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The Elgon Bee and Varroa Mites

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The Elgon bee is a combination bee bred according to Buckfast principles, with a marked influence of the East African Mountain bee Apis m. monticola. *There have been reports of the work with this bee in* American Bee Journal *since the start of these breeding efforts in 1989.(1)*

Bornholm in the Baltic

In the May 1998 issue, I began to tell the readers of this magazine what was being done with the Elgon bee on the island Bornholm in the Baltic. Two apiaries of Poul Erik Karlsen were treated for the last time in autumn 1994. Almost all of the rest of his colonies were treated for the last time in autumn 1995. In 1998 he successfully wintered 200 colonies. In the May issue of 1999 I mentioned that Karlsen had treated 90 of the wintered 200 colonies with 200 - 250 ml of 85% formic acid evaporated from soft boards. One reason for this was to get a picture of the number of Varroa mites in the colonies. One hundred and ten colonies were not treated at all, as usual for several years. The average total number of mites in the colonies in autumn 1998 could be calculated to average around 1500 mites.

Of the 90 colonies, 87 died during the winter 1998/1999 and spring 1999. Of the 110, one died due to mice. Explanation? The acid affects not only the mites, but also the bees to some extent--probably more if the bees already are affected through a number of mites in the colony that is over a certain level. That's why in a strategy where formic acid is used, it is very important to keep the number of mites very low throughout the whole season, so that the bees that will form the winter cluster will be as little negatively affected as possible.

Today Karlsen is wintering about 100 colonies, as he is getting older and has some back problems. Every year, however, he always makes a good number of nucs that will form mating nucs, new colonies for himself, to be sold, or to be combined with colonies that have failing queens.

In the beginning of the 2000 season he saw a few colonies that didn't develop well enough, maybe due to mites. As soon as he had new queens, they got a new one. This is the way he has solved this kind of problem for a number of years now. You can

say the treatment he uses is selection and breeding.

Colony A superseded its queen and the new fresh queen handled the mites.

Photo: E Osterlund

Karlsen is helping a growing number of beekeepers with new colonies. One friend has purchased a new colony twice from him, but both have died from what he thinks are varroa mites. Is this just bad luck getting the poor variants that always show up in all breeding? Maybe the apiary site is part of the explanation. It is situated in the shadows of a big tree at the bottom of a hill. Karlsen said this place always felt a little cooler than the surroundings. Maybe it is such a place as was described in a lecture in Tucson 10-12 April 2000.(2) Where you place your bees seems to affect the mite growth.

The number of honey bee colonies is still very low on the island. The average honey crop the season of 2000 was said to be between 0 and 25 kg. Poul Erik Karlsen had an average this same season of 48 kg.

In October I visited Karlsen and asked him to show me the worst colonies he could find and the best concerning being affected by varroa mites. He showed me several strong colonies on two stories, in a number of apiaries, and also a number of new good looking colonies made up the same year. In two apiaries he had one colony in each he had had under

observation to see what happened. Both were in June/July dwindling on one box with too many "wingless" bees. Karlsen sometimes doesn't give such a colony a new queen right away, to keep it with mites for a while, as he sometimes wants a colony with many mites for test purposes. If he doesn't "save" a few such colonies, he happens to find, he will have problems finding colonies with too many mites, when he "needs" them. For example, if he really wants to test a new eventual breeder queen, he can put it in a hive with a lot of mites, to see if the queen can handle the situation. That's what he has done more than once. In 1999 he put two sister queens in two such colonies he had that year. One of the sisters did well and that one Karlsen used as a breeder last season. The other one failed.

The new queen in Colony A with some healthy brood and bees in October.

Photo: E Osterlund

One of these two colonies (A) failing in 2000 had an old queen. That colony had been a good colony for a number of years with this same queen. The other failing colony (B) Karlsen had obtained from a friend who originally had purchased it from Karlsen. His friend treated with formic acid, but perhaps didn't treat his colonies well enough to keep the mite level low the entire season last year. Karlsen didn't know the status of these colonies when I visited, but they had to have had strength enough for him to decide to feed them extra sugar for winter prior to my arrival. Anyhow, it was interesting also for him to check them now. Colony A was a strong colony now with no sign of any "wingless" bees. What had happened? It was late in the season, but there was some brood left, but no obvious sign of varroa. We found the queen; it was a new one. The bees had superseded the old one themselves. A new queen with rich amounts of pheromones and maybe mated to drones with good

genes--was that the explanation? Also, probably a period without brood when supersedure was occurring helped reduce varroa numbers. Colony B looked the same, but there we found a few "wingless" bees. However, we had difficulties finding any varroa in the few patches of brood. They had also superseded their old queen. Had the formic acid applied last autumn also affected the pheromone production of their queen?

We checked a two-story hive that Karlsen thought housed a good colony, as it superseded its 3-year-old queen last year. He had bred from that colony, No. 482, as discussed in the May 1999 *ABJ* article. It had shown mites in spring each year, but had handled the situation well. Her daughter was obviously a poor variant, as the colony now surprised Karlsen because it was just a small remnant with many wingless bees and visibly many mites. "I will kill it tomorrow," Karlsen said. I was not surprised. There has to be some on the negative side among all variations of descendants, especially from a colony that had shown visibly many mites during a period of the season. I told Karlsen to watch out for the other daughters of No. 482.

For Poul Erik Karlsen, the Varroa mite today is just another "disease" that "helps" him to avoid the worst colonies and select the best ones from which to breed--no big problem at all actually. Karisen and I have been discussing the size of the bee and the cell it's born in. For those interested, it can be noted that the Elgon bee in general is smaller than, for example, the Buckfast. The cell size Karlsen uses currently is 5.3 mm. He molds his own foundation.

Beekeeper A in Skane

In the very south of Sweden, in the county of Skane, two beekeepers wanted to test their Elgon queens thoroughly. They therefore made up an apiary each, quite isolated from other bees. Beekeeper A made 10 nucs in 1997 from big colonies treated the last time in autumn 1996 with Apistan strips during 6 weeks. In 5 nucs he put Elgon queens; in the other 5, he put Buckfast queens. By the autumn of 1997 he had already started seeing a few wingless bees in the 5 new Buckfast colonies.

In 1998 nothing special happened with the colonies. They gave a normal crop and wintered normally. In 1999 the colonies appeared to be normal, too, with a normal crop and wintering--no wingless bees. In 1999 naturally fallen mites were collected during 14 days in the first part of June. In the Elgon colonies there was a daily downfall of 14-28 mites, average 22. For the Buckfast 39-67, average 49. Honey crop--Elgon 41-51 kg, average 45 kg.; Buckfast 43-53 kg, average 49 kg. The fifth Buckfast colony had problems with its queen, remained small throughout season and gave no honey. It died during winter. Two other Buckfast colonies and one Elgon colony also died during winter/spring 1999-2000. Half of the frames were full of food, but no bees were left in the colonies. (See Figure 1.)

Beekeeper A **Figure 1**

Co-lony	Daily mites June -99	Crop -99 kg	Daily mites Maj/June-00
E1	37	41	†
E2	28	44	34
E3	28	40	33
E4	18	51	27
E5	14	48	25
B1	43	49	49
B2	39	53	44
B3	49	52	†
B4	67	43	†
(B5*	12	—	†)

*Problems with queen and weak colony with little brood

In summer: Take daily figure times 120 and you get an estimated number of the total amount of mites in colony.

† = dead during winter/spring 2000.

In spring 2000 the remaining colonies developed well, but not as good as the other apiaries of Beekeeper A, as the spring flow in this apiary was not very good. During 16 days in May-June 2000 natural downfall of mites was collected. For Elgon the daily downfall was 25-34, average 30. For Buckfast 44-49, average 47. In June, Beekeeper A discovered some wingless bees in all the colonies in this apiary. He now stopped his test. The foundation A uses has a cell size of 5.4 mm.

Beekeeper B in Skane

The other beekeeper in the very south of Sweden, beekeeper B, also started a 10-colony test apiary in 1997 with Elgons and Buckfasts in a similar way as beekeeper A. The test site of B had a better spring flow and a good main flow. It was placed high up on a slope, but still protected from most wind. B did not collect downfall of mites in 1999. The honey crop that year was an average 60 kg for Elgons and 45 kg for Buckfasts. All colonies looked strong and normal when wintered in 1999. All "pure" Buckfast colonies were gone in spring 2000, some of them leaving full frames of food and no bees. During 18 days in May-June natural downfall was collected. It was 5-21 in daily downfall, with an average of 14. Colonies with the largest number of mites were observed to have the biggest bees. The colony with the smallest number was observed to have relatively small bees. A number of queens are made from this

colony. They are all smaller than average in size. Their progeny is small in size, in spite of the fact that they were reared in 5.5 mm cell size.

Part of the test apiary of Beekeeper B.

Photo: E Osterlund

Another mite downfall was collected immediately after the first 18 days. Now the daily downfall was measured to be 6-25 (multiplication with 120 gives the total mite population to be about 700 - 3000 in these colonies at that time), with an average of 16. (See Figure 2.)

Beekeeper B **Figure 2**

Colony	Average crop 1999	Daily mites May/June-00	Daily mites June-00	Average crop 2000
E1	Ca 60 kg	15	17	Ca 63 kg
E2		18	21	
E3		13	15	
E4		5	6	
E5		11	14	
B1	Ca 45 kg	†		
B2		†		
B3		†		
B4		†		
F5*		21	25	

*Egyptian (Lamarckii) 5 times crossed with Buckfast

† = dead during winter/spring 2000.

In summer: Take daily figure times 120 and you get an estimated number of the total amount of mites in colony.

In October 2000 I visited beekeeper B and he took me to his test apiary, so I could check the colonies there. I observed the colony with the largest number of mites, to have two groups of bees concerning size - one with big-sized bees and one with small-sized. I draw the conclusion that this could be due to the fact that the colony had superseded their queen in 2000 and that the new queen could be mated, at least partially, to small drones. All the colonies in the apiary were strong and looked very healthy. All the surviving colonies had superseded their queens themselves, some in 1999 and the rest in 2000. Is the size of the bees part of the explanation for the relatively long survival of these colonies? Is 1000-3000 mites a 'normal' number of mites in "mite-tolerant" bee colonies?

E4, the colony with Beekeeper B which had so few mites and was strong and healthy.

Photo: E Osterlund

Beekeeper C in Smaland

A little north of beekeeper A and B another beekeeper, called C, received four Elgon queens from me in 1999. He put them in nucs made from bees and brood frames from some of his ordinary colonies. They expanded enough to be able to be wintered. He didn't use any treatment against the varroa mite in these new colonies in the autumn of 1999. His other colonies were treated with Apistan in autumn 1999. In spring 2000 he used drone comb to trap mites in all of his colonies. He thoroughly looked for mites in the removed drone comb. In the drone comb taken from the colonies treated with Apistan in autumn 1999 he found some odd mites. In the drone comb from the new colonies, started as nucs in 1999, he couldn't find one single mite, though he looked carefully. Of course, they had mites, but these results tell us that if it wasn't the Elgon queens causing the low mite count, then making nucs is a very effective method in getting new colonies for next year with a very low level of mites. Even if you use brood combs when you make the nucs. Probably the correct answer involves effects from both the Elgon queens and from making nucs.

Israel

The first positive tests came with some pure Elgon colonies and the first cross (F1) Elgon colonies and this was reported in the May 1999 issue of *ABJ.* In autumn 1998 new tests were started with F1 Elgon colonies, Buckfasts and two different Italian strains. Colonies were established in three apiaries. No chemical treatment or any other kind of treatment was performed. After one year the tests stopped in two apiaries due to high numbers of mites combined with uncertainty of how to compensate the beekeepers if many colonies should die. In one

apiary with originally 33 colonies the test continued. This apiary originally had 11 F1 Elgons type A (Group A), 11 F1 Elgons type B (Group B) and 11 Italian colonies type Zrifin (Group C).

July 2000 **Figure 3**

Group	Crop kg average	Remaining no of colonies	No of colonies with original queens
A	29	6	2
B	28	8	5
C	30	9	5
D	37	15	

Group A has F1-crosses Elgon x Italian. Group B has another type of F1-cross Elgon x Italian. Group C have Italian colonies bred in Israel (strain Zrifin). Groups A-C were *not* treated autumn 1998, which would have been normal, and not anything after that. Group D is a control group which is treated twice a year in the same apiary. Groups A-C had originally 11 colonies each. Mite amount had been high in these groups a long time. Autumn 1999 queens were shifted in all colonies, to their own type in each group. Autumn 2000 queens were shifted again in the same way. Shifting queens every year is normal in Israel. *(Figures from Chaim Efrat.)*

Normally beekeepers requeen every year in Israel due to the harsh environment and year-round brood rearing. So, in autumn 1999 all colonies were requeened in the test apiary. F1 Elgon colonies received new Elgon queens mated to Italian drones. Italian colonies received new Italian queens. The mite level was high. Chaim Efrat, who gave me this information, said that shortly after the introduction of the new queens, the colonies looked healthier. He suspects that the procedure of requeening itself is positive for the colony's ability to fight the mite.

During winter some colonies disappeared. A control group of 15 Italian colonies that were treated with chemicals twice a year was kept in the test apiary; called Group D. In July 2000 some of the colonies had superseded their queens. In autumn 2000, the colonies were requeened again in the test apiary, this time with some Elgon queens mated with Elgon drones.

They hope to be able to secure a number of colonies, Elgons and Italians, that can be used as breeders to develop a more varroa-tolerant bee adapted for their type of climate. The cell size in Israel is 5.6-5.7 mm.

Comments

With all these experiences during these years, from Bornholm and from the south of Sweden, it would be wrong not to say that Elgon bees are more tolerant to the Varroa mite than

ordinary bees. All Elgons are not alike in Varroa tolerance, like all other bees. It is also quite obvious that you can make it easier or more difficult for the bees, whatever type of bee you have, by how you manage your bees. Also, the climate has an influence. There were many research reports on this issue presented at *The Second International Conference on Africanized Honey Bees and Bee Mites* in Tucson 10-12 April 2000.(3)

If you want to take advantage of the bees' own fighting ability against the mite to the highest degree, you can't use any chemical in order to be sure not to have any interference with the natural varroa tolerance of the bees. Chemicals don't only have an effect on the target pest. A whole, small scale or large scale, ecological system with possibly many different kinds of "bugs" and microbes are affected in a way that, in practice, is impossible to know beforehand. Sometimes it may even result, a short time after the treatment, in an even better environment for the "bug" you wanted to get rid of.(4)

A strategy taking care of the natural tolerance of the bees has to be developed. Eric H. Erickson has done this.(5) There's room for more such research. Erickson has also been involved in research concerning the possibility that smaller cell sizes of the wax comb can help the bees against the mite.(6) As far as I know, there are only two studies published in this field.(7) The first with positive input and the second with negative. For a "full scale field study" you could call on the experiences of Ed and Dee Lusby in Tucson, Arizona, which give positive input on small cell size.(8) There is certainly room for more research in this area.

Today I dare to say it is possible to achieve bees that are tolerant to the Varroa mite, not only in one odd place, but in most places. I have understood there are more bees than just Elgon bees that have higher tolerance to the Varroa mite. The Russian bees imported into the USA are another strain, a strain that in Germany also now has been confirmed to be more Varroa tolerant.(9) Still another example is the bees developed by Erickson in Arizona.(10) However, to really preserve tolerance I have no doubt about it that strategies without any chemical have to be developed.

A Varroa-tolerant bee is achieved, not only through breeding, but also through management methods adapted to the environment where you live. It would be most valuable in todays situation to see more research funds used for integrated management and breeding systems for different environments.

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