar concentration of nectar after it is secreted. (1 point).
18. Name three soil characteristics that may impact nectar secretion. (3 points)
19. Minor components of nectar are responsible for giving honey from a particular floral source a distinctive aroma and flavor. Name two of these minor components (2 points)

ANSWERS ON PAGE 43

Mark Winston

Agriculture Syndrome

"I pose this thought for your consideration: Perhaps we should get our own chemical and antibiotic house in order before criticizing what happens outside of our hives."

I had the scientifically disturbing experience of debate by anecdote a few months ago, at the annual Canadian Honey Council meetings in Moncton, New Brunswick. I'm sure you've shared the experience; a research scientist or two presents some preliminary and scanty data at a meeting, a few beekeepers come up to the microphone and recount the time their hives went into a tailspin, and before you know it a rumor is born.

The immediate issue under discussion at these meetings was Gaucho, a seed treatment developed by Bayer to kill insects that might attack crops like sunflower and canola. The first presentation summarized North American research that found Gaucho did not harm bees when used on canola. The second report came from a French beekeeper insinuating that Gaucho used in France on sunflowers has been inducing abnormal bee behaviors and decreasing honey production since 1994.

The Gaucho issue erupted in France when bees moved to sunflower for pollination stopped producing the substantial honey crops beekeepers expected from past seasons. Sunflower growers had started using Gaucho that year, an insecticide produced by the Bayer company that has an active ingredient chemically related to nicotine. Gaucho was applied to seeds along with fungicides, and beekeepers claimed that its insect poison migrated up the stem of growing plants, made its way into nectar and pollen, and disrupted the nervous system of bees foraging on the crop.

A fascinating series of contradictory and hazy studies were conducted over the subsequent years, some from Bayer indicating that the low levels of Gaucho's active ingredients found in nectar or pollen could not possibly have been affecting bees. In contrast, French university and government research scientists produced evidence indicating that the residue levels in nectar and pollen might cause bees to behave abnormally, although not resulting in immediate death.

The French studies were suggestive but preliminary and inconclusive. The work from Bayer appeared to be more thorough but was distrusted by the beekeepers. The opponents of Gaucho saw compelling patterns, the company read the data as "no problem," and a neutral observer would have to conclude that more research needed to be done. After intense lobbying by both Bayer and beekeeping associations the French government took the middle ground, decided the data were not strong enough to pull Gaucho from the farmers' toolbox, and continued its registration but suggested more studies should be conducted.

The North American research was done in the summer of 2000, as part of the process to have Gaucho registered for use in Canada and the United States on canola. The studies were done by Marla Spivak at the University of Minnesota and Cynthia Scott-Dupree from the University of Guelph, two well-established, independent researchers. Their work was funded by Bayer but with no strings attached. They looked for bee kills, unusual bee behaviors, decreases in honey production or adult population, and residues in nectar and pollen. Their studies indicated no effects of the seed treatments on bees at three different sites in Ontario and Minnesota and acceptably low residues in floral products, although their colony numbers were on the low side and the work so far has been limited to one year of data.

Following these reports, a number of respected Canadian beekeepers came up to the podium and presented their own stories of unexpected declines in honey production and bee populations. One fellow from potato-growing country on Prince Edward Island delivered a tale of woe after putting bees into potato regions when a different formulation of Gaucho was being used. He experienced problems similar to the French beekeepers, although it is difficult to attribute his problems to Gaucho since bees hardly forage on potatoes. A second producer from out West then came forward and told his story of moving bees on to canola and taking them off with a decent honey crop but low bee populations. In that case Gaucho was not involved, but he suspected pesticide impact.

Continued on Next Page

"Gaucho itself may or may not have impact on bees, but there is a bigger beekeeping issue here that I've named 'Agriculture Syndrome.'"

So who was right? Most beekeepers in the audience favored the French interpretation suggesting Gaucho impact rather than the North American data indicating no effects, although the Canadian and U.S. studies were more definitive and the two beekeeping stories had little connection to Gaucho. Nevertheless, the reports led to a resolution during the business meetings to further study and if necessary ban the use of Gaucho, although the evidence for a problem was arguable.

I took a different conclusion from the fuzzy science and anecdotal reports that to me were connected not by Gaucho but had in common moving colonies on to crops and experiencing bee loss or poor honey production. Gaucho itself may or may not have impact on bees, but there is a bigger beekeeping issue here that I've named "Agriculture Syndrome," the result of too many beekeepers moving too many colonies on to acreages of single-crop fields drenched by a diverse array of contemporary agricultural chemicals.

Many factors contribute to Agriculture Syndrome, but pesticide impact is probably number one. There are, of course, clear incidents where one insecticide spray kills bees, but these occurrences generally are traceable to a single improperly used compound and can be avoided by using proper spray protocols. However, while any single chemical may be safe for bees when applied according to registration guidelines, the accumulated residues from the diverse compounds sprayed by farmers may together reach a critical dose that puts bees at risk.

Thus, Gaucho alone might not be a problem, but Gaucho plus two or three other pesticides could exceed the minimum threshold for damage and induce sublethal effects on bee behavior responsible for dwindling populations and a poor honey crop. We should add our own chemical use into the pot as well. Apistan or Check-Mite alone may not harm bees, but these miticides plus Gaucho plus a few other farmer-sprayed compounds might add up to big trouble inside the hive.

Herbicides and the vast single-crop acreages planted by most farmers also could contribute to colony malaise. Herbicides take away weedy pollen sources and uni-cropped fields provide only a single type of pollen, leading to a nutritionally limited diet for bees. Pollens vary widely in their protein content and nutrient blends. We humans would do poorly on a diet in which our only protein source was steak, and bees also require a mix of proteins from diverse sources for optimal nutrition.

Another contributing factor to Agriculture Syndrome is putting too many colonies on crops. In France, for example, there are 3.4 million bee colonies, about the same number as are run in North America in a country the size of a typical American state. In western Canada, canola is a highly prized honey source, and increasing numbers of beekeepers are moving their colonies to the crop to pollinate hybrid seeds or produce honey. Combine over-use of chemical pesticides, too many colonies in too small of an area, and a single pollen source causing poor bee nutrition and voila, declining bee populations and mysteriously low honey production will rear their ugly heads.

Agriculture Syndrome is a component of a bigger issue, the way large-scale commercial agriculture is practiced in developed countries around the world. It is akin to the growing public concern about residues in human food. Evidence is mounting that our own health is diminished by the accumulation of individually low pesticide and antibiotic residues found in food, with any one compound testing out below minimal thresholds but all residues taken together having a negative impact on our health. Similarly, reduced crop varieties and limited seed selection by farmers result in increasingly homogeneous produce that limits consumer selection and the diversity of our nutrient intake.

A final irony surfaced during the business meeting of the Canadian Honey Council, with a resolution calling for the Canadian government to register the Bayer product Check-Mite for use in Canadian bee hives against varroa mites. Check-Mite contains the organophosphate pesticide coumaphos which is considered to be harder than more recent substances like Bayer's Gaucho, and organophosphate use is diminishing as regulators try to phase out this class of compounds.

Similar resolutions have been passed by American organizations anxious to keep Check-Mite in their miticidal arsenal, and the French beekeepers are well-known for their readiness to apply registered as well as unlicensed miticides into their colonies. In addition, North American beekeepers are struggling with American Foul Brood becoming resistant to oxytetracycline, a problem that has surfaced from overuse of this antibiotic in our colonies.

Few in the room appreciated the inconsistency of jumping on farmers for using the relatively benign Gaucho while promoting the use of dinosaur organophosphate compounds and antibiotics for pest and disease control inside of bee hives.

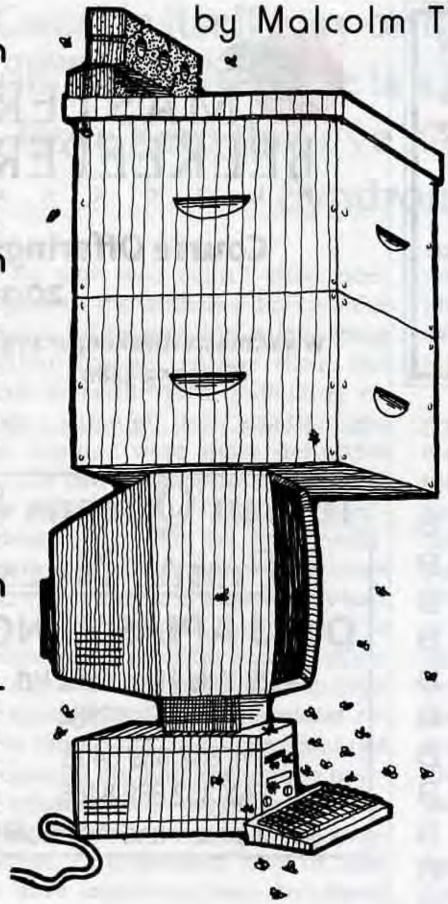
Ladies and gentlemen, with all due respect, I pose this thought for your consideration: Perhaps we should get our own chemical and antibiotic house in order before criticizing what happens outside of our hives. Our own overuse of toxic substances in beekeeping reflects a broader agricultural reliance on pesticides and antibiotics. We may be experiencing the cumulative impact of this chemically dependent life style finally catching up to beekeeping. BC

Mark Winston is a professor and researcher at Simon Fraser University, Burnaby, B.C., Canada.

Beekeeping In The Digital Age

by Malcolm T Sanford

Geography and The Beekeeper



"Precision Agriculture, in the form of Site-Specific Management, offers a remedy to many of these concerns. The philosophy involves matching resource application and agronomic practices with soil properties and crop requirements as they vary across a site. Collectively, these actions are referred to as the 'differential' treatment of field variation as opposed to the 'uniform' treatment underlying traditional management systems. The result is an improvement in the efficiency and environmental impact of crop production systems."

There is a huge number of resources available on the World Wide Web with reference to precision agriculture. This is easily seen by entering these words into a typical **search engine**. The above link to the University of Sydney is an example. Closer to home is the **Precision Agriculture Center Online** at the University of Minnesota. It seeks to foster the use of site specific management techniques through collaborative research, education, and outreach programs. "The Center's greatest contribution will be it's legacy of practitioners, researchers and educators. In development are an undergraduate minor in precision agriculture and a graduate program. Both efforts will emphasize multidisciplinary instruction in spatial and temporal variability, management, engineering, and environment protection. Research projects and internships with farmers and agribusiness will give students the practical experience and relationships they need for future success." An interesting **example** of this kind of research shows a profile of intensive sampling at Loveall's Field in Southern Minnesota as a tool for exploring the value of site specific information for managing fertility. The project consists of a CD-ROM containing a long (1.5 to 2 hours) and short (45 minutes) presentation, a book of maps and charts and an 11 page presentation guide. The presentations are in Powerpoint® format.

Precision agriculture takes advantage of a myriad of resources and provides almost unlimited information potential. Thus, beekeepers and their employees can easily find beeyards and the least time-consuming routes can be plotted. A most useful online mapping service is provided by **mapquest** where highways are available. One can enter a beginning and end point and almost immediately be offered a marked-up map showing the most direct vehicular route. Additionally, it is possible to zoom in and out on certain sections, changing scale on the fly.

Perhaps the most powerful resource available to agriculturists at the moment is accurate global positioning through the use of satellites. However, it's important not to lose sight of the "old-fashioned resources," good old topographic maps published by the **United States Geological Survey** (USGS): "The USGS is proud to offer a collection of nearly 70,000 topographic

Ann Harman (see page 32) asks if beekeepers really know the 18,000 or so acres that any particular beeyard encompasses. This fits the often-used realtor's maxim, what really matters is location, location, location. She discusses that on a very local scale beekeepers can analyze how location affects their operations, but suggests that new kinds of mapping and satellite images may provide even more information. The digital revolution is in fact causing us to see many things in a different light with respect to location and scale. We can now view systems in much greater scope and with infinitely more precision. Thus, the appropriate term precision agriculture has been coined.

According to the **University of Sydney**, Australia, "Historically, agronomic practices and management recommendations have been developed for implementation on a field or paddock basis. This generally results in the uniform application of tillage, fertiliser, sowing and pest control treatments at a field scale. Farm fields, however, display considerable spatial variation in crop yield, at the 'within-field' scale. Such uniform treatment of a field ignores the natural and induced continuous variation in soil properties, and may result in zones being under- or over-treated, giving rise to economic and environmental problems associated with this inefficient use of resource inputs. The more substantial of these problems being: economically significant yield losses, excessive chemical costs, gaseous or percolatory release of chemical components, unacceptable long-term retention of chemical components and a less than optimal crop growing environment.

map titles for sale. These maps, which have been prepared to exacting standards of accuracy, are available in a variety of scales. USGS topographic maps have been popular with generations of Girl and Boy Scouts, hikers, campers, and other outdoor enthusiasts, as well as with planners, engineers, and other business persons. (For more information about USGS maps, please refer to our **online booklet**.)" This interactive, electronic catalog is another example of how the new information technology interfaces with the old. However, another Web site goes one step further. At **Topozone** one finds "the Web's first subscription service that lets you create custom topographic maps and download them right to your desktop. You can make maps to your specifications any time and any place you need them."

Global positioning or GPS is not as complex as it might first appear. Several **portals** point to many resources on the World Wide Web that deal with this topic. A step-by-step **tutorial** explains, "The military had to have a super precise form of worldwide positioning. And fortunately they had the kind of money ($12 Billion!) it took to build something really good. The result is the Global Positioning System, a system that's changed navigation forever. The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. GPS uses these 'man-made stars' as reference points to calculate positions accurate to a matter of meters. In fact, with advanced forms of GPS you can make measurements to better than a centimeter! In a sense it's like giving every square meter on the planet a unique address. GPS receivers have been miniaturized to just a few integrated circuits and so are becoming very economical. And that makes the technology accessible to virtually everyone. These days GPS is finding its way into cars, boats, planes, construction equipment, movie making gear, farm machinery, even laptop computers. Soon GPS will become almost as basic as the telephone."

GPS works through satellite triangulation and employs radio signals. The **tutorial** says that "GPS technology has matured into a resource that goes far beyond its original design goals. These days scientists, sportsmen, farmers, soldiers, pilots, surveyors, hikers, delivery drivers, sailors, dispatchers, lumberjacks, firefighters, and people from many other walks of life are using GPS in ways that make their work more productive, safer, and sometimes even easier. This is done in five broad categories.

The first of these is **location**; GPS has, for example, helped rescue teams search out **survivors** in natural disasters and assisted in measuring the continuing growth of mountains. Secondly, there is navigation. Accuracy here has helped New Zealand fisherman return to the same spot year after year and medivac helicopters find accident scenes with great accuracy, helping save lives. Other functions include tracking and mapping: "GPS used in conjunction with communication links and computers can provide the backbone for systems tailored to applications in agriculture, mass transit, urban delivery, public safety, and vessel and vehicle tracking." A last category is timing: "Time is a powerful commodity, and exact time is more powerful still. Knowing that a group of timed events are perfectly synchronized is often very important. GPS makes the job of 'synchronizing our watches' easy and reliable."

Use of precision agriculture and GPS by those managing agricultural plots in the vicinity of bee yards can help determine many of the inputs used, including insecticides. Perhaps most useful, however, will the relationship of the bee yard location with surrounding fields. It might be possible to determine best locations by seeing how far and in what direction vegetation resources for the bees are located. Most bee vegetation is wild, but much of it may also be found in cultivated fields, and so can be a changing phenomenon each season. The state of the vegetation itself is also an issue. This can be visualized using a technology called remote sensing. According to an **on-line course** at Michigan Technological University, this is the "science and art of obtaining information about a phenomenon without being in contact with it. Remote sensing deals with the detection and measurement of phenomena with devices sensitive to electromagnetic energy such as light (cameras and scanners), heat (thermal scanners) and radio Waves (radar). The technology "provides a unique perspective from which to observe large regions. Sensors can measure energy at wavelengths which are beyond the range of human vision (ultra-violet, infrared, microwave). Global monitoring is possible from nearly any site on earth."

A detailed **remote sensing tutorial** is found at a NASA Web site. It shows a chart of various uses across six different disciplines. For agriculture these are, discrimination of vegetation types, measurement of crop acreage by species, determination of vegetation vigor and stress, and soil associations and type. In the future, therefore, it will not be too far fetched to see beekeepers using this technology to not only find plant resources, but also to determine the health, vigor, moisture content and other conditions that will determine their production potential. A **virtual** library of **remote sensing** contains many resources of help to those interested in this area, including on-line publications, journals, and conventions and meetings.

As Ms. Harman concludes: "You have learned from your newly-found investigative resources that the honey plants and even the potential for your area is declining. Look at the area beyond your 18,000 acres. Establishing an outyard in a new area, still within a convenient distance from your honey house could prove to be extremely worthwhile. You can repeat your computer "flyover" for different 18,000-acre circles and investigate data for these new areas. Now you are traveling over a really, really huge area. All without leaving home." And I add here, this is not fantasy, but a reality using precision agriculture, global positioning and remote sensing through the miracle of technology provided by the digital age. BC

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Queen Excluders ARE NOT Honey Excluders

Used *correctly*, a queen excluder is a great management tool

Roy Hendrickson

Queen Excluder or Honey Excluder? The answer depends on who's being asked. Without a doubt the Queen Excluder is the most maligned, misunderstood piece of beekeeping equipment in use today. The mere mention of Queen Excluders can stir heated debate between otherwise sane individuals. This has been going on for years, decades actually, and could continue forever were it not for Ms. *Varroa* Mite. Due to increasing colony damage from *Varroa* and its associated viruses, it's become necessary to remove the surplus honey crop quickly to allow chemical application for mite control before the damage becomes irreversible. Queen Excluders to the rescue!

Without excluders, except under the strongest of honey flows the queen will expand the brood nest up into the supers. If, at the point of crop removal *Varroa* levels are high and treatment necessary, what happens to the supers containing brood? Do you delay treatment until brood emerges, leave them on during treatment, or move them to untreated colonies? All poor options, the second a violation of label instructions. Use a Queen Excluder and off comes the crop and treatment begins immediately.

So what is the secret to using Queen Excluders? There is no secret. It's knowing your local conditions, getting your colonies built up for the flow and including Queen Excluders as part of the supering process. The general rule of thumb is, *bees will not work through an excluder unless forced to.* In other words, they will if at all possible try to live below the excluder – particularly in double hive body colonies.

In order for excluders to work colonies need to be in tiptop condition, full of bees, brood, honey, and pollen – especially bees and brood. Then, once the main flow starts, the nectar passes through the brood nest and up into the supers. The brood nest can't be plugged up with honey because it's *already* full of bees, brood, and (some) honey. Colonies with a single hive body brood nest seem to recognize that they can't live below the excluder; not enough room and they will work into the supers with little difficulty. In fact my personal experience is that single hive body colonies are more efficient producers than doubles in the majority of cases. Double hive body colonies that won't reach full strength in time for the flow should be reduced to singles. This eliminates any reluctance to pass through the excluder. Any brood in the half removed can be used to boost weak colonies, or allowed to emerge above the excluder. Where production singles are going to be overwintered in doubles, the second hive body can be replaced once the crop is removed and allowed to fill with fall honey. Or, if no fall flow exists, the second hive body can be added as a super late in the main flow and moved down when the surplus crop

is removed. The photo on the bottom shows two strong colonies. The single on the left is producing cut comb honey. One super has already been removed. The double is being run for liquid honey and has almost a two hundred pound surplus. Both colonies were managed as described above and excluders were installed with the first supers.

Another area of concern is the use of full supers of foundation above the excluder. Strong colonies, especially singles, often need more clustering space than the brood nest can supply. Drawn comb above the excluder not only meets the need, but also acts as an incentive to draw the bees up. Foundation is often ignored until the flow has started, and offers no incentive to draw excess worker bees through the excluder. Once the flow starts, due to the lack of super storage space, the brood nest becomes clogged with nectar. The queen ceases egg laying and swarm preparations are initiated. By the time the foundation is drawn, it's often too late. If only limited amounts of drawn comb are available bait the first super with several of the drawn combs, four or five if possible.

Increasing amounts of foundation can be added once the flow starts and the bees start working in the supers in earnest. If no drawn super comb is available, omit the excluder until the foundation is partially drawn and filled. On a subsequent visit, make sure the queen is in the brood nest and install the excluder below the partially filled super. The photo in the title is of two superior colonies, both with excluders, and both managed as described above. The colony on the right had three frames of brood removed four weeks prior to the flow. Supers and excluders were added three weeks ahead of the flow. Neither colony made any attempts to swarm and both produced monster crops – three hundred and sixty five pounds from the colony on the right. All of the supers from both colonies were removed at one time. The colony on the left was treated for *Varroa* at that time. The colony on the right was resupered for the Fall flow without any treatment being applied. There is no rocket science involved here. Just good basic beekeeping and a decent (not great) honey flow. If I can manage colonies to produce crops like this, so can you! BC

Roy Hendrickson uses queen excluders and harvests lots of honey in Northeast Ohio.

Managing Brood Diseases

Nicholas Calderone

One of the most serious sources of AFB transmission is the negligent beekeeper who allows colonies weakened by disease to be robbed, or who sells used, contaminated equipment.

Effective disease control is one of the foundations of successful beekeeping. It is based on three simple skills: identification, treatment and management. Last time we discussed disease identification and treatment. This month we will take a look at a comprehensive disease management program.

WHO IS RESPONSIBLE

The spread of disease. The spread of disease can be traced to two sources: the behavior of the bees and the behavior of the beekeeper. Let's take the bees first. Bees transmit disease by two routes. The most important is the robber bee. The term 'robber bee' refers to a bee from one colony that attempts to enter the nest of another colony in pursuit of honey, usually during a nectar dearth. If a colony is unable to defend itself, robber bees will gain entry and pilfer whatever honey they can. If the colony being robbed is diseased, the robbers may carry pathogens back to their own nests, thereby spreading the disease. The other route is known as drifting. Often, especially in crowded apiaries and during nectar flows, bees will enter the wrong nest when returning from the field. This is called drifting. It may spread disease, but is secondary to robbing.

Although the bee's behavior is partly responsible for spreading disease, the beekeeper is more to blame than any other factor. Beekeepers move infected combs from diseased colonies to healthy colonies, fail to recognize or treat disease, purchase old, infected equipment, keep colonies too close together, leave dead colonies in apiaries where they are robbed, and a whole lot more. All of these activities contribute to the spread of disease. Little can be done to change the propensities of bees to rob and drift, but a great deal can be done to improve one's personal management practices that exacerbate these propensities and that, in other ways, contribute to the spread of disease. So, before you ever start to work your bees, make sure that your management plan includes well-defined protocols for disease management.

INSPECTION

Inspect your colonies regularly. The key to detecting disease is the colony inspection. If you don't look, you can't find it. You should conduct a thorough inspection of each colony at least twice each year. A thorough inspection means a careful inspection of every comb in the brood nest. The first such inspection should be in the spring, when there is a lot of brood present, but before you add your honey supers. The second major inspection should be near the end of the late summer or fall nectar flow. Two or more less rigorous inspections should be conducted in between these two major inspections. Inspect at least three combs with brood during each of these briefer inspections. You should always conduct a thorough inspection of any colony that is noticeably weak, relative to the other colonies in an apiary, regardless of when you notice the condition.

Carry several clean hive tools when you inspect your bees. If you encounter AFB, wrap your hive tool in foil or a paper towel. Clean your smoker using a damp paper towel and an EPA approved disinfectant[2]. Then, clean your hands thoroughly, rinsing with potable water. Use a clean, sterile hive tool to continue your inspections. Be sure to sterilize contaminated hive tools before using them again. If you suspect AFB, but cannot make a definitive diagnosis, take a sample and send it to a lab for diagnosis. Clean up as though you had a confirmed case of AFB.

When to work bees. Ideally, you should inspect your colonies on warm, sunny days when there is a good nectar flow in progress. Bees will generally not rob under such conditions, and you are less likely to be stung. Stack hive bodies squarely on an empty hive body nested inside the outer cover placed behind the colony. The empty super will provide some ventilation and greatly reduce the stress on your back. Keep the top super on this stack covered with an inner cover with the escape closed. If you are working during a nectar dearth, place the combs you remove from the hive in a spare super and keep it covered. At the first sign of robbing, stop working and put the colony back together. Reduce entrances with reducers, or with loose grass if the temperature is high, leaving only a small opening for the bees to defend. The bees will remove the grass overnight. Cover any holes in the hive bodies and any cracks between supers or between the inner cover and the top super with several layers of masking tape.

Burr comb bucket. Pieces of comb with honey can start robbing if left in the apiary; so, you should carry a plastic feeder pail with a lid to store burr comb that you cut from the hive.

Fresh water. Always carry a supply of fresh water for cleaning up honey spills.

Working during a dearth. If you must work during a dearth, go through the apiary before inspecting the colonies and crack all of the supers apart, shifting them to the side about ¼" but not enough to let

Robbing is a major source of disease transmission that can inevitably be traced to poor management practices. Working colonies during a nectar dearth, leaving pieces of honey-laden comb in the apiary, allowing bees to clean out wet combs, improper feeding during a dearth, and maintaining deadouts and weak colonies all lead to robbing. To prevent robbing, or to stop it once it has begun, you must know the warning signs. Bees fighting at the entrances, bees snooping at cracks between supers, and bees flying back and forth in front of a colony looking for a way to get past the guards all indicate that robbing is occurring. Without corrective action, robbing can quickly escalate from a handful of bees attacking one colony, to tens of thousands of highly aggressive bees swirling around an apiary like a tornado, fighting and stinging everything in sight. Not only will weak colonies be robbed or killed, unsuspecting bystanders and animals can be injured, and you may lose a good apiary location if your bees are located on someone else's property. Manage your bees to prevent robbing from getting started, and take appropriate steps to stop robbing if it starts.

bees in and out. This will break up the burr comb, and the bees will clean up the leaking honey before you actually open the hive to work it. That way, you don't have to scrape off as much honey-laden burr comb, and the bees will get less excited because there is less open honey available.

Feeding. Sugar syrup should be fed at a time when the bees are not going to be flying for several hours, such as in the evening. Once on, syrup may be left on until it is consumed. If you feed syrup when the temperature is high and the sun is shining, you may start robbing. Leaky syrup pails also cause robbing, in addition to drowning your bees. Plastic pails make better feeder pails than metal ones, because metal feeders rust and develop pinholes in their sides, and that causes them to leak. Leaking also occurs when feeder pails are not level, so invest in a 69¢ level and keep it in your bee truck. Be sure to level feeder pails in two directions at 90-degree angles to each other. Combs of disease-free, capped honey will not start robbing and can be fed at anytime.

Wet combs. Do not leave supers with combs of honey or supers of extracted combs where bees can rob them. This is not a good method for feeding bees. Not only will you start robbing, but you may also spread disease to other colonies, including feral colonies and your neighbor's bees. To avoid robbing, wet combs should be placed on colonies above an escape board with the escape open. Do this in the evening or on a day when the bees are not flying. Once on, the combs may be left on until they are cleaned out. If you place wet combs on a colony when the bees are flying, you may start robbing.

Strength. Keep your colonies strong so they can defend against robbing. A weak colony should be inspected to determine the cause for its condition. The proper course of action will depend on what your inspection reveals, but you will probably want to consider requeening it or combining it with a stronger colony. If the colony is disease free, but has a failing queen, you should requeen it. If a colony's strength drops below 3-4 combs of bees, but is disease free, remove the queen and combine it with another colony. Do not winter weak colonies. They will die and be robbed out on warm days during late winter and early spring. Combine them with other colonies after determining that they are disease free.

Use Terramycin only as a preventative. *Generally, hobbyist beekeepers in states with good inspection programs and a low AFB rate need not use drugs. If you keep bees in an area where AFB is known to be a problem, you should use Terramycin (TM), an antibiotic that controls the vegetative stage of AFB. TM should only be used as a prophylactic. That means feeding to healthy colonies with no evidence of disease. I recommend that you use TM as a dust or as a syrup additive in the spring. Follow the label directions.*

Dead Colonies. Visit your apiaries as early in the year as possible to determine if there are any dead or weak colonies present. Close-up dead colonies so bees cannot enter. Make sure they are bee-tight and remove them from the apiary as soon as possible. Be sure to do a postmortem on each dead colony in order to determine the cause of death. A thorough inspection that confirms that the combs are free of AFB scale or AFB diseased brood is critical before reusing the equipment.

Entrance reducers. Entrance reducers should be used from the end of the fall flow until colonies are strong again in the spring. Reducers should be used whenever a colony is not strong enough to defend itself, regardless of the time of year.

DISEASE MANAGEMENT

Burn colonies with active AFB. If you find active AFB in one of your colonies, or if you detect AFB scales, destroy the colony and burn the equipment[1]. You can salvage used supers, bottom boards, excluders and outer covers if they are in good shape, that is, if they are basically solid, without lots of wax and propolis-filled cracks that may harbor pathogens. Scrape the equipment clean with a sharp hive tool. Remove metal frame rests and scrape underneath them. Burn the scrapings. Use a weed burner to scorch the insides of all supers, bottom boards and outer covers, lightly charring all wooden surfaces. Replace old metal frame rests with new parts after scorching the super. Char all wooden surfaces of a queen excluder, and burn off all of the wax from the metal portions. Don't bother with inner

Continued on Next Page

DISEASES ... Cont. From Pg. 21

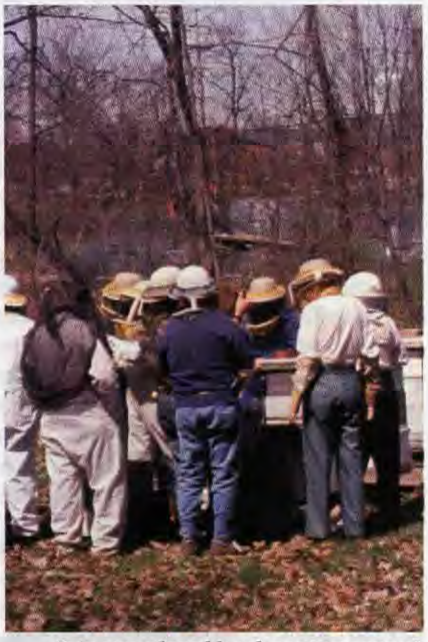
covers, as they generally have too many cracks that may harbor pathogens.

Do not mix combs among colonies. Moving combs between colonies is probably the most common means of transmitting disease. Minimize mixing supers and combs between colonies. Do so only after determining that the colonies involved are disease free. Never transfer combs from a diseased colony to another colony, even if the combs appear to be free of disease. If you are a hobbyist, it is a good practice to assign an identifying number to every colony in your operation. Mark brood chambers and supers on each colony with a unique number. With this identification system, you can return the same supers to the same colony every season.

Keep colonies queen-right. A colony that is not actively rearing brood cannot be properly inspected for disease. Therefore, you should replace failing queens and drone layers as soon *as* they are found. If a colony becomes hopelessly queenless, it will eventually die and be robbed.

Sterilize your equipment. All hive tools should be cleaned on a regular basis. First, clean off all of the wax and propolis by scraping two hive tools together. Next, scrub each hive tool with a scouring pad and an EPA approved disinfectant, being certain to remove all traces of wax, honey and propolis. Ideally, bake the hive tools in an over at 550°F for two hours or scorch both sides with an LP weed burner for 20 seconds per side.

Bee brushes, bee gloves, and frame grips all provide a direct physical link between colonies. They are not desirable accessories except under special circumstances. When bees are very defensive, a pair of tight fitting, light-colored **latex dishwashing gloves** provides good protection against stings (use **nitrile rubber** gloves for pesticides). Bees are less inclined to sting rubber gloves, probably because of the smooth surface. You may get a little sweaty inside the rubber gloves, but they prevent stings while retaining a sense of touch that you lose with heavy-duty leather or canvas bee gloves. Rubber gloves can be easily cleaned at the end of the day with liquid hand cleanser and a scouring pad while still being worn. This will also remove any residual alarm pheromone, so they will not provoke stinging the next time you use them. Feeder pails should be cleaned, scraped free of wax and propolis, rinsed with a mild solution of an EPA approved disinfectant solution, then rinsed with potable water after each use. This will inhibit the growth of mildew on the plastic pails.



Join your local beekeeping organization. Local beekeeping groups bring together beekeepers with a wide range of knowledge and experience.

Bee-ware what you feed your bees. Pollen is often used to enhance the attractiveness of pollen substitutes. Do not feed bees pollen or pollen supplement unless you know the source to be disease free. In general, this means that you collected the pollen from a colony that you know from repeated thorough inspections to be disease free. Do not feed bees combs of honey or extracted honey unless you know the source to be disease free.

GENERAL MANAGEMENT

Beware of used equipment. The sale of old bee equipment is a major route for the transmission of disease. Remember! AFB spores survive 50 years, or more, under ideal conditions. The laws of many states require that equipment and colonies be certified disease-free before sale or transfer. However, AFB can be temporarily masked by the inappropriate use of antibiotics. Therefore, a colony without active disease may still harbor AFB spores that will become active when the antibiotics wear off. ***Unless you know the equipment to be disease-free, used equipment is always risky.***

Introduce newly acquired, used equipment to a single, isolated "hospital" yard. Withdraw all antibiotic treatments and monitor closely for three seasons. Keep the supers from this yard separate from the rest of your operation and extract honey from this yard last to prevent transferring disease to your healthy colonies. Colonies that are free of disease for three years may be incorporated into your regular operation. Colonies that break down with AFB should be burned. **Do not establish a special hospital yard for your AFB colonies – burn them!**

Reduce drifting. Workers drifting between colonies may transfer both disease pathogens and parasitic mites. Use irregular spacing, with colonies or pallets 6 9 feet apart, or more, where possible. Make use of conspicuous landmarks in the beeyard.

Processing honey and wax. Clean your uncapper and extractor at the end of each day with an EPA approved disinfectant followed by several rinses with hot, potable water. Be sure to remove all traces of honey and wax from all surfaces. Do not extract honey from an AFB infected colony. AFB contaminated wax, honey, combs and frames should be burned. Combs from colonies with less serious diseases (EFB and chalkbrood) should be extracted last.

Reduce stress. A number of diseases are thought to be stress related. A good location reduces stress. Dry is better than wet. A gentle slope with a south to southeastern exposure ensures early morning sunshine. Avoid hilltops where strong winds will buffet your bees. Keep colonies on stands with a slight forward tilt to keep them dry. Upper ventilation also helps. A windbreak and good air drainage are very important, as is a source of fresh water during dry spells. Use entrance reducers from the end of the fall flow until colonies are strong in the spring. Minimize your bee work during a nectar dearth.

Register your bees. Register your bees if required to do so. Disease prevention works best when everyone cooperates. If you know any unregistered beekeepers, tell them to request registration materials from your state regulatory agency. Unregistered colonies may not be inspected, and, if infected, they may spread disease throughout an area.

Follow your protocol. The best management protocol in the world is only as good as the beekeeper implementing it. Familiarize yourself with all aspects of your disease management protocol. Then, follow it to the letter, every time, all of the time, without exception. If you do, your bees will stay healthy and you will enjoy them year after year. BC

[1] Regulations covering the burning of beehives varies from jurisdiction to jurisdiction. Be sure to contact your local fire department or city hall to find out what regulations affect the burning of infected bee equipment in your area.

[2] Examples of cleaning products approved by EPA as disinfectants include Comet Disinfectant Cleanser with Chlorinol and Austin A-1 Bleach For Institutional Use. Be sure to follow all label requirements when using these products. Never mix bleach with other cleaning products.

BASIC BEEKEEPING TOOL KIT

When you work your bees, you may encounter disease. When you work bees during a dearth, you may start robbing. Therefore, you should always carry a number of supplies with you so that you are well prepared for these situations. You will need:

- 1 gallon container filled with potable water;
- extra clean hive tools;
- flat wooden toothpicks to evaluate diseased brood and to collect disease samples;
- a few coin envelopes to store toothpick disease samples;
- aluminum foil to wrap up contaminated hive tools and toothpick samples;
- newspaper to wrap up suspected comb samples;
- 3x5 cards to label suspected colonies and comb samples;
- pencils for making records;
- thumbtacks to tack 3x5 cards to suspected colonies;
- liquid hand cleaner;
- an EPA approved disinfectant;
- paper towels;
- several rolls of masking tape;
- entrance reducers.

Most of these items can be carried in a toolbox made from a hive body. Nail a piece of ½ inch plywood to the bottom, then, nail a 2 x 2 inch runner along the bottom on each side to keep the box off the ground. Waterproof the exterior of the box with a coat of exterior wood primer followed by several coats of exterior finish paint. Next, divide the interior into several compartments with pieces of wood. You can use the box to carry all of the items listed above. It also serves well as a smoker fuel box. Cover the box with an outer cover.

Recommended readings

Shimanuki, H., D. A. Knox, B. Furgala, D. M. Caron, & J. L. Williams. 1992. *Diseases & Pests of Honey Bees.* In: The Hive & the Honey Bee (J. M. Graham editor). Dadant & Sons. Hamilton, Il.

Shimanuki, H. and Knox, D. 1997 *Summary of Control Methods.* In: Honey Bee Pests, Predators, & Diseases. 3rd edition. (R. A. Morse and K. Flottum editors). A. I. Root Co., Medina, OH.

Dr. Calderone is an Assistant Professor of Apiculture in the Department of Entomology, Cornell University, Ithaca, NY.

2 QUEEN SYSTEM

Intensive Management = Increased Profits

Ancel Goolsbey

After a period of receiving 75 cents a pound for our honey, it may be hard for a lot of us to go back to the lower 65-cent price. Yet, if we are going to survive in the bee business, we just might have to. So let's look at some of the things we have going for us that can make this possible. So what can be done to even out the playing field? The one thing that offers the greatest possibility is to work for higher per hive production. Very little research has gone into a hive management system that will increase hive production, but we know that most hives are capable of producing hundreds of pounds of honey per year. Yet we seem happy if we produce at best 100 pounds from a colony.

Many of the beekeepers here in the Northwest are working on higher production per hive by going to a two-queen system. Some are having great success and more than doubling their per hive production. Others are not doing as well and feel that the increased production does not justify the extra work involved.

To this end I would like to pass on some of my findings. Perhaps they may help those of you interested in raising your production by the two-queen method.

There are many ways to run a two-queen system. The two that are used most often here in the Northwest are what we call the horizontal method and the vertical method. In the horizontal method, queen excluders are used to keep the queens apart, and usually a purchased mated queens used for the second queen. This method is not easy, and it takes a master beekeeper to achieve the desired high honey production. Unless the hive is watched carefully, swarming can become a real problem, wiping out all the benefits of the two-queen system.

If either queen wants to swarm, she will take the bees from both queens along with her, so this is definitely not a system for beginners or amateur beekeepers. Its one advantage is that the beehive needs no modification.

In the vertical system, the hive has to be modified so that slide-in partitions can be slipped into the center of the super so as to make two four-frame compartments that are bee-tight and stacked three high.

So now you have two three-story brood nests consisting of 12 combs each. The bottomboards are modified so that each compartment has an entrance on opposite ends, an inner cover made in two pieces and fastened together with a light piece of plastic strap as a hinge. This inner cover is made out of half-inch plywood, and each compartment has an entrance on opposite ends that can be closed with a wooden turn button.

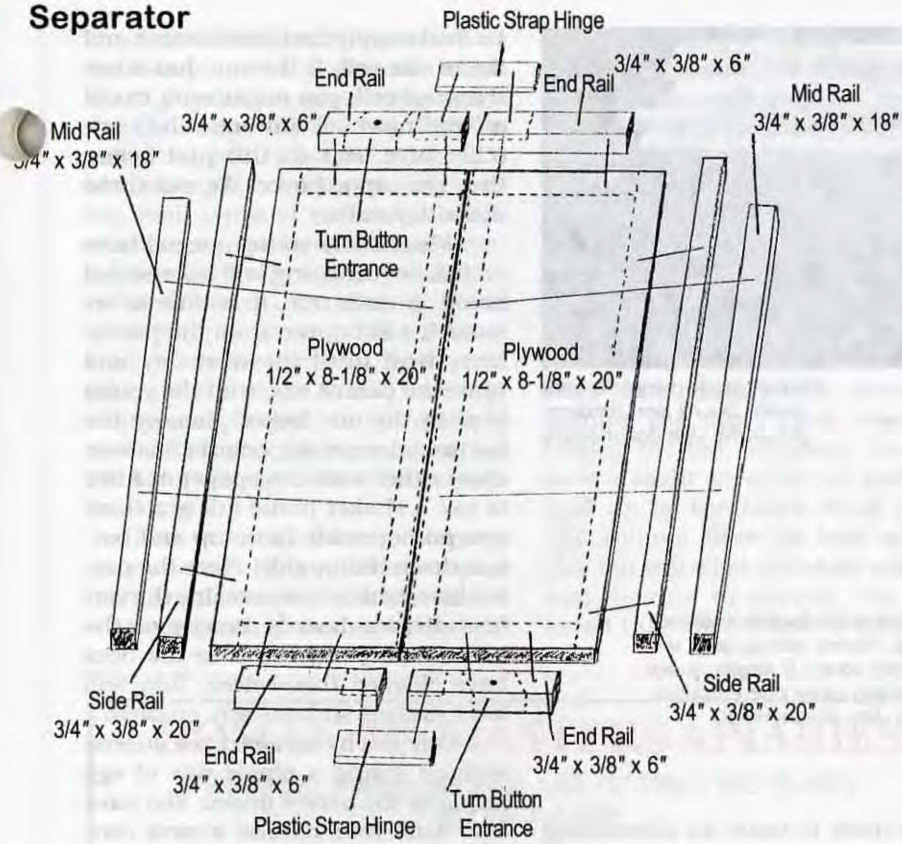
How to make this modification? Let's start with the bottom board.(see photo). We really need a bottomboard that is 24 inches long to make a two-inch landing strip on each end, which also supports our entrance feeders. So let's take a piece of half-inch exterior plywood, seven-ply if you can get it, and add to it two pieces of pine lumber 3/4" x 3" x 16-1/4" which are nailed across the bottom side of the bottomboard, two inches back from each end. This will allow air to circulate under the bottom of the hive and dry out the bottomboard when the hive is placed on a commercial pallet.

Then you will need three strips 3/4"x 1"x 20" Nail one on each side of the top of the bottomboard; the third rail goes in the middle of the top side. These three rails should be in from each end about two inches. This gives a 3/4-inch deep air space between the bottomboard and the bottom of the combs. This space is necessary for air circulation during the heat of Summer.

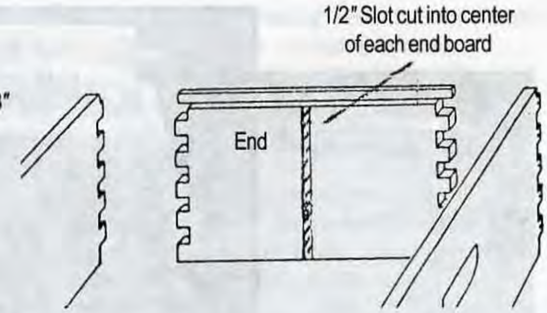
Then you will need strips 3/4" x 1" x 6" on each end to close off the bottom air space on opposite ends of each compartment. The open end should have a removable entrance reducer. Now you have an entrance on each end of the bottomboard. This will prevent drifting and help the returning queen find the right entrance when coming back from the mating flight.

Now you add the bottom story super, leaving out the removable dividing board. I like to nail or fasten the bottomboard to the bottom su-

Separator



Same Framing, minus hinges, on bottom of plywood boards.



Detail of separator board construction and groove in hive body for division board.

Deep bottomboard showing two entrances. (photo by Mahlon)

per so they do not get out of alignment and allow the bees to go from one compartment to the other.

You will need three supers with removable partitions for each hive for the brood nest. Make them by cutting a groove the depth of the frame rest, 1/2-inch wide, down the center of each end board of the inside of the super. This can best be done on a table saw with a dado blade. However, if you are fixing up supers already nailed, you can do it with some skill saws (portable circular saw) and cut two saw curls by setting the saw to the right depth and then cut out the center wood with a wood chisel. Most power shapers will also do a good job.

To make the divider board, use a 3/4-inch pine board cut so it will be flush with the bottom and the top of the super. Supers may vary here but should be about 9-5/8" wide. The length should be the distance between the two ends when measured on top of the frame rest. This may vary with different manufacturers but should be close to 19-1/4" long. Then dado back each side of each end 1/2-inch so it will slide nicely in the grooves in your super's end boards. Normally the bees will glue this in, but if it is too loose you can secure it with a small nail through each end board of the super so the board does not fall out while working the bees. Do not drive the nail all the way in so it can be removed easily if necessary.

For queen rearing you need a separator board to close off the bottom story from the second story. An inner cover could be fixed up to work, but they are a little frail. I like one made in two pieces and fastened together with two light plastic strap hinges so you can fold back one side at a time while keeping the other side covered. Make this out of half-inch exterior plywood, again seven-ply if you can get it. Cut two pieces each 20" by 8-1/8", and on each of these pieces, nail four strips of 20" x 3/4" x 3/8" pine. Around the perimeter of each board (two of them) dado out one side of each end about 1/16 inch deep and 1-1/2 inches back from the end to allow for the thickness of the plastic strap hinge. Then you will need four pieces of 3/4" x 3/8" pine, one for each end on each side to complete the perimeter. Then with a hacksaw or a hand miter saw cut one, and on one side only, on opposite ends make two cuts on a angle to make a turn button entrance that can be closed or left open. One of these separator boards is needed for each hive.

You can use an old commercial pallet that you can pick up almost anywhere to set this new hive on, but place only two hives on a pallet. Line up the two hives side by side but stagger them so the entrances will not be in the same configuration. Place the pallets in rows so that you can work them from each side. If you are using a boom truck, make the rows far enough apart so you can drive the truck between them.

Now transfer the combs of brood and bees and queen from your single-queen hive to the bottom story of the new hive with the dividing board out, both entrances open but entrance reducers in place. Put only eight frames in the bottom super, and place the rest of the comb in

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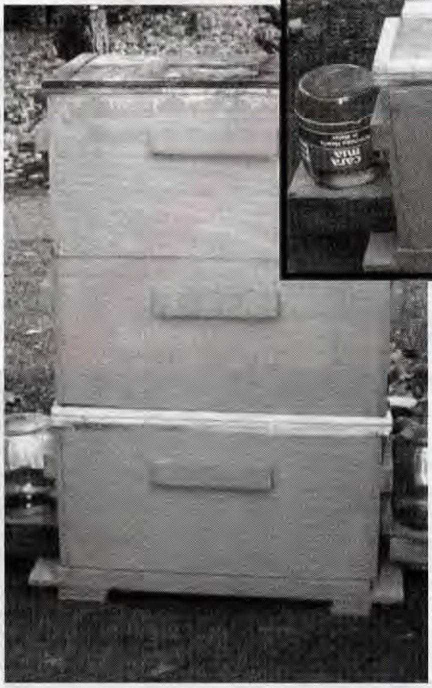
Bottom story complete with queen board and feeders. (photo by Joe Jovanovich)



Inner cover with double entrance facing up. Parent colony goes on top of inner cover. If single queen parent colony close one entrance. (photo by Joe Jovanovich)

the second and third supers that you now add. Close up any upper entrances you might have and let the hive set for about a week or until the bees are flying regularly from both entrances. This rest will keep the bees from deserting your queen-raising units.

When you have bees coming and going from both entrances, you can start your queen rearing. To begin, move all your combs of sealed brood up into the second story and insert your division board in the bottom story. Now you need to put frames of honey with pollen and attached bees in each side of your divided hive, sliding them up against the division board. Then you will need two frames of open brood with eggs in them. They can come from that same colony or if you have a breeder colony, take them from that. With attached bees, place them next to the frames of pollen (one in each compartment). Now add two more white extracting combs to each side, making four combs in each compartment.

Place the separator above the bottom super, and below the two top supers with the entrances up and open. The original queen is in this top section. Don't put in the division boards. The trick here is to have just enough bees in each compartment to keep the brood from chilling. Too many bees can sometimes cause them to issue an absconding swarm when the virgin queen goes out to mate, especially if you have more than one queen cell left in the nuc. This is one of the reasons queen breeders use baby nucs with only a cup-full of bees in the nuc boxes. You can, however, remove some of the bees later on before the virgin emerges if you find the nuc is overpopulated, and put them back in the parent colony.

The bees will be forced to make queen cells in the lower super from the frames of eggs in each of the compartments, which they will naturally do. Remember, your best queens come from eggs, not from young larvae. (These will be quality queens, not grafted queens.) Finally, add the inner and outer covers.

You need to feed the bottom two nucs. We use entrance feeders and half-gallon glass jars with three small holes punched in the lids filled with a thick sugar syrup. This gives you an artificial honey flow, making for a well-fed queen cell with plenty of attending bees. The result is two beautiful, plump virgin queens.

It takes about a month to raise these queens and get them mated and laying, so don't try to rush them. Do check them occasionally, however once the queen cells are sealed over, do not jar them as this will cause the larva to fall down away from its food supply and it will starve and die in the cell. If the nuc has more than one cell, you might want to cut off and move all but one cell to another hive. But do this just before they are capped over. We call these three-day cells.

When these young queens have mated, begun laying and have sealed brood in each nuc, it is time to remove the old queen from the parent hive. Wait until the next day and unite the parent hive with the young bees in the nuc below. Remove the horizontal seperator board and unite them either with newspaper or I like to use a shaker bottle full of a thick syrup to sprinkle both top and bottom down thoroughly. Place the parent hive, which now contains the vertical division boards directly on the bottom story. By the time the bees have cleaned themselves, they will have merged without any problem.

Now you have raised two queens without losing a single day of egg laying by the parent queen. You have also done your natural swarm control, as a queen raised within that hive will seldom swarm that year.

All you have to worry about at this point is the bees absconding. These young queens will build up a tremendous cluster of bees. Just adding more supers may not be enough to take care of the cluster, so be sure the brood nest does not get plugged up with honey. If this happens and the queen does not have room to lay eggs, she will take a swarm of bees and abscond. This we call an absconding swarm. Don't blame this on a bad queen. It is really the beekeeper's fault for not relieving the congestion in the brood nest by moving in empty clean extracting combs, or frames of foundation, in time.

I know the book says never to spread the brood combs and put empty combs or foundation between them. However, the bees have never read the book, so it's okay, in fact, necessary to do it to prevent absconding swarms. I have found that this is a good way to get foundation drawn out and get these new combs down in the brood nest where you need them. It takes honey to make wax, so put on your feed bottles to help them along. This way you can work the dark combs out of the brood nest and replace them with new white combs.

Just remember that swarm control is important to your bottom line. When you lose a swarm, if you see it go or not, you lose $25 to $50 in potential honey sales. With this hive management you can easily control both types of swarms, the absconding swarm by relieving the congestion in the brood nest and the natural swarm by having young queens. It is an important part of your hive management system so take time and do it. All this may sound complicated, but it really is easier than you think, once you get the hang of it, and know the reasons for doing it.

Now with a 12-frame brood nest on each side (three divided supers high, four frames in each divide) and a young queen, you should have 20 frames of brood by honey flow time. Can you imagine the foragers this will support, with plenty of backup for lost bees during the honey flow?

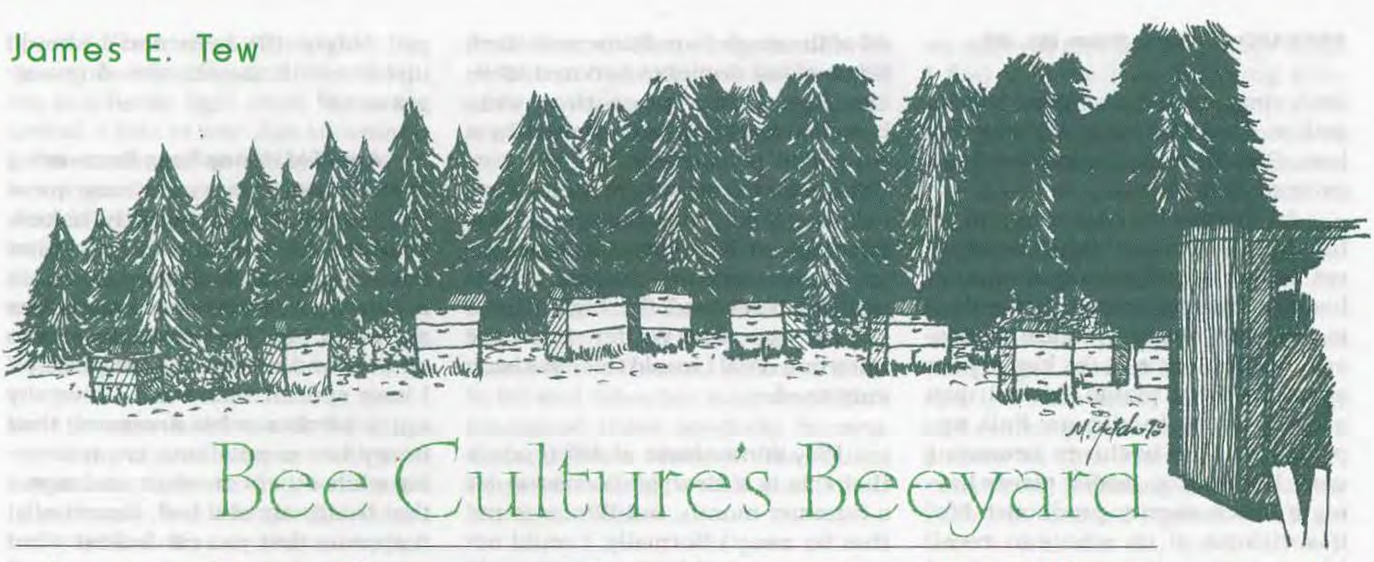
So pile on the honey supers by raising up the full ones and placing the empty ones on top of the third-story brood nest (bottom supering), letting the bees on top mingle. When taking off the honey, take only down to the third story.

Winter this hive in the three-story mode, saving both queens by turning the inner cover over and closing the top entrances. You will have a slight air space on each end held up by the fabric strap hinge. This will not allow the bees to come out, but will allow moisture and carbon dioxide to escape. We have found that this makes for very good Wintering, using less honey than two separate colonies would.

The metal telescoping cover goes on top of the inner cover for protection from the rain and snow. This procedure is quite easy and even beginners can learn it quite easily once the hive has been modified. It can more than double your per hive honey production. BC

Ancel Goolsbey has raised two-queen colonies for years. He lives in Spokane, Washington.

James E. Tew



Bee Culture's Beeyard

Another Spring Season in the Beeyard

As always in these articles, you have a couple of months lead time on me so it's Summer to you and spring to me. Spring officially arrived yesterday. Big deal. Yesterday was replete with blue skies and birds singing. Today (my day off to work bees) is rainy and cool. Such is life in the real world. Not much colony work that I could do except get a mortality count.

Winter Kills (so far) Three so far. But 12 others are in pretty good shape. I was not surprised to see the three that were dead, but there is a fourth in bad shape that surprises me. I did the routine checks last Fall and pronounced it to have enough honey stores, yet now it is nearly out. This is the hive I was feeding in previous articles. At best I will give it a 50/50 chance. I suspect others will also die.

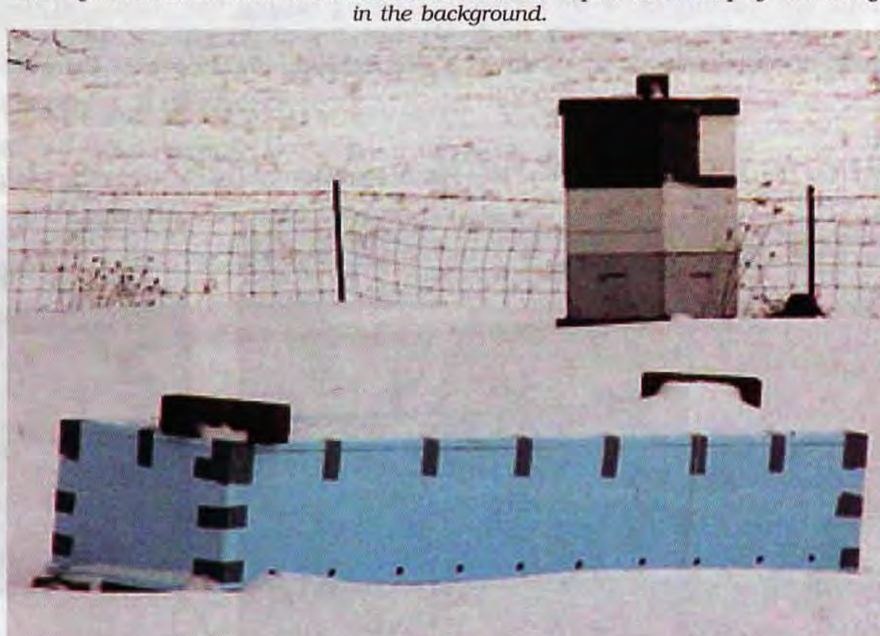
BC Yard Winter Kill Philosophy My Winter kill philosophy could best be described in terms that are unfit to print. Upon finding a dead colony, I suppose my first response is "drat" (or something like that). A quick perusal usually indicates I did not leave enough honey stores. However, it is easy to become superstitious. This past Winter was a good Winter for kills. I don't know why. Apistan resistance? Secondary viral infections? Poor queen stock? I don't know, but the most obvious common cause is simple starvation.

My philosophy: If they die, replace them. I try to determine why they died, but I don't axiomatically jump to exotic diagnoses. It's probably something I did wrong.

Yes, It's True. Beekeeping Management Procedures are Changing The Winter kill thing makes me even more conscious of the changes in beekeeping. This past Winter many of us suffered high Winter losses – even some commercial beekeepers reported high losses. Why? I have no idea other than the routine answers. I have given presentations on the invasion of plastics into our wooden industry. I have addressed the concerns that you and some academicians have about the reduced gene pool. I have sympathized with queen breeders, who for years have developed a productive strain, only to find that it was not particularly mite resistant. The hue and cry now is for resistant strains so many commercial breeders are scrambling to modify their stock. Everything changes, so we all start over again.

By far most of you are hobby beekeepers and if my observations hold true, most of you are fairly new hobby beekeepers. Beekeeping in the old school was to develop a hive and

Ten 4-frame nucs covered with insulation. Note the duplex nuc on top of the colony in the background.



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BEEYARD ... Cont. From Pg. 29

then you and the hive grow old together. That is happening less and less. Our Winter kills are one indicator of that change.

As distasteful as it may be for those of us who are "older" beekeepers, are we being forced to accept our hives as being more temporary than in the past? Most of you are gardeners. You don't pine at the loss of your annual garden plants. In fact, you expect them to die as Fall approaches. Are beehives becoming more like annual garden plants having a much shorter productive life? If so, those of us who can recall 'classic beekeeping' are bummed out while those of you who are new are more tolerant of our new colony management challenges. Whether or not we want it, we are all forced to admit that beekeeping is not as risk-free as it was 15 years ago – but don't forget that it wasn't easy even then. I'm not certain that all of our established hive management schemes will survive the changes. In the interval, be happy that some of your colonies have survived and make splits from them.

My Nucleus Hives From previous articles, some of you may recall that we have been attempting to Winter abnormally small colonies – 4-frame nucleus hives. Though I am not suggesting that we are employing advanced science, my initial observations are nothing more than common sense. We are testing single nucs, duplex nucs and "group nucs." All of the single four-frame nucs died. Some of the duplexes survived while the four-frame nucs that were bunched together and covered by a expanded polystyrene box are surviving – for the most part. Of the forty colonies going into Winter, 17 are surviving at this time, most in the group-nuc category. Earlier in this article I discussed the high Winter kill for this past Winter. If all the nucs had died, I would not have been surprised.

Why Winter Nucs at All? (I admit that this is a strange discussion for a Summer month, but Winter is not that far away.) Normally, I could not recommend that beekeepers in cold climates Winter nucleus hives. The projected losses would be too great. To quickly review, I have several reasons for wanting to learn more about nucleus hive management. It would be a great advance start to have nucleus hives underway to replace Winter losses in early spring. Some specialty beekeepers would like to maintain small hives for gardens and finally, I personally enjoy tinkering with small friendly hives. I'll talk more about our nucleus Winter procedure before next Fall.

Hive Stands (Again) In the early stages of the development of the BC Yard, I built hive stands and reported that to you in previous articles. Then in even later articles, I described the "Attack of the Skunks." I am considering raising the stands off the ground to a height of about 18 inches. But I don't have a clear plan yet. Maybe the bees and I should just live with the skunks. Any suggestions?

Are Wild Honey Bees Recovering from *Varroa*? This is a common question that I am frequently asked. Truthfully, I don't know and neither does anyone else. I hear extremes constantly – "I never see honey bees any more," to "There are honey bees all over and no beekeepers nearby." I have spoken with other university apiculturists who are sure that honey bee populations are recovering while others are dour and report that things are still bad. Essentially, it appears that you can believe what you want. Just now, the jury is still out.

Fearing that I appear pessimistic, I have not seen a radical honey bee increase in Ohio nor in Alabama, two states with which I am intimately familiar. I don't sense that wild honey bees are making a marked comeback yet. Having said that, I admit that I do see bees on blossoms when there are apparently no hives in the vicinity. But in many instances, beekeeper numbers have increased along with concomitant swarm losses. Are wild honey bees recovering or are more beekeepers losing swarms – or is it a combination of the two? I don't know. I do know that honey bees were nearly as common as houseflies for my entire life until *Varroa* became established. On the best day, they are nothing like that now.

Is it a good thing for beekeeping if the wild honey bee population re-

My hive stands are low enough that skunks are a problem. Raising them will be a pain.

Sonny's bee shed. This should look cool to you right now.

covers? Yes and no. The public has viewed honey bees and their keepers in a better light since the mites' arrival. I hate to lose that advantage; however, too much honey bee rarity is not good either. As a beekeeper, I would like to be appreciated, but not be extinct. Summary...I don't sense that wild honey bee populations are making an amazing recovery, but I'm not particularly worried about it. What's your opinion?

Your Communications with Me

Many of you flatter me with your communications and I try to respond to each one, but I frequently do get badly behind. If your communication was not answered, please try again.

Bruce K. wrote saying, "*As I was cleaning a dead hive to get ready for a new colony, the dead colony cluster actually had fuzzy mold on it and their was a terrible odor through most of the frames. The capped honey even had a white cast over it (mold without fuzz?). I am assuming it is just "dead stuff mold" and not to worry... just clean it and continue. Does my analysis sound reasonable?*"

I told Bruce, "*There were no obvious problems. Dead clusters do stink. Be alert for American Foulbrood, but otherwise, reuse the equipment*"

I've been periodically communicating with Sonny, from Maine, as he described long cold winters and snow-buried bee colonies. Sonny uses a bee shed to protect his bees. How many others of you use bee sheds or bee houses. Recent articles in BC and other bee magazines have discussed these specialty houses. If you use bee sheds or bee houses (anywhere in the world), how about letting me know.

John Spiller[1] (1952) wrote a short book entitled, "*The Advantages of the House Apiary*" *in which he lavished praise on the concept of housing bees. Other authors of the day had opposite views citing difficulty in maneuvering inside the small building, the cost of the building, and constant mouse invasions.*

A Personal Note

As I have written this article, I have been fighting an allergic rash on my eyes and the side of my head. I find it ironic that bee sting reactions carry so much weight while many of us suffer from other less life-threatening reactions to pollen, bee hair, or bee feces. I react to honey bee feces by breaking out in a rash – always on my eyelids and cheeks. I can barely ride in the car with an observation hive. When I went out to the yard earlier this morning, I opened hives that were spotted with fresh bee droppings and evidently got it on my hands. Am I alone in this kind of reaction? I considered including a photo of my rash but decided against it. I'll get over it. I always do, but I will continue to avoid bee poop. BC

Dr. James E. Tew, State Specialist, Beekeeping, The Ohio State University, Wooster, OH 44691, 330.263.3684, Tew.1@osu.edu

[1] Spiller, John. (1952) *The Advantages of the House Apiary*. W.J. Cornwell & Company, New Bridge Street, Exeter, England. 56 pp

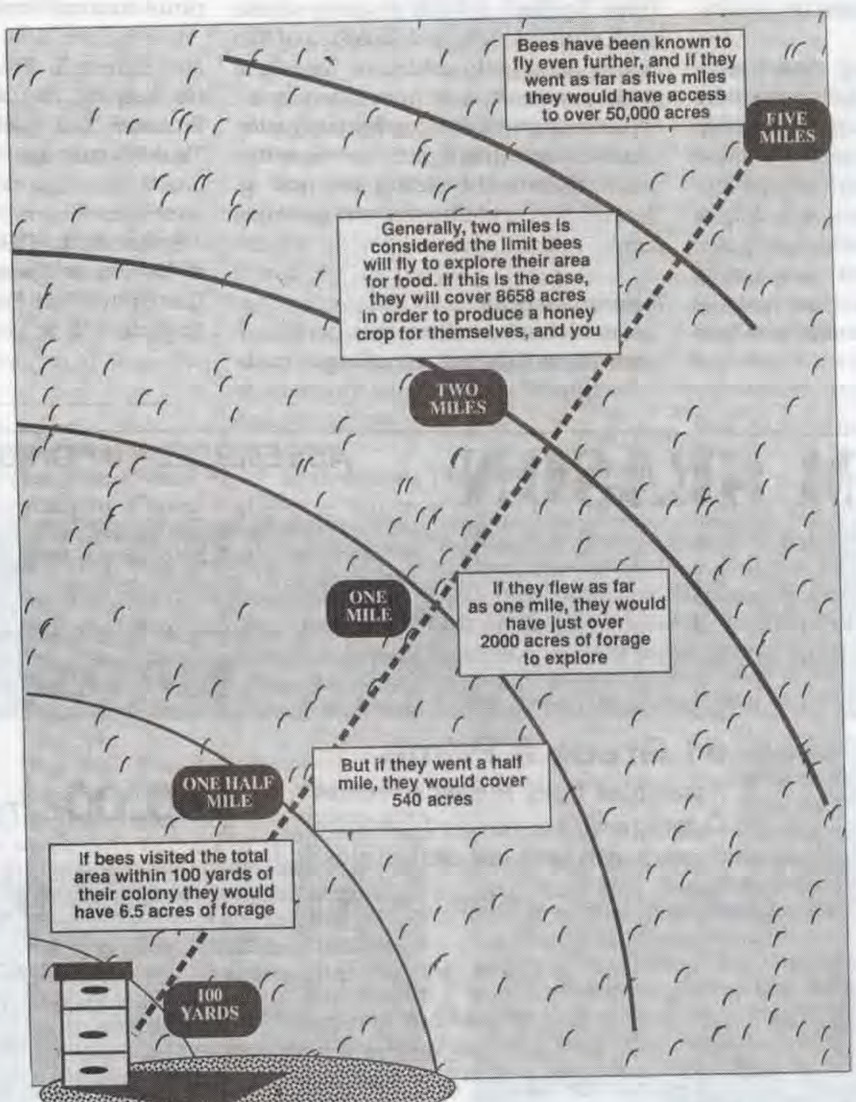
18,000 Acres, Or More

Ann Harman

Here's a project for you. Before you read further take this magazine out to your bee yard and stand there. Now you can continue reading.

Where are you? Where are your bees? Now, before you say those are dumb questions, let's consider what I mean by those questions. You, and your bees, are now in the center of their foraging area. Time for a bit of arithmetic. Although bees like to forage close to their hive, they certainly do not object to going up to three miles away. Sometimes farther, but we'll work with three miles.

So we have a radius of a circle equal to three miles. The area of this circle (a reminder, it is equal to pi times the radius squared) then is 3.1416 x 3 x 3 or 28 square miles. Well, since that number is hard to grasp, we'll convert to acres. So that area is equal to 18,000 acres. Is that still hard to grasp? It's a big area, that's for sure. OK, we'll convert that to a unit used frequently for measurement comparison—a football field. That 18,000 acres equals 16,400 football fields. Big area no matter how you look at it.



What is in those 18,000 acres for your bees? Consider the possibilities: different microclimates, soil types, water sources and drainage, cultivated crop land, pasture land for various livestock, forests, scrub land, desert, asphalt and concrete, groomed lawns, swamps, flatland, hills, mountains, rocks, even someone else's apiaries. Your bees certainly encounter some of these things every day they fly.

Now, it may be impossible for us to walk, ride a horse, drive or fly over this 18,000 acres and even then what we see is only part of the story. For example, the soil type and the water availability will govern the kinds of plants that grow wild and even the cultivated crops. The soil where you are now standing can be completely different from that on the other side of the hill. Therefore, the plants are different. It may seem to be quite impossible for you to investigate this large area.

With the remarkable satellite images now available on our home computers, we can literally "fly" over those 18,000 acres and investigate in detail what we cannot see or reach from the ground. In addition bucketsful of information exist to help you investigate soil and water characteristics, areas of plantings, wildlife preserves (potential for bears?), location of roads, cities and towns, and more. Using information available to us through our computer we can become quite knowledgeable about the area in which we live and our bees work.

Let's see what possibilities—and dangers—this 18,000 acres could hold for your honey bees. Perhaps you will find reasons why you have sudden pesticide damage, or a slow decline in honey crop, or a just-as-sudden bumper crop. Knowledge of a field of clover, that you never knew existed, could encourage you to put on some extra supers to take advantage of this newly-found source.

Groomed lawns and tidy flower beds can spell pesticide disaster in addition to less useful nectar and pollen sources. Dandelions and white Dutch clover seem to be forbidden in today's sculptured and tended urban and suburban lots. Fields of corn or cotton, along with fruit orchards also present possible pesticide damage. Do you really know where such lots or fields or orchards are? Such knowledge can help you combat those mystery losses that could be slow pesticide damage.

Suppose some fields of beautiful clover are now being turned into a housing development. There goes a good nectar source. But because that area is not on your "beaten path" you were unaware of the construction.

Farms change owners and farms also change crops. An inefficient, old apple orchard, that gave you early spring pollen for a number of years, has been uprooted and will be turned into a wheat field, something of no value to your bees. You need to be aware that life in those 18,000 acres changes and those changes can affect you and your honey crop.

Hills and valleys give temperature gradients with cooler air settling into valleys, especially at night. Asphalt and concrete absorb heat during the day and slowly release it during the night. So cities and towns generally are warmer than surrounding countryside. A few degrees difference can translate into a prolonged sequence of bloom for your bees. That's good; perhaps a bigger honey crop is possible.

Do you know where that nasty-tasting honey comes from that seems to spoil some batches you extract? You may have a guess as to what it is, but have no idea where it could be growing, or even how large its growing area is. If you could identify areas of various plants you have a possibility of moving hives to a nearby nectar source that would provide premium honey and avoid the nasty-tasting stuff.

Today beekeepers are being encouraged to take advantage of varietal honeys that can command premium prices. If you investigate those 18,000 acres with the thought of acquiring at least two different varieties, you can then decide whether keeping your hives at home or whether moving hives is a more economical approach.

One thought on moving hives—watch out, will you be driving into a swamp? What do the satellite images, combined with water and soil information, tell you about access? You want to position your hives close enough to the nectar source but in an area that you can reach easily. Beekeepers do have a knack of getting stuck in the mud.

Beekeepers tend to keep to themselves unless they are active in beekeeper organizations. Just suppose in those 18,000 acres several people are keeping bees. You could have competition for some choice nectar plant. It would be nice to know where hives are and approximately how many. Just wandering around and asking may not produce any useful information and it wastes time. However beehives and apiaries may be visible on satellite images. It might be worthwhile to have a look.

Quite a number of trees are good nectar sources. But just one or two scattered trees of the sort you want for honey just won't give you the yield you want. If you can see some patches of forest on the satellite images and make use of your local forest service, you can determine whether your bees are going to be busy or just flying past. The types of trees and the area they cover can give you the information you need to increase your honey crop.

Do you sell your honey locally? Then you must be selling at least within those 18,000 acres. But if you sell your honey in a neighboring town, say half an hour away, you are in another area. How can you tell if you are selling your honey in the best area. True, you may sell out of honey each year and feel rather proud of it. But if you are selling your honey for $2.50 a pound and customers refuse to pay more, even for top quality, perhaps you need to look for other outlets for your honey.

You certainly can drive more than three miles in a sensible length of time. So shall we expand your area beyond that of the bees? You probably know the towns and cities, farmer's markets and various events within a convenient driving time. But do you have an accurate picture of the economic situation within your area? Is there some "island" of higher-than-average income that you may be unaware of? You can have a look at the economic situation for many areas of the United States. Then you could make some sensible plans for new honey markets.

So your honey crops have been lower than normal for a few years but your local weather cannot be blamed. You have learned from your newly-found investigative resources that the honey plants and even the potential for your area is declining. Look at the area beyond your 18,000 acres. Establishing an outyard in a new area, still within a convenient distance from your honey house could prove to be extremely worthwhile. You can repeat your computer "flyover" for different 18,000-acre circles and investigate data for these new areas. Now you are traveling over a really, really huge area. All without leaving home.

Suppose you have just discovered a potential nectar source in another area close to your original 18,000 acres. Not only have you found a source but you have also found a way to reach this source because roads, visible on satellite images, can take you there easily. Grab a jar of your nice honey and visit the owner of this newly-discovered bee pasture. It's possible that the only thing you knew he grew was cattle.

Take advantage of a rainy day and visit your Cooperative Extension Service. They can lead you to your nearest soil and water information, to the local forestry service, to environmental information, even to pesticide and herbicide information. Now that the world is appearing on the Internet, many of these services provide electronic information—so you don't need to wait for a rainy day. You can just finish your chores during the day and search for your information after the sun sets.

Keep up the investigative work and soon you will know as much about your 18,000 acres as your bees do. BC

Ann Harman is a sideline beekeeper and international marketing consultant.

Natural & Suppressed Reproduction of Varroa

Jeffrey W Harris & John R. Harbo

In 1995 we began selective breeding of honey bees for resistance to *Varroa destructor* (the common *Varroa* mite that was formerly called *Varroa jacobsoni*). From a population of bees that we assembled from Michigan and Louisiana, we measured many characteristics that we thought could be associated with the growth of mite populations in bee colonies[4]. Based on that study and the reports of other researchers[11], we chose suppression of mite reproduction (SMR) as the trait of the honey bee that would be the basis of our selective breeding. Since that time we have intensified SMR from about 20% in an unselected colony to a recent group of queens that averaged 100% SMR in worker brood[5,6]. This trait is widespread in our bee population, so anyone can select for it as long as they know how to measure it. This article describes metamorphosis in worker bees, normal reproduction of varroa mites, and the abnormal reproduction of mites found in colonies of bees that have been selected for SMR.

Introduction

Our breeding objective is to control the growth of mite populations within bee colonies by the selective breeding of honey bees. At first, we settled for a slower growth of the mite populations, and then we wanted no growth. Now we want a decline in mite populations.

Our approach is to measure small changes in mite populations over relatively short periods (2 – 4 months). This requires accurate and sometimes tedious measurements of brood, bee populations, mite populations, and mite reproduction.

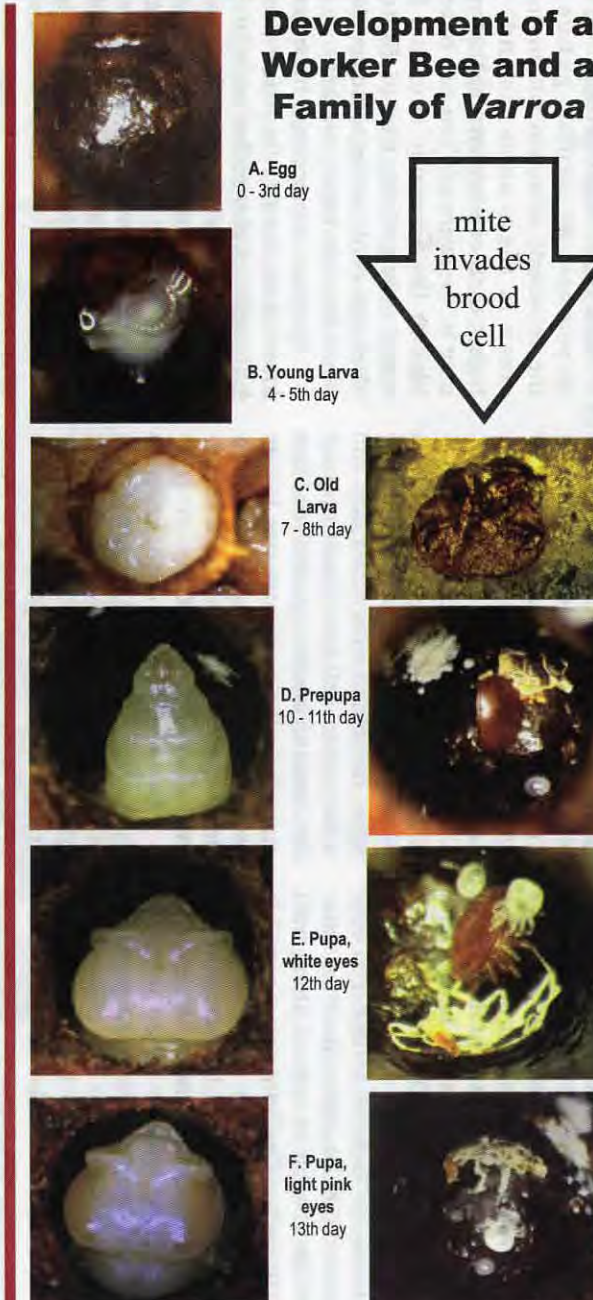
A colony does not need to show long-term tolerance of *Varroa* mites to be valuable in selective breeding for resistance. We selected queens for breeding by screening 25-30 colonies of bees for *Varroa*-resistance in 80-120 day field tests. Typically, each colony started with 2 pounds of worker bees and 400 mites. We measured populations of mites and bees from each colony at the beginning and end of a test, and we measured various traits during the experiment. Then we chose queens from the best colonies to become breeder queens. Later, we found that the percentage of nonreproducing mites (%NR) predicted the growth of a population of *Varroa* mites; mite growth was lowest in colonies with the highest %NR. We then began to select queens based on the %NR rather than on overall growth of the mite population.

Varroa mites reproduce within the capped brood cells of the honey bee. Nonreproducing mites are those that enter brood cells and do not lay eggs, or if they do lay eggs, none of the daughters can mature before the adult bee leaves the brood cell. Experiments showed that a genetic characteristic of bees caused mites to become nonreproductive. We call this trait the "suppression of mite reproduction" (SMR). Before describing the abnormal reproduction of *Varroa* mites from colonies having the SMR trait, we will describe the normal life histories of worker bees and *Varroa* mites.

Metamorphosis of Worker Bees

Honey bees develop within cells on a brood comb. The total development time from egg to adult varies among and within the three castes: about 15 days for queens, 23 days for drones, and 20 days for workers. The following description focuses on worker metamorphosis. Although *Varroa* mites prefer drone brood cells to worker cells by about 8:1, we did not provide drone cells in our field trials, so the mites invaded only worker cells.

Like beetles and butterflies, honey bees undergo complete metamorphosis. The immature



Development of a Worker Bee and a Family of *Varroa*

insect looks dramatically different from the adult insect in this type of development. Honey bees advance through four morphologically distinct life stages: egg → larva → pupa → adult (Fig 1).

The rate of metamorphosis for most insects depends on temperature. Generally, development slows at cooler temperatures. This is also true for honey bees. However, healthy colonies of bees hold their brood nest temperature constant (about 95°F), and this constant temperature makes a predictable rate of development for the bee. Therefore, the size of a larva or the external coloration of a pupa can be used to estimate age (age is measured from the moment the queen bee lays the egg). A pupa with purple eyes and a white body is probably 15 days old (Fig 1H) give or take a few hours. The duration of each stage of development is constant. For a worker bee, an egg is 3 days, a larva is 8 days, and a pupa is 9 days. The egg and young larva live in uncapped brood cells, and the duration of the uncapped period is 8 days. The oldest larval stages, pupal stages and first half-day of the adult stage occur in capped brood cells. The capped period, or postcapping time, spans 12 days.

The life of a worker bee begins when a queen lays a single fertilized egg onto the base of a worker-sized brood cell (Fig 1A). An egg stands erect from its point of attachment. The external appearance of an egg does not change before hatching; however, the embryo within the egg dramatically changes from a tiny blob of cells into a segmented larva (Fig 1B). Just before hatching, the larva begins to flex within the egg while dissolving the eggshell. This occurs at the end of the third day.

Nurse bees feed a larva within minutes of hatching and continue to provide food (Fig 1B) while the cell is uncapped. By the end of the 7-8th day, a full-grown larva weighs about 1,500x its original weight at hatching. Older larvae completely fill the bases of their brood cells (Fig 1C). Attendant bees construct a wax cap by the end of the 8th day, and the larva eats the remaining brood food during the first several hours postcapping. Afterwards, the larva defecates or clears her gut and spins a cocoon around herself. Glands within the mouthparts of the larva produce the silk used to weave the cocoon. The cocoon usually separates the larva from her feces. Immature bees molt and shed their skins as they grow; 5 molts occur in the larval stages, and 1 at the end of the pupal stage. The final larval molt occurs soon after the cocoon is spun. This molt differs from the previous 4 molts because the newly formed prepupa (Fig 1D) remains within the old larval skin for a couple of days (rather than shedding it immediately after molting). The prepupal stage spans about 2 days.

The pupal stage begins after the prepupa sheds the fifth larval skin at the end of the 11th day (Fig 1E). The external body of a 12-day-old is all white. Subsequent external changes involve darkening of the eyes and the cuticle. Although the external shape of a pupa does not change dramatically, the internal structures undergo major rearrangements. The organs and tissues of the larva degrade, and new organs and tissues of the adult bee gradually replace them. The most obvious external changes in pupae involve pigmentation of the compound eyes (large eyes), the ocelli (three small eyes at the top of the head), and the cuticle or outer skin. A young pupa (Fig 1E) lacks pigment in the eyes or the body. The eyes and ocelli gradually change color from white to pink (Figs 1 F—G) to purple (Fig 1H) by the end of the 15th day. The cuticle of the bee slowly darkens from white (Figs 1 E—H) to tan (Figs 1 I—J) to gray or black by the end of the 18th day (Fig 1K). The wings expand fully as the bee sheds the pupal skin on the 19th day. This completes the pupa-to-adult molt, which is the sixth and final molt of the worker

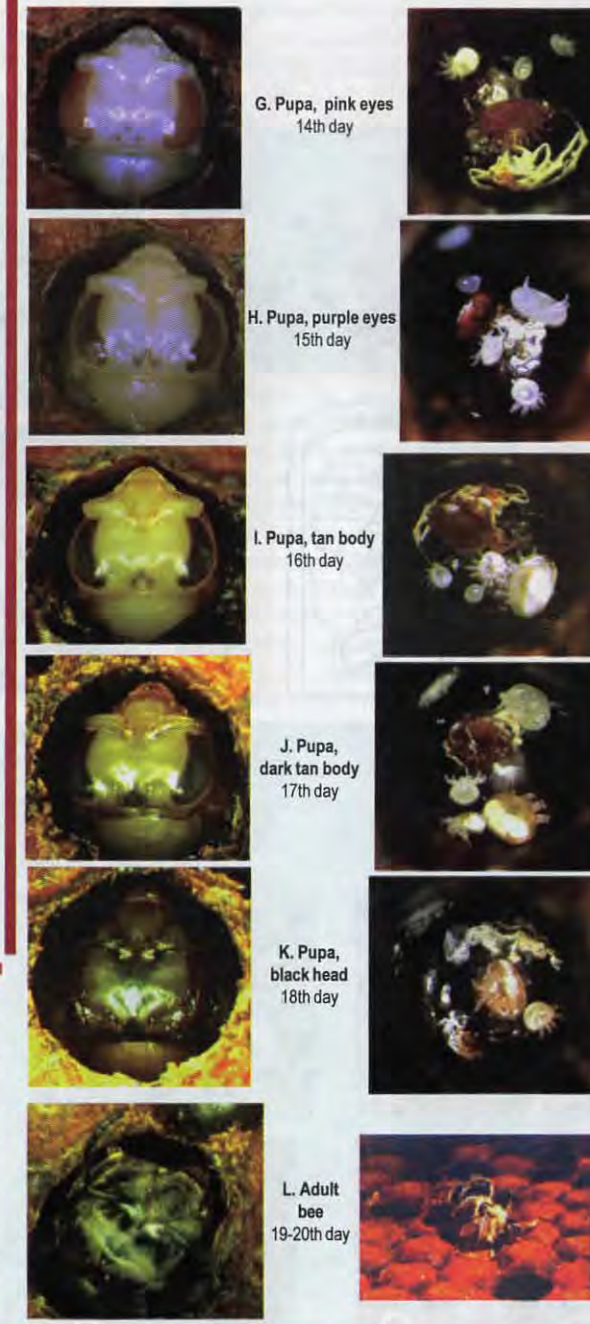


Figure 1: *Stages in the development of bees are given in the left column, and the corresponding mite family (or activities of the mite) is shown in the right column of the table. The center of each row is labeled by a description of the bee's stage and approximate age of development (days). The mite photos in* ***D—J*** *show the progressive growth of the mite family. The mite in* **C** *is covered by brood food, and an extended peritreme can be seen between the 3rd and 4th legs on each side of the body. The right side of* **K** *shows adult male and female mites with their shed skins from the final molt (see also Fig 2E).*

bee during metamorphosis. The young adult bee remains in the capped brood cell for another 10-18 hours. Her cuticle continues to harden during this time, and she frequently moves her legs and wings. Eventually she chews away the cell cap and emerges from the brood cell to begin her life as an adult member of the colony (Fig 1L).

Varroa Mites Reproduce in Capped Brood Cells

Two distinct phases comprise the life cycle of a *Varroa* mite: (1) a phoretic phase when the mite lives on adult bees, and (2) a reproductive phase when she enters a brood cell to lay eggs. Potential attacks from adult bees make phoretic life more perilous than when a mite lives in a capped brood cell. The phoretic phase lasts from several days to more than a month, but the average is about one week. Mites prefer young nest bees to older workers and drones during the phoretic period. Reproduction by *Varroa* mites requires bee brood, and a colony of honey bees usually has brood except during the late fall and early winter. Mites must live solely on adult bees during broodless periods.

A *Varroa* mite may attempt to reproduce as many as 7 times during her life[1], but the average is about three reproductive cycles per mite[10]. The reproductive phase must fit within the 12-day postcapping period of the worker bee because mites cannot enter or leave a cell while it is capped. A foundress mite (or mother mite) begins reproduction by invading a brood cell. She does this by riding the belly-side of a nurse bee and running into an open cell that contains an old larva (Fig 1C). The mite probably chooses an appropriate cell by detecting the chemicals that the bee larva emits to stimulate the sealing of the cell by attendant bees. The mite moves down the cell wall and immerses herself in the brood food beneath the larva.

The mite becomes immobile while in brood food. She probably breathes from an air bubble that she holds around the bases of her legs while lying on her back in the brood food[12]. Varroa mites inhale and exhale air through a pair of tiny spiracles or stigma. One stigma is located on each side of the body near the base of the third leg (mites have 4 pair of legs). A fingerlike tube or peritreme extends from between the third and fourth leg on each side of the body when a mite is immersed in brood food (Fig 1C). Each peritreme connects to the mite's airway near the stigma. Scientists believe that the two peritremes eliminate excess CO_2 from the blood and retain water in the blood during respiration[12].

The bee larva inadvertently liberates the foundress mite by eating the remaining brood food (before spinning her cocoon). Bee blood is the only food for adult and immature mites. An awakened mite usually sucks the blood of her host beginning in the late larval stage, and these early meals are necessary for the development of her eggs.

Feeding sites usually occur on the abdomen of the bee, but mites can feed anywhere on the host. The mouthparts of immature mites are too short and soft to puncture the cuticle of the host, and the mouthparts of adult males are modified for transferring sperm during mating. Therefore, immature mites and adult males must feed from a wound made

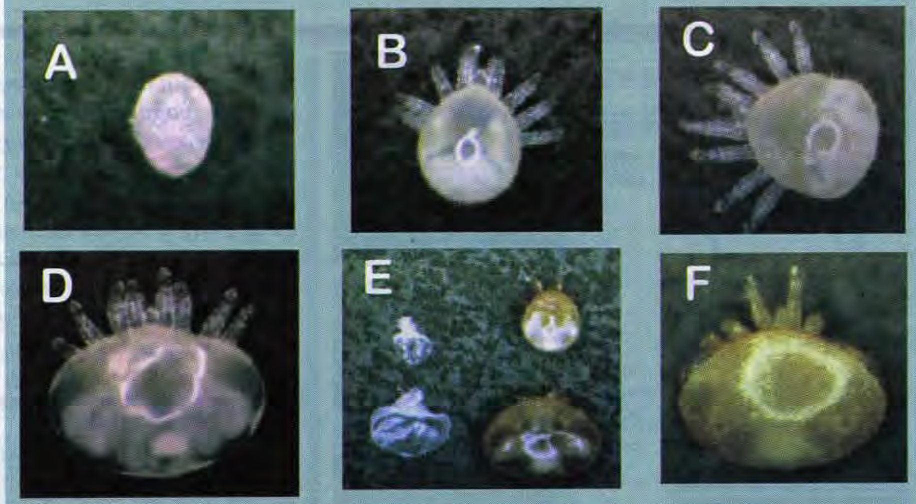


Figure 2: *Life stages of Varroa destructor.* ***A****, egg;* ***B****, protonymph;* ***C****, male deutonymph;* ***D****, female deutonymph;* ***E****, young adult male (above) and female (below) with their shed deutonymph cuticles on the left;* ***F****, adult female that has not yet darkened (Halos on the mites are a reflection from a circular light source).*

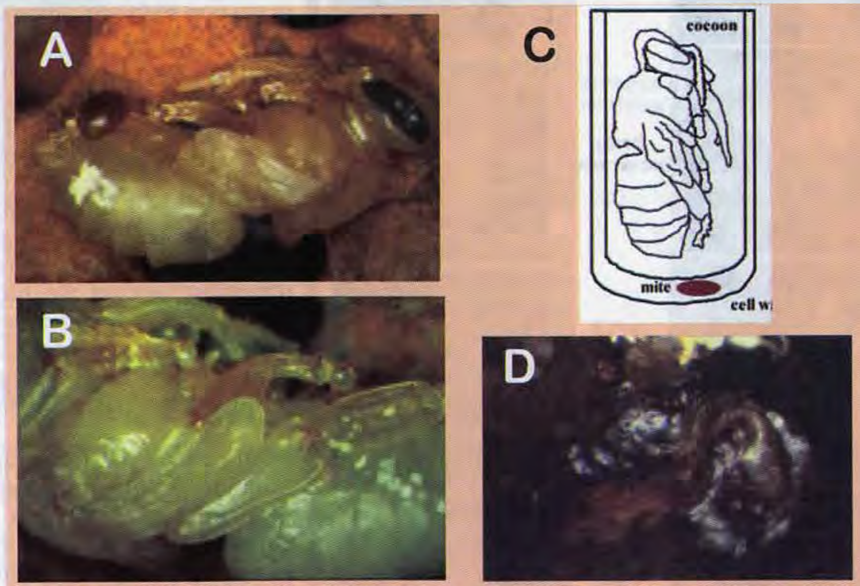


Figure 3: *Typical nonreproduction.* ***A****, a mite places her fecal patch on the bee rather than on the cell wall where it is normally placed;* ***B****, sometimes nonreproductive mites place several small fecal patches on the bee. For some reason, defecating on bees is often associated with mites that lay no eggs;* ***C****, diagram showing a mite entrapped between the cocoon (top layer) and cell wall (bottom layer);* ***D****, an entrapped mite as seen through the silk cocoon.*

by their mother[2]. All members of the family tend to defecate on the cell wall near the feeding site. The white mite excreta contrast sharply with the dark wall of the brood cell (e.g. Fig 1D).

Varroa mites develop through gradual metamorphosis like grasshoppers. The immature mites, or nymphs, have the general shape of an adult. Both sexes of mites have four life stages: egg → protonymph → deutonymph → adult (Fig 2). Males and females need 6.5 and 5.5 days, respectively, to develop from egg to adult.

Eggs and protonymphs of the two sexes look alike, but the deutonymphs and adults of the sexes are easily differentiated (Fig 2). The duration of each stage varies between the sexes. A male lives 30 hours as an egg, 52 hours as a protonymph, and 72 hours as a deutonymph. A female lives 20-24 hours as an egg, 30 hours as a protonymph and 75-80 hours as a deutonymph. Immature mites actively feed, or they walk on the host bee or cell wall when not preparing to molt. Mites of both sexes molt and shed their outgrown skins twice during development; between protonymph and deutonymph, and then between deutonymph and adult. A mite becomes immobile during the 16 hour period preceding its first molt, and for a 50 hour period (30 hours for males) preceding the second molt. The dried skin from the second molt is easily seen with a dissecting microscope (Fig 2E). Immature mites of both sexes are white. Newly-molted adult mites are tan. Bodies of females darken to reddish brown within a couple of days of the final molt (e.g. Fig 3A); males remain light tan (Fig 2E).

The reproductive success of a foundress mite depends on her ability to lay eggs so that 1-2 daughters have time to mature fully before the host bee leaves the cell. A mite produces as many as 5 eggs, but she cannot lay all 5 at once because each egg is large relative to her body. Many blood meals provide the nutrition needed to produce a single egg.

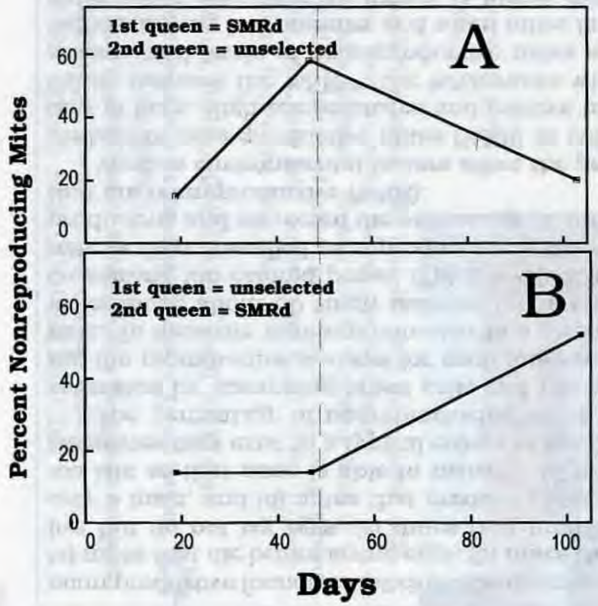


Figure 4: *Changes in the percent nonreproducing mites in the queen exchange experiment.* ***A****, plot of the average percent nonreproduction for 10 colonies that began with a queen selected for SMRd and were given an unselected queen after 48 days;* ***B****, a plot of the opposite group - 10 colonies that began with an unselected queen and were given a SMRd queen after 48 days. Generally, the percent nonreproducing mites increased in all colonies within a few weeks of installing the SMRd queens, and it decreased within a few weeks of installing unselected queens. The dotted line indicates the day that queens were exchanged.*

Evidence suggests that either the first blood meals or chemicals from the bee (larva or prepupa) stimulate *Varroa* mites to produce and lay eggs. The stimulus synchronizes a mite's reproduction to the metamorphosis of the host bee and ensures that all eggs will be laid along a schedule that maximizes the number of adult daughters. A mite lays her first egg, which is usually male, about 60 hours after attendant bees seal the brood cell. She places the male egg on the cell wall near the head of the prepupa (Fig 1D). The mite lays each subsequent egg (females) at 30-hour intervals, placing each egg on the cell wall near the abdomen of the host pupa. The typical mite will stop laying eggs on or before the 15th day.

The staggered sequence of egg laying causes the development and maturation of the offspring to be staggered relative to each other. For example, a typical mite family on a pupa that has purple eyes and a white body consists of a male deutonymph, an immobile female deutonymph (1st daughter), a mobile female deutonymph (2nd daughter), a female protonymph (3rd daughter) and an egg (4th daughter) (Fig 1H). Although the foundress mite lays the male egg about 30 hours before the first daughter egg, the longer development time of a male causes him to mature less than half a day before his oldest sister. Theoretically, a foundress mite can produce three adult daughters in a worker cell, but most mites only produce 1-2 mature daughters. The foundress mite and her adult daughters will exit the brood cell and survive after the young bee emerges (Fig 1L). Adult males and immature mites cannot survive after the host bee matures.

Varroa mites do not have eyes, so they depend on touch and smell to navigate through their environment. The mite excreta attract immature mites, which probably helps them find the feeding site. Mite excreta also attract newly-molted adult mites of both sexes, and mating occurs on or near the feces[2,3]. An adult male mates with a female shortly after she becomes an adult. He uses specialized mouthparts to transfer sperm from the genital opening of his chest to one of the two genital openings of the female. Each of her openings is located between the bases of her third and fourth legs. A typical female mates many times, but only a few sperm are transferred with each mating[3]. A fully-mated female mite stores 40-70 sperm within her spermatheca. She will use the stored sperm to produce eggs after she enters a cell in a future reproductive cycle.

Suppression of Mite Reproduction

Not all *Varroa* mites in a colony of bees attempt to reproduce at the same time. During periods of active brood rearing by the bees, about 1/3 of a population of *Varroa* mites lives on adult bees, and 2/3 of them live within capped brood cells. In normal colonies of bees, about 15-25% of the mites that enter worker brood cells do not produce even one mature daughter[11]. Four categories of these nonreproductive foundress mites can be described: (a) mites that die before laying eggs, (b) mites that live but do not lay eggs, (c) mites that produce only a male, and (d) mites that produce progeny too late so that none is able to mature. All four categories may exist in a typical colony of bees.

The percentage of nonreproducing mites is estimated by uncapping brood cells and recording the reproductive success for each foundress mite. To measure mite reproduction in a colony, we examine about 30 singly infested brood cells containing tan-colored pupae (Fig 1 I—J). Each mite is then classified as reproductive or nonreproductive, and we record the percentage of mites that are nonreproductive (%NR).

Various environmental factors affect the percentage of nonreproductive mites (%NR) in colonies of bees. High temperatures and relative humidity increase the %NR[8,9]. The %NR varies with season, and levels of nonreproductive mites are highest during late summer and when mites first enter brood cells after the winter. A higher %NR occurs in colonies from tropical climates than in those from moderate climates.

However, if we are to succeed in selective breeding, some of the nonreproduction must have a genetic basis in the bees. We showed that there is a heritable trait in bees that affects mite reproduction[4]. Therefore, it is possible to enhance this trait with selective breeding. Generally, high percentages (50 —100%) of living mites that had not laid eggs occurred in colonies of our selected line[6]. These non-laying mites often placed their feces on the bee (Fig 3A—B) rather than in the normal position on the cell wall. We also found that many non-laying mites had no stored sperm, which suggests that nonreproduction could be related to nonmating. With continued selective breeding, we began to find dead mites that were sandwiched between the cocoon that is spun by the host larva and the cell wall (Fig 3C—D)[6]. We term this condition "entrapped by the cocoon". Few entrapped mites (1-2%) are found in unselected colonies, but > 50% of the mites in colonies of bees bred for SMR are entrapped.

High levels of nonreproducing mites become apparent about 6 weeks after placing a queen with the SMR trait into a colony of bees. This delayed suppression of mite reproduction is called SMRd. Another type of mite suppression occurs in the first brood produced by a queen with the SMR trait. The acronym for immediate suppression is SMRi. Our past breeding work has been with the SMRd trait. We have only recently found the SMRi trait at high levels.

Queen Exchange Experiment

We demonstrated the effect of SMR in an experiment where queens with and without the SMRd trait were exchanged between colonies[7]. We established 20 uniform colonies, each with about 2 pounds of bees and 600 mites. Ten colonies started with queens having the SMRd trait, and the other ten colonies began with unselected queens that did not have the trait. After 48 days, we exchanged queens between colonies so that each colony was given the opposite type of queen. Bee and mite populations grew for 103 days. The %NR was measured at the beginning of the test (day 19), just before queens were exchanged (day 47), and at the end of the test (day 103) (Fig 4).

It was clear from this study that mite reproduction changed when queens were exchanged. Mite populations became more or less reproductive in response to the type of queen. Suppression was the delayed type (SMRd) because mite reproduction was nearly identical in all colonies during the first reproductive cycle (the observation on the 19th day). Differences were not apparent until after several weeks (day 47).

Based on our studies and that of others, we are confident that honey bees will become resistant to *Varroa* mites. SMR is only one of the possible mechanisms that can help our bees become *Varroa*-resistant. Our plan is to insert *Varroa*-resistant traits into our honey bees so that the bees will need fewer chemical treatments to control mites. Eventually they will need none. BC

Jeffrey Harris and John Harbo are research scientists at the USDA Honey Bee Breeding Lab in Baton Rouge, Lousiana.

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Beekeeping's Friendly Curse

It seems that half the people on Earth have some memory or have had some actual interaction with a bee swarm sometime during their lives. Their individual stories were milestones an event to be remembered and retold. Yet, I don't have such a story. As a child, I don't remember tossing stones at a hanging swarm. I don't ever remember bees pouring from a tree as I watched in rapt terror. My Dad never had to call a beekeeper to come get a swarm off our property. Not one memory do I have. It's a common event in one's life, but one I didn't have until after I was a beekeeper. Now I have plenty of swarm stories, but I can't find anyone who cares.

Pre-Varroa Swarming

Before *Varroa* revamped beekeeping worldwide, swarming was at once a beekeeping reward and a beekeeping curse. A call to come pick up a five pound swarm hanging three feet off the ground was reason enough to take a vacation day from work. Conversely, realizing that a colony of mine had swarmed was reason for annoyance, shame, and an indication of poor management.

In the old days, at my lab, we commonly averaged 25-40 swarm calls per year. We could routinely fill all the local beekeepers orders who asked to be on our swarm list. In heavy swarm years, we would simply tell callers to ignore them and they would go away. Prophetically, we don't even maintain a swarm list now. We may get a few calls per year, but we can randomly phone a beekeeper to take care of them. For the most part and for the immediate future, honey bee swarming – this harbinger of Spring – this memory maker – is history.

Post-*Varroa* Swarming

But swarming is not dead and will readily happen within your hives if you don't prepare for it (You can't absolutely prevent it). It has always been a beekeeping irony that if your colonies: (1) wintered well, (2) had reversed brood chambers, (3) were disease free, (4) had plenty of honey and pollen stores and (5) had a strong early nectar flow, they would probably swarm and all that good luck and hard work would fly away while you were gone.

For all the changes that *Varroa* infestations have perpetrated, they have not changed the basics of swarm prevention: reduced colony crowding and young queens heading the colony.

Reversing Brood Chambers

Wintering colonies move upward in the colony during the Winter. By Spring, the queen, cluster, and brood nest, is near the top of the hive. Though plenty of space is now below the cluster, many times, the colony will consider itself crowded and begin to make swarm preparations. In early spring, reversing brood chambers will help limit swarming. Basically, you are putting the brood chamber back on the bottom board and providing expansion space above.

Requeening Every Two Years

To prevent swarming, people like me have told people like you to requeen every other year for as long as I can remember. Personally, I al-

Long before a colony gets to this point in its swarming cycle shown here, less obvious, but measurable activities occur inside the hive. Foraging decreases. The queen begins to lose weight, is laying fewer eggs and is putting eggs in the now more-numerous queen cell cups. Queen cells appear, perhaps 10's or even hundreds. The brood nest is in such a position that expansion is restricted, by a honey layer, by the top of the hive, or least noticeable, by an empty super full of curing nectar. Of course a two, or three year old queen will add to the problem because her pheromone preserve is diminished. Early signs of swarming behavior are numerous, and prevention, or control is often possible.

ways mean to requeen but I rarely ever do. I should. In fact, with all the changes ongoing in hive management now, I would not hesitate to recommend requeening ***every*** year. Requeening is a form of hive surgery. Know what you are doing before you start the process. Requeening can occur anytime during warm months. In fact, it may be more difficult to get queens in the early spring. Everyone wants them then.

Destroying Queen Cells

Destroying queen cells as a swarm prevention procedure is in the same category as winter-feeding. It reads well, but it really doesn't work. It's a desperation measure. For those of you who haven't tried it, essentially, swarm cells are systematically destroyed as a way to prevent swarming. Problems? Miss just one cell and the colony will still swarm. Even so, some colonies will swarm with no swarm cells in the colony. Finally, it's a lot of work for you opening and closing hives every few days. I'm betting you're going to tire of doing it and then your colony will swarm.

Lost swarms

Letting the bees swarm and hiving the swarm is a common procedure for time-stressed beekeepers, but not a good one. I have no statistics, but I suspect that most swarms escape without beekeepers ever knowing they swarmed. It takes about ten minutes for a full-sized swarm to become airborne. You've got to be mighty observant to watch the hive that closely.

Getting the Swarm Call

So some poor beekeeper's bees got away and you got the call to come for them. Normally the caller is distressed. They are allergic to stings. Their kids are allergic. The dog is allergic. Everyone is at risk and only you can save them. (As aside...actually that's not completely true. Past creative homeowners have sprayed swarms with water or with insecticides. Some have shot the clusters with shotguns. When none of that works, you get the call.)

In previous articles, I have routinely suggested that you ask some basic questions. My list of questions has developed after years of dealing with swarms and people. Here they are again.

Are they truly honey bees? Be suspicious of swarm calls during Summer and Fall. Too often they are Yellowjackets or wasps.

How long has the swarm been there? A hanging swarm that has been at the site for more than a day can be remarkably aggressive. Be prepared. People are always around to watch you hive a swarm.

How high from the ground is the swarm? The reason for this question is obvious. Space prohibits me from describing some of the spectacular saves beekeepers have done in order to get a high swarm. Normally, it's not worth it.

How big is the swarm? Is it as big as a basketball, a baseball, a volleyball, or a Chevrolet? Small swarms late in the season are not worth much.

Is the swarm yours to give away? Occasionally, there is a beekeeping neighbor who wants the swarm but is not aware that it has issued. Asking this question helps you avoid a moral dilemma.

Hiving the swarm

Most times, putting the swarm in a hive is a walk in the park. A fresh swarm is not aggressive and is looking for a new home. You show up with one and the bees will seem happy for it. Most often, just getting the hive near the swarm is enough to entice the bees to begin to move in; however, not infrequently, the surrounding limbs may need a shake to start things up. It is true that shaking a swarm of bees can cause a good deal of excitement, but if the swarm is new (less than a couple of days) and the weather is clear and warm, nothing should happen. Even so, admonish onlookers to stand back.

So what if the swarm made a mistake and left on a day when rain and cool weather was predicted? Consequently they have been unable to move to a permanent home site. An atomizer bottle filled with sugar syrup and sprayed on the bees – frequently – will refill the hungry bees and improve your chances of an easy event.

What if the bees return to the original limb after the limb shake? You didn't get the queen in the shake. Try again. Sometimes you win while other times you lose. Scenting bees in and around your equipment is a good sign that they have accepted the new domicile.

What if the swarm is small and the bees are skittish? There's a good

Continued on Page 42

A high, unreachable swarm. At lower left, note the comb from a previously unreachable swarm.

Many times, beekeepers simply get as many bees as possible and leave all the flying bees. In theory, these bees will return to the parent colony. Be aware that homeowners are not wild about this procedure. Bees will be flying about for the next couple of days and can actually be more of a pest than a hanging swarm. The best of both worlds is come back for the tricky swarms while remote swarms, not involving people, you get as many of the bees as possible and go. You will save a return trip.

Woe the Wild Swarm

Decreased natural swarming is a sad loss to beekeeping. Innumerable people have become beekeepers after coming across a swarm. That simply does not happen so much any more.

A large, healthy swarm is a great thing. It is productive, builds up fast, is gentle and is free – and it pumps up the beekeeper. Be ready for the spring/summer swarms, but you need not be quite as ready as you once were. However, the thrill is still there and it feels good (so long as the swarm came from another beekeeper's hive). BC

Dr. James E. Tew, State Specialist, Beekeeping, The Ohio State University, Wooster, OH 44691, 330.263.3684, Tew.1@osu.edu

chance it is a secondary swarm (also called a mating swarm or an after swarm). A virgin queen, which is not chemically in complete control of the swarm, heads it. The virgin queen can easily fly and the swarm goes with her when she leaves. Nothing different for you to do in this case, except keep trying to hive the swarm in traditional ways.

Swarm Hiving Equipment

The rare prepared beekeeper assembles single deep hives for the swarm season. When the call comes, most of us go dashing around looking for anything that will do in a pinch. Equipment that we would not use to start a winter fire will suddenly be okay for a swarm box. Of course, our plan is to bring the colony home and transfer it to nicer equipment, but you know how that goes.

Old Comb, Old Equipment

Bees in swarms are attracted to old equipment and old comb. I suppose it smells right. But it need not be old to be successful. The wax smell accompanying foundation could be enough to attract the bees to the hive body.

Nucleus boxes are frequently used to hive swarms. Only in a perfect bee world are all swarms near the ground. Carrying a nucleus box up a ladder is much easier than trying to carry a full-sized hive.

On many occasions nearly any container has been used to retrieve a swarm. Corrugated board boxes, buckets, even the beekeeper's veil can be improvised to serve as a temporary container – but be prepared for a good deal of bee leakage on the ride home. I have heard the story of a beekeeper who clipped the limb of a hanging swarm, put it in his car, hurried home, and released all the flying, crawling, confused bees from his car. He then hived the swarm. Though interesting, I can't routinely recommend the procedure.

For the sophisticated beekeeper, bee vacuums are available. These specialized vacuums put the swarm into screen-walled boxes or even package cages. Some of these vacuums can be modified to accept long extension tubes for reaching high swarms. However most of us will just carry a box and shake the limb.

Transporting the Swarm

Simplistically, you have two choices when moving a swarm. Move it now or move it later. Rarely, it can stay where it was hived, but that is infrequent.

Confined bees will quickly suffocate, so a technique like shaking the swarm into a five-gallon can and then jamming lid on the bucket is a recipe for a bucket of dead bees. Ideally, the best procedure is to position a hive near the swarm and entice the bees to enter. Come back after dark for the unit and move the colony in the traditional way.

?Do You Know? Answers

1. **True** The conversion of floral nectar to honey by the honey bee involves chemical changes brought about by enzymes and physical changes due to the evaporation of some of the water contained in the nectar. The more dilute the nectar source, the more fanning and nectar droplet manipulation (energy expenditure) required to ripen the nectar into honey.
2. **True** The quality of the nectar secreted by the plant is essentially a function of the carbohydrate (sugar) supply to the nectary and indirectly related to photosynthesis (process by which green plants produce their food). Most of the sugar of nectar probably comes from leaves fairly close to the flower. In herbaceous plants, the nectar sugar is likely to be of recent origin, whereas in trees and shrubs, it may also be derived from stored carbohydrates.
3. **False** The best daily temperature pattern that promotes nectar secretion (honey production) is high temperature during the day which promotes photosynthesis and plant growth and low temperatures at night. The low temperatures during the night results in the plant having reduced metabolism/respiration which helps conserve the sugars that were produced during the day, thus making them available for nectar secretion the following day.
4. **True** The relationship of nectar production to soil fertility is extremely complex and research by different scientists often appear conflicting. Both nectar secretion and flower production are affected. Many agricultural crops often require commercial fertilizers to obtain ideal secretion conditions. Too much nitrogen, which promotes vegetative growth, can lead to a reduction in nectar secretion. In many studies the level of potassium and phosphorous are not as critical.
5. **True** Nectar is basically phloem sap that has undergone some alteration during the secretory process. Depending on the plant species, xylem sap may be added. The overall sequence includes the unloading of sap from the phloem sieve tubes, passage of the sap from cell to cell through the sub-glandular tissue and into and through the secretory cells, and finally the expulsion of the finished nectar to the outside.
6. **True** Early scientists believed that nectar was simply an 'excretion' of the plant and the nectary was often described as a valve for the release of excess pressure. Nectar secretion, however, appears from the evidence of several studies to be an "active" process, requiring energy built up in respiration and released by the hydrolysis of ATP. Thus nectar secretion is dependent upon the metabolism of the nectary.
7. **False** Not all flowering plants are attractive to honey bees. Flowers that are brightly colored, sweet smelling and offering a supply of nectar are likely to be attractive to honey bees. There are some flowers with these characteristics where flower structure will not allow honey bees access to the nectar supply, thus they can only be visited by long tongued bees, butterflies, humming birds etc. There are other types of flowering plants that are not attractive to honey bees in that they have floral odors similar to carrion in order to attract flies, beetles etc.
8. **True** Both nectar and honeydew are collected by the honey bee, processed and stored as honey in the comb. They are both mainly composed of sugar, but also contain very small quantities of proteins, vitamins, minerals and a number of other substances. When used for food the bees have to dilute them again.
9. **True** The sugars of stored honeydew are even more complex than those of honey, perhaps since two sets of enzymes, those of the hemipterous insect and of the honey bee, are involved in its production and storage.
10. C) Sugars
11. B) Photosynthesis
12. B) Honey Stomach (Crop)
13. The primary purpose for a flower in providing a supply of nectar is to attract and reward a potential pollinator.
14. An impending thunderstorm sends the foraging honey bees back to the hive where they remain confined during the storm. The rain will dilute available nectar supplies or may even wash the nectar from the flowers.
15. Solar Radiation, Soil Moisture
16. Flowers that are pollinated by moths or bats secrete nectar during the night whereas, flowers that are pollinated by bees, flies, butterflies and birds secrete nectar during the day.
17. Relative Humidity
18. Soil Type, Soil pH, Soil Temperature, Soil Fertility, Soil Moisture, Soil Aeration
19. Organic Acids, Mineral Salts, Volatile Oils, Proteins, Enzymes, Pigments, Alkaloids, Pollen, Amino Acids

There were a possible 25 points in the test this month. Check the table below to determine how well you did. If you scored less than 12 points, do not be discouraged. Keep reading and studying- you will do better in the future.

Number Of Points Correct
25-18 Excellent
17-15 Good
14-12 Fair

Clarence Collison is a Professor of Entomology and Head of the Department of Entomology and Plant Pathology at Mississippi State University, Mississippi State, MS.

DICK BONNEY

Richard "Dick" Bonney, 71, of 73B Fairview Drive, died at home on Monday, March 26, 2001.

Born April 22,1929, in Newton, MA, he graduated from Norwood High School in 1946, served in the U. S. Marine Corps until 1951, married Joan Morton of Wellfleet, MA in 1953, graduated from U. Mass. Amherst with a degree in landscape architecture in 1954; and received a masters in science education from Fairleigh Dickinson University in 1971.

After a successful first career in computer systems management in NJ, working for such companies as the Rand Corporation, Univac, and Systems Development Corporation, in 1978 he and Joan moved to Charlemont, MA to start a second career in beekeeping. There he founded and operated Charlemont Apiaries; wrote numerous books and magazine articles about bees and beekeeping; served as Mass. State Extension apiculturist, and taught beekeeping at U. Mass. Amherst until retiring in 1997.

His interests included natural history, nature photography, camping, canoeing, square dancing, and encouraging all around him to think clearly and independently.

In addition to wife Joan, he is survived by son Richard Bonney, Jr. of Ithaca, NY; daughters Cynthia Bonney of Anchorage, AK and Linda Bonney of Los Gatos, CA; brother Marshall Bonney of Randolph, VT; six grandchildren, and numerous nieces, nephews, grandnieces, and grandnephews. He was predeceased by brother Kenneth Bonney of Shelburne Falls.

Services were private. Memorial contributions may be made to the Mass. Audubon Society's Camp Wildwood,c/o Massachusetts Audubon Society, 208 South Great Road, Lincoln, MA 01773.

Dick began writing for this magazine in 1991 and continued for 10 years. A complete article on Dick will appear in next month's issue.

CHUCK DADANT

Charles 'Chuck' Dadant, 81, a lifelong resident of Hamilton, IL, and owner and past president of Dadant and Sons in Hamilton died March 24, 2001, in the Keokuk Area Hospital.

He was born on December 12, 1919, in Hamilton, the son of Maurice G., and Helen Hassett Dadant. He married Arlene Timberlake on May 23, 1942 in Bulington. She survives.

Additional survivors include tow daughters, Vicki Marting and her husband Wayne, and Marta Menn and her husband Mark, all of Hamilton; two sons, Tim and his wife Mary and Nick and his wife Gloria of Hamilton.

He was preceded in death by an infant son, John, a brother Robert and a sister, Mary Ross.

Chuck began work in sales for Dadant and Sons in 1946 after WW2. In 1966 he assumed his position as president of the company. Chuck was a visionary, trying new beekeeping products, methods and marketing approaches. He was always striving to improve the company while remaining vitally interested in the well being of the beekeeping industry.

He attended numerous state and national beekeeping conventions, speaking at many of them. He supported legislation to help beekeeping through the years and was not afraid to write his congressional representatives to encourage their support for the industry.

Under his tenure as president the company grew tremendously with the addition of branch locations, a metalware plant in Dallas City IL, a woodenware plant in Polson, MT, and a new candle factory in Dahoka, MO. In the early 50s he encouraged his friend and co-employee Dr G.H. Cale, Jr., to work on the development of a hybrid bee breeding program.

With Dr. Cale's guidance, this program successfully developed the first commercially available hybrid queen bees, known as the Starline and Midnite Hybrids. Chuck remained committed to that program for many years.

Chuck was a graduate of Hamilton High School and the U of IL. During the way he served as a U.S. Naval Officer in the south pacific.

Chuck too a less active role in the company beginning in 1990, turning over leadership to his sons, Tim and Nick, and his nephew Tom Ross.

AUSSIE BEES TO CANADA

Aussie Grant Lockwood is happy Canada has had a tougher than usual winter - it means new business for him. The veteran New South Wales beekeeper is about to start exporting nucleus hives and queens to Saskatchewan for the first time.

"We had an inquiry from Canada from a chap in Saskatchewan who imports them," he said. Lockwood of Goldfields Apiaries in Lucknow is also exporting live bee packages for the first time to South Korea and queen bees to France.

He said the export procedures are relatively simple, involving an inspection of the hives and having them as certified free of disease a process that only takes an an hour or two. The hives are then shaken out into packages with one hive filling one and a half packages and prepared for flight.

"Once they are in the packages, they go into the cool rooms for a couple of days and are fed sugar syrup," he said.

"From here they go to the airport, where they are kept in another cool room until they are on the plane."

He is waiting for the temperatures to rise in Western Canada before he starts the shipments of 1,500 nucleus hives and "a few thousand" queens on April 21.

The flight to Canada will be a little more complicated than the nine-hour non-stop journey to South Korea. The bees have to transit through Hong Kong because direct flights between Australia and Canada pass through Hawaii and the United States has a ban on Australian bees entering its territory.

"My son will fly to Hong Kong with the bees that are going to Canada," Lockwood said. "They are taken off the plane there to be watered and re-iced and he will go along to make sure it is done properly." The U.S. is the only country

Cont next page

Aussie Bees...

that refuses to allow entry to Australian bees and the Australians have been negotiating to end this ban for 14 years. They now are petitioning to establish an import agreement.

Australia is experiencing a boom in live bee shipments because of its status as the only continent without Varroa, Asian and acarine mites that cause high mortality rates in hives and reduce productivity. Live shipments this year will also go to such countries as Germany, Italy, Israel, Jordan, the United Arab Emirates, Japan and the Philippines.

The discovery of Varroa in New Zealand last year has lessened its role as a major Australian competitor.

Alan Harmon

ORGANIC STANDARDS FINALLY SET

It's been a long, long fight, but the US finally has national organic food standards. The new regulations, which went into effect February 19, 2001, are more palatable than the last, but there are still serious flaws.

These new standards are significantly better than the first set proposed in 1998, which allowed irradiated foods, genetically modified organisms, antibiotics, and organic food to be grown in sewer sludge. After much angry protest, the final regulations exclude all of these. However, there are still major shortfalls, including the following: the additional cost of certification to organic farmers (who will then pass these costs onto consumers); the lack of substantial funding to support organic farming and research (the USDA gives $30 billion to conventional

Organic..

agribusiness but only $10 million to organic farming), and a long list of allowable additive (including synthetics) to processed organic foods.

The good news is that the NOP will help insure organically produced products meet a consistent standard. Consumers will be able to recognize organic products by the mark "USDA Organic."

Though the new standards went into effect in February, they won't be fully effective until 2002.

Debbie Ortman

SLOTTING FEES & PRODUCE

A large share of today's fresh produce is sold directly by shippers to retailers, bypassing intermediaries and terminal wholesale markets. Price may be just one component of a more complex shipper/retailer sales arrangement that could include off-invoice fees to retailers such as promotional fees or rebates, as well as services such as automatic inventory replenishment. In addition, while the fresh produce industry has traditionally marketed primarily through daily sales arrangements, the volume requirements of very large produce buyers and the demand for reliable, year-round availability and quality of produce is making longer term arrangements-i.e., contracts-more desirable for both shippers and retailers. Marketing Fees Reflect Supplier-Supermarket Relationship

In supplier-supermarket arrangements for marketing a variety of products, the use of marketing fees to retailers-e.g., rebates, shelf placement fees, and advertising allowances-is becoming more common. Specialized fee agreements between suppliers and food retailers may be fixed payments or may vary with the quantity exchanged in the transaction or with volume of sales of a particular product. Most controversial is the "slotting" fee, a lump sum paid by suppliers to retailers for introducing new products to supermarket shelves. From the anticompetitive perspective, marketing fees are the result of changing balances in supplier vs. retailer market power, but the procompetitive view argues that fees help to enhance market efficiency.

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Honey bees have two pairs of wings attached by very mobile joints to the thorax. The larger front wings can be hooked to the hind wings during flight, allowing the two to beat together, improving flight efficiency and performance.

About half way along the leading edge of the hind wing there are a series of hooks called hamuli. Directly across from the hooks of the hind wing, there is a fold in the fore wing into which the hooks fit during flight to hold the two wings together. When the wings are extended before flight, the front wing is pulled over the top of the hind wing, engaging the hooks into the forewing groove. At rest the wings are generally unlatched again.

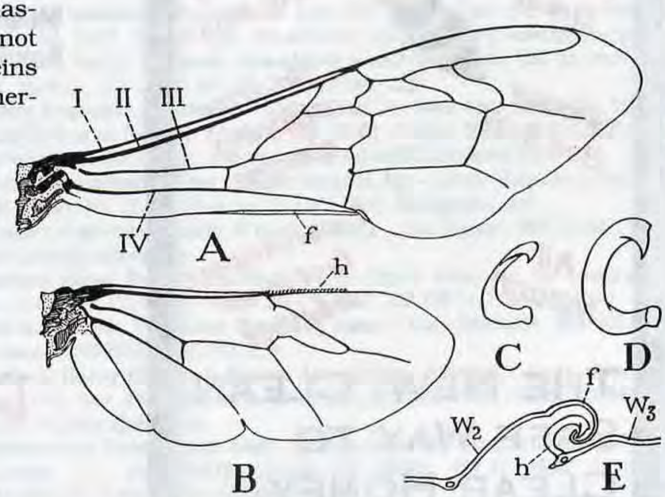
The thin, membranous wings are strengthened by a network of veins which also act as conduits for blood, oxygen and nerves. The wing surfaces are covered with fine hairs and small pits, which are probably sensory in function.

In flight, a worker bee's wings beat at about 200 cycles per second. This rate is too high to be sustained by normal nervous and physical input, and it is thought that the muscles of the thorax resonate (respond more than once to each nerve impulse) to achieve the observed frequency of wing beats. The wings are balanced on a sort of a fulcrum between the upper and lower parts of the bee's thorax. Complex musculature and skeletal interactions allow the wings to be manipulated up and down as well as pitched at different angles for flight.

Comparisons in wing venations are important in the classification of insects, but the Hymenopteran wing veins do not seem to conform to most taxonomic systems. Bee wing veins are therefore frequently named just with the Roman numerals I IV.

SEM Wing Hooks of Honey Bee x610. A very close look at the hooks which fit into the fore wing groove. Note also the abundance of hairs on the wing surface. (Royce/Stringer photo)

SEM Leading Edge of Honey Bee Hind Wing x65. Veins reinforcing the wings supply air, blood and nerves to the wing. The hooks on the edge of the wing latch into a groove in the fore wing to connect the two in flight. (Royce/Stringer photo.)



(Snodgrass Fig. 43 a-e)) The wings. A. Fore wing of drone. B. Hind wing of drone. C. Hook of hind wing of worker. D. Hook of hind wing of drone. E. The interlocked wing margins. I, II, III, IV main veings of wing, f-fold on posterior margin of fore wing, h - hooks on anterior margin of hind wing, W2 - fore wing, W3 hind wing. (Reprinted from R. E. Snodgrass: Anatomy of the Honey Bee. Copyright 1956 by Cornell University. Used by permission of the publisher, Cornell University Press).

Up Close & Personal – Wings

B.A. Stringer

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