

THE HIVE TOOL

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March can be the cruelest month for a honey bee colony. Some colonies, depleted of their stores are desperately hanging on for the early spring sources of nectar and pollen, while simultaneously raising brood to replace their aging adult bees. It is both puzzling and fascinating to observe the variability so apparent in colonies at this time of the year. No two are alike. Some colonies can be bursting with bees while others have such small clusters one wonders how (or if) they will survive. A good beekeeper must be attentive, be prepared, and respond quickly to either circumstance and everything in between. It is good to know what to expect and what to do, so anticipate what you might find when you make your early spring inspections. As Jerry Fischer wisely advises, always have a goal/plan when you go to the bee yard. I heartily concur. If you haven't thought about what you might find and what you will do, you may just lose an important advantage (if not a colony!). A beekeeper supplements what the bees do naturally, so if your bees need nectar and pollen to raise that all-important new brood, be prepared to supply it and right away (don't YOU be cruel!).

I'd like to share with you some information I found interesting in the talk by Dr. Gordon Wardell at the MSBA Winter Meeting. He began by stating that although we don't know exactly what Colony Collapse Disorder is, we do know there is not a single cause for the collapse of colonies. The problem seems to be related to adult bee longevity. If you think of a colony of honey bees as a series of overlapping generations, the problem created by shortened life expectancy is there are not enough bees to carry on the normal activities of the colony to the point where the colony collapses. So to understand CCD, one must try to determine what is shortening adult bee lives. Again, there is not a single cause in the case of CCD; he named five factors which need to be investigated individually and in combinations. The first is pesticides, and he emphasized this means both outside and inside the hive (what do we use to control mites?).

The second is parasites and their effects on the colony. The third is pathogens (viruses, bacteria,

nosema). Fourth is stress (he named both environmental and migratory stress). And finally, nutrition.

Now nutrition and its affect on bees was the main focus of his talk; he is after all the originator of the new pollen substitute Megabee. But aside from the properties and value of his particular product, honey bee nutrition is a topic which deserves our attention in these days of CCD, etc. He mentioned of course the paradigm shift in industrial agriculture to monocultures, more Round-Up ready crops (and the resultant wasteland between the rows of corn, soybeans, etc.) and I'd throw in the feedlot mentality of the large migratory beekeepers who place thousands of colonies in areas without a single blossom or alternately only one source of nectar/pollen (back to monocultures). But what about nutrition for us hobby and sideline beekeepers? What do we need to know? Is honey bee nutrition a concern for us? Apparently so.

We are all familiar with the concept of feeding our bees sugar syrup or some other nectar substitute. So much for the carbohydrates. But what about pollen (the protein)?

Studies have shown that colonies fed with pollen or a pollen substitute, stimulated with a light sugar syrup, produce more brood, earlier, and ultimately make more honey - 38% more! I started feeding a pollen substitute to all my colonies last year in February and I had one of my better years for colonies making it through the winter, building up quickly and strongly (I made several early spring splits simply to avoid swarming), and getting a honey crop. Granted, one year's evidence is little proof of anything, but it did encourage me to feed pollen substitute again this year and I'm thinking of feeding pollen substitute again in the fall to stimulate brood-rearing so I have stronger colonies going into the winter.

You wouldn't know it, but I hesitate to tell you exactly what I do as a beekeeper. I've kept bees long enough to know there is no single "right" way to keep bees and that in fact everything we do with our bees is just our best educated guess. The bees will pretty much do what they do regardless of our interference (no matter how well-intentioned). But I do strive to understand these creatures and do my part to supplement what they do naturally and I'm always thinking about ways I might do it better (for them, not

just me). So, pun intended, there's some food for thought for you. Gnaw on that a while.

On to CMBA business. First, I'd like to welcome our new members, the participants in the 2008 CMBA-sponsored Short Course in Beginning/Intermediate Beekeeping. As part of your course registration, your membership dues in CMBA for 2008 are paid. We welcome you and hope you take full advantage of all the benefits membership brings with it. If you are a past member and have not paid your dues for 2008 (all five bucks!), now is the time to see or send Bob Crouse your money. Check your newsletter address label for the year you are paid up through. Our complete membership directory will be published along with next month's newsletter. Thanks to Mike Spencer and Jon Bealer and Lloyd Snyder for getting this together. We hope the membership directory will help you contact other members to share your questions and information. The board of directors continues its work on revising CMBA's By-Laws and we plan to publish them soon for membership review, discussion and finally your approval.

As you will see in the April newsletter, our audited Treasurer's Report for 2007 shows a balance in excess of \$35,000. In March and April, here in the newsletter and at our meetings, I will be soliciting your ideas and suggestions on ways we might best utilize our wealth to advance the aims of our organization. Please use the suggestion box on the stump at meetings or email/call me if you have ideas, but please make them as specific as you can. For example, it would be a good idea to use some money to encourage beekeeping with young people (we'd all agree with that), but to make a decision the board needs a specific proposal (like funding a local 4-H program on beekeeping). So be as specific as possible (we may ask you for more information). But most important, let's not waste this opportunity to make an impact as an organization on the future of beekeeping and honey bees. If you'd like to participate in the decision-making process, the Philanthropy Committee (for lack of a better name) will meet on Thursday, April 3rd at ORNC at 7:00pm to assemble the list of ideas and suggestions for presentation to the Board of Directors in May. I will, of course, present the list to you, our members, here in the newsletter for your response as well.

Finally, don't miss the March meeting on the 4th. Our nationally-recognized speaker will be Dr. Wyatt Mangum, regular contributor to *The American Bee Journal* and expert in many areas of beekeeping. His topic will be wax moths, understanding them, controlling them and living with them. I'm sure it will be good.

Hope to see you all there! Mark your calendars for June 3rd. Our June meeting's speaker will be Ross Conrad, the author of *Natural Beekeeping, Organic Methods for Keeping Bees*. This speaker was suggested by a member after we purchased his book for our library. Do you have a suggestion for a speaker or a topic.

We'd like to respond; let us know. Use the suggestion box or speak with one of the officers.

Good beekeeping to you! Welcome Spring on the 20th!

Better Stock For Beekeepers

Malcolm Sanford

Bee Culture January 2008

"The beekeeping world is beginning to tread the path that plant and livestock breeders have pioneered over the last four decades."

It looks like the time has come to look much more closely at stock improvement. Finally, the beekeeping world is beginning to tread the path that plant and livestock breeders have pioneered over the last four or so decades. It has not come easy and only appears to be happening because beekeeping is inexorably driven toward this response due to the ravages of exotic organisms and subsequent use of chemicals inside the beehive. In the final analysis, it appears that the honey bee in fact has become more "domesticated."!

Many are now coming to the realization that genetic improvement is considered the best long-term solution to the many problems beekeepers face today, whether it be managing mite populations, controlling viruses or attempting to solve the CCD dilemma. The idea is not new; for generations beekeepers have known and practiced that most universal solution for when their colonies failed, replacing the queen. This has always been both an advantage and curse, because so much genetic potential is involved in one individual. The bees know this as well, the reason so much diversity has been programmed into the natural mating process.

A pioneer in bee breeding whose work will be more appreciated in the future was Dr. Walter Rothenbuhler, a prominent honey bee geneticist from The Ohio State University. I wrote a homily to Walter in the March 2003 *Bee Culture*? One of his most thoughtful and valuable contributions on his favorite subject was published in a two-article series in 1980.³

He began his series with "Ever since beekeepers have known that queens and drones mate in flight, they have felt somewhat powerless to engage in bee breeding. It is true that certain queen producers have grafted from carefully selected queen mothers, but

very little control could be exercised over the drones with which the virgin queens mated." Even though there have been some improvements Walter concluded, "no great change in the bees of North America was brought about by such limited selective breeding."

Walter then listed the following research that was needed and had been done in order to have better genetic control:

1. Reliable instrumental insemination, pioneered by Watson, Nolan, Laidlaw, Mackensen and Roberts.
2. Recognition that Inbreeding via selection leads to brood inviability over time, such the colonies become unable to maintain themselves. Inbreeding is thus both useful and harmful; the bee breeder must distinguish these.
3. Intentional selection leading to:
 - a. Resistance to American foulbrood (what Walter is most known for)
 - b. Resistance to chronic bee paralysis
 - c. Resistance to wax moth depredation and European foulbrood
 - d. Development of high pollen collection and nectar hoarding
 - e. Development of "hybrid vigor"

Since Walter's paper, there have been other developments showing the value of selection, including *Varroa* mite resistance (SMR/VSH), careful introduction of resistant Primorski stock (Russian bees), and the incorporation of genes from "survivor colonies." In addition, there is evidence for genetic resistance to tracheal mites in honey bees and dominance of Africanized honey bees in the tropical lowland environment.

In 1992, I wrote about the possibility of developing a stock center based on ideas presented by Tim Lawrence and Susan Cobey." They concluded this would be an expensive endeavor. At that time, I said, "Some might not understand what skills are involved in bee breeding and how these might be reflected in the costs of a stock center.

"Thus, I am reprinting a slightly edited version of a presentation on queen breeding I received via electronic mail. It is not likely to be published elsewhere in the United States, being presented in July, 1992, as part of the meeting of the National Beekeepers Association of New Zealand. According to Nick Wallingford, the source of this paper, it is one of the most understandable treatments on the subject he's heard. Finally, the talk was given by a commercial queen breeder (Mr. D.W.J. Yanke) who is intimately acquainted with the many practical aspects

of queen production. "5

The difficulty in improving stocks, according to Mr. Yanke, is based on the following barriers:

CONTROLLING MATING BEHAVIOR: It has been shown that virgins very rarely mate with related drones, which reduces the chances of inbreeding, one of the perils to avoid in any controlled breeding scheme. Thus, if we allow virgins to mate naturally, we have no control over the drones. Even with isolated mating yards, control is not absolute. What other plant or animal breeder has to make an attempt at genetic improvement with only control over 1/2 of the genetic equation? To compound this there are multiple matings. Each virgin mates with seven or more drones, and thus the colony is made up of seven or more sub-families.

RETAINING SEX ALLELES: In most sexually reproducing organisms, sex determination is governed by a sex chromosome. In honey bees, however, sex is determined by a single gene. This gene has many variants or alleles, maybe as many as 18. One should feel lucky, however, to maintain 10 or so in a breeding population. It works like this, if two different alleles come together at fertilization, a female (worker or queen) results. Drones are haploid and have one allele. However, if two of the same allele come together, a diploid male results. We never see diploid drones in the hive because when only a few hours old, they are cannibalized by the workers. Evidence of this is a hole (spot) in a slab of newly capped worker brood.

As the number of sex alleles decreases, the more likely it is that two of the same allele will come together, increasing the number of diploid drones. As the percentage of diploid drones produced increases, so does the spottiness of the brood. There is an obvious impact on a colony's productivity, therefore, when some well-intentioned bee breeder reduces the number of sex alleles in a queen. Even if such queens are of high physiological quality and genetic potential, they are handicapped because a percentage of their eggs are not viable.

"The biggest question facing the industry then is not whether superior stock can be produced, but whether or not beekeepers will continue down the same road they have in the past resulting in cheap queens that produce unproductive and disease-susceptible colonies."

REDUCING INBREEDING DEPRESSION: Hybrid vigor results when two unrelated members of a species are crossed. The vitality of the progeny usually exceeds that of either parent. This is also known as heterosis, a mostly unexplained increase in

life force. The crossing of unrelated parents results in many more genes carrying two different alleles. When a pair of genes consists of different alleles the resulting organism is said to be heterozygous. A generalized increase in heterozygosity is responsible for triggering heterosis. The opposite state is when genes carry two of the same allele. These organisms are said to be homozygous.

A reduction in heterosis occurs with inbreeding. An "inbreeding depression" is triggered as the percentage of homozygous genes increases. This results in an unexpected loss of vigor - sluggish colony build-up, loss of disease resistance, decreased production, and higher Winter loss.

Inbreeding depression can result from selections over generations for the best genetic combinations. The breeder's downfall is increasing the percentage of homozygous genes in too small a population. This is not always apparent to a producer who is selecting breeders from perhaps hundreds of colonies. Unfortunately, it is not the size of the test population, but the number of breeding queens used, which determines how quickly inbreeding depression develops.

MAXIMIZING QUANTITATIVE TRAITS: The characteristics we are trying to improve in honey bees are quantitative traits. These may involve many genes, each contributing only a small effect. Compounding this is the fact that these traits are not those of a single breeding individual (the queen) but, instead characterized in a colony composed of many sub-families.

It is fortunate that many important economic traits such as honey production and winter hardiness in bee populations, even though they are hugely complex, and controlled by a large number of genes, do show good response to selection. However, once these selections cease, any increase in traits which has been achieved is lost very quickly as gene frequencies return to pre-selection balances. Thus, maximizing quantitative traits is a continuous process which must be done with great care.

MINIMIZING ENVIRONMENTAL VARIATION: Evaluations must reliably identify the genetically superior individuals in the test population in order to increase quantitative traits. However, because colony performance is evaluated in the field, it is difficult to control environmental influence. Possibilities to reduce environmental effects consist of equalizing colonies before evaluations begin, minimizing drift; and eliminating evaluations between apiaries. Finally, because a queen's physiological quality itself can have a major effect on some aspects of colony performance, queens undergoing evaluation must be uniform in age and condition.

MINIMIZING THE INFLUENCE OF RACIAL HYBRIDS: Even if we implement all the suggestions above, and put into evaluations the care and effort required, it is all for naught if the genetic superiority we identified with our evaluations is not heritable. Unfortunately, the increased vigor provided by heterosis cannot be inherited.

We have two races of honey bees in New Zealand, the Dark European honey bee and the Italian. Even though most of the bee breeding effort goes into maintaining commercial bee stocks as Italian, the reality is that most of the colonies are to varying degrees racial hybrids. Racial hybrids can be great, and through hybrid vigor, are often productive. However, they are of no breeding value, and provide only false leads to someone carrying out colony evaluations.

To get anywhere, we have to breed true to race - whatever that race is. The Dark European honey bee drones appear to be very aggressive in the drone congregation areas because they appear to have a mating advantage of almost Africanized-bee-like proportions. So the only way to keep a test population true to race is to have absolute control over the mating using Instrumental Insemination.

KEEPING AN OPEN MIND: It may be a lot cheaper to import a silk purse, than to try and make one out of a sow's ear. Taking advantage of different races and breeding work done overseas by importing genetic material could save time and money and be a dramatic shortcut to better bees. Times have changed, importations of genetic material can be done safely, whether they be semen or breeder queens.

Returning to Walter's paper, he stated that much of the work he referenced produced only information. It was not designed to supply better bees to beekeepers, but to learn how to get better bees. To supply better bees to beekeepers is a greater task he concluded. It will take three links in a chain, 1) field tests, 2) genetic decisions, and 3) commercial production. What has been mostly missing is the second link.

The geneticist, according to Walter, must provide input for the nature or the field tests, how data will be taken and number of colonies tested. *In* addition he/she must help decide which colonies are to produce queens and drones for the next generation and when instrumental insemination or natural mating should be used. Finally, the geneticist must help decide how to maintain improved stock over a period of years and how to release it to beekeepers.

The complexity of any breeding project is now apparent, Walter concluded: "Someone must manage

the whole affair and see that the three components interact cooperatively and creatively on a continuing basis. Almost as an after thought he said; "It may be apparent also that a considerable amount of financing is required.

This goes back to the idea by Tim Lawrence and Susan Cobey referenced above that bee breeding is a costly enterprise. The biggest question facing the industry then is not whether superior stock can be produced, but whether or not beekeepers will continue down the same road they have in the past resulting in cheap queens that produce unproductive and disease-susceptible colonies. It seems abundantly clear that "you get what you pay for," and beekeepers will have to say goodbye to inexpensive queen bees in the future if they wish to be successful in managing healthy, productive colonies of honey bees.

References:

- 1.Sanford, M.T. 1996, *Apis Newsletter*, Vol. Volume 14, Number 4, April 1996 <<http://apis.ifas.ufl.edu/apis96/apapr96.htm#1>>, accessed November 18, 2007.
- 2.Sanford, M.T. 2003, *The Lasting Influence of Two Men: A Retrospective on the Career of Dr. W. C. Rothenbuhler*," *Bee Culture*, (March) Vol. 131 (3): 19-22.)
- 3.Rothenbuhler, W.C. 1980, *Necessary Links in the Chain of Honey Bee Stock Improvement*, *American Bee Journal*, Vol. 120, pp. 223-5, 304-305.
- 4.Lawrence, T. and S. Cobey. 1992 *Bee Science*, Vol. 2, No.2, June, 1992.
- 5.Sanford, M.T. *Apis Newsletter* Volume 10, Number 9, September 1992 <<http://apis.ifas.un.edu/apis92/apsep92.htm#2>>, accessed November 18,2007.

March Speaker

Dr. Wyatt Mangum, a brilliant entomologist and mathematician, will tell us all about Wax Moths. He has raised them and studied their biology and even written about them in the *American Bee Journal*. An interesting guy and an entertaining speaker, Wyatt will make this a memorable evening. You'll know him by his trademark blue jumpsuit and straw hat. Just don't call him "Magnum."

SEMINAR/DEMONSTRATION For Beginning Beekeepers

Saturday, March 22, 2008 - 12:00 - 3:00pm
Stewartstown, PA

This free seminar is an optional adjunct to the CMBA-sponsored Short Course in Beginning/Intermediate Beekeeping and is open to short course participants and any interested beekeepers. It will be taught by David Papke and other CMBA members. The focus of the seminar is hands-on, practical demonstrations of the concepts/skills taught in the short course; specifically, assembling and using different types of equipment, harvesting and processing honey, and manipulating live honeybee colonies (weather permitting).

DIRECTIONS (from ORNC):

1. Travel North on I-83 to Exit 4 (the first exit in PA). At the bottom of the exit ramp, Turn Left onto Forrest Ave.
2. Go to the second traffic light, Turn Right onto Mt. Airy Road.
3. Go about a mile, Turn Right at dead-end stop sign onto Plank Road.
4. Go about a mile, Turn Left onto Mt. Olivet Road (follow sign towards Winterstown).
5. Go about a mile and a half, Turn Right onto Shangri-La (cornfields all around).
6. Go about a mile, Turn Left onto Blymire Hollow Road (between house and barn).
7. Go about a half mile, Turn Right into driveway (recycled farmhouse, barn in back);
12703 Blymire Hollow Road
(717) 246-2339

Note: The entire trip from ORNC should take less than a half hour. Enjoy the drive!

Snow Cancellation Policy

In case of snow or ice on the meeting date, listen to WBAL radio before 7:00 PM. If Baltimore County's snow emergency plan is in effect at 6:00 PM, then the meeting is automatically canceled.

IMPORTANT PHONE NUMBERS

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DATES TO REMEMBER

General Meeting – March 4, 2008 – at Oregon Ridge Nature Center. 7:30PM Subject: A talk on Wax Moths by Dr. Wyatt Magnum.

Board Meeting – March 17, 2008 – 7 PM at Oregon Ridge Nature Center.

Beekeeping Short Course - Starts February 28, 2008 - 7 PM at Oregon Ridge Nature Center. For more information and the complete schedule and a application check our website WWW.CMBEEA.ORG.

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