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Mites on safari

By Christopher Davey

Here at last

The implications of a recent study are potentially catastrophic. In a region where 'hands-off' husbandry is the norm and most beekeepers are unlikely to afford chemical treatments, finding *Varroa destructor* was a shock. "We knew it was coming" said Tom Carroll, a beekeeping expert formerly with Baraka College in Kenya's Rift Valley. "*Varroa* was moving up from South Africa and by 2007 it had reached Zambia, but nobody knew it was here yet." Is this a further blow to impoverished rural households, a threat to commercial agriculture and a danger to the ecology of some of the most fantastic landscapes in the world? No! It may even be a bit of a blessing.

The studyⁱ, published as a Scientific Note by a team of ICIPEⁱⁱ, Beltsvilleⁱⁱⁱ and Penn State^{iv} scientists, was one of the first studies on *Varroa* in the region. The Note describes how (for the first time, in 2009) *Varroa* was found in colonies in Kenya, Uganda and Tanzania. Beekeepers in the two back-to-back surveys were not aware of the mite's presence, and had not seen any negative impact on bee survival or productivity. (The Note is summarised in the Box: [*Varroa destructor* Found in East Africa](#).)

Varroa destructor Found in East Africa

The Scientific Note describes the research team's work in East Africa. Their first survey was in Central and Eastern Kenya where the bees studied were probably *Apis mellifera scutellata* and their hybrids. They found mites in all 38 sampled colonies.

The second survey was wider ranging and tested 125 colonies. It covered eastern, western and coastal regions of Kenya, coastal Tanzania including Zanzibar (probably *Apis mellifera litorea*) and Western Uganda. These found *Varroa* in 87% of colonies. Only the 14 colonies in western Uganda, and two of the Zanzibar colonies, tested negative.

The mite is identical to the South Korean haplotype of *Varroa destructor*. This is the haplotype found in South Africa.

The Note says the presence of the mite is highly significant given that honeybees (of several different native African races) are probably responsible for pollinating 40-70% of indigenous plants (and crops). *Varroa* could be devastating if colonies succumb. It would impact on both agricultural production and non-agricultural ecosystems.

But the researchers point to South African experience. Twelve-years after *Varroa*'s introduction, feral and managed populations of both *Apis mellifera scutellata* and *Apis mellifera capensis* seem to show tolerance. They point to work by Mike Allsops who suggests the pest is now "incidental" and that tolerance is probably linked to increased hygienic behaviour and the absence of chemical controls.

African bees seem to deal with mites more effectively than European bees. Hygienic behaviour, especially the ability to detect and remove brood infested with *Varroa*, is important; but this is linked to other behaviours like grooming, increased swarming and absconding.

The authors suggest the high genetic variable of honeybee races in Africa may maintain contain evolutionary answers to limiting the impacts of *Varroa*. Understanding these mechanisms will be important for preserving agriculture in developed countries and maintaining the biological diversity of tropical ecosystems.

Surprise!

Tom said "I've been looking out for it for years." Cornelius Kasisi, an extension worker at Baraka College told me "Yes, I knew about *Varroa* but I haven't gone into detail because it

was not a threat in Kenya. I don't know how long it's been here. It seems new to most beekeepers."

I spoke to local beekeepers. Jacob Muchiri in Njoro didn't know what *Varroa* was, and has seen no changes in his bees. Richard Tanui and David Ketton (from Kericho) and John Njenga and Nicodemus Mwangi (from Nakuru) also said they didn't know about *Varroa*. None of them have seen their colonies affected or dying because of pests or anything strange.

They haven't heard of *Varroa* but its presence may account for some local observations. Humphrey Langat in Londiani has noticed problems. "There's something that stays in the beehive and production goes very low. I started seeing it in the last two years. Colonies become weak and they abscond." He said "It lives in the honeycomb and affects small colonies more than big ones." And Samuel Terer in Kipkellion has also seen problems in his 45 hives. "We didn't harvest last year, and the bees were few. I thought it was the drought."

Peter Paterson is a Nairobi-based beekeeper and an authority on African beekeeping. He told me "for most of my working life bee pests and diseases were not considered an issue in this part of Africa. Whether they simply did not present themselves, or whether nobody looked or spotted them, who knows? We practice a very left-alone beekeeping in Kenya. Our bees are not conducive to management." He added "I have never seen *Varroa* here".

The safari

It's difficult to say how long *Varroa* has been in East Africa. Its spread would suggest it's been there a while, and it probably came north as Tom anticipated.

Mike Allsops is a Senior Researcher at the Plant Protection Research Institute of the Agricultural Research Council, in Stellenbosch, South Africa. "These days I am the only 'agricultural' bee researcher in Southern Africa" he said. Mike found the mite in local honeybee populations around Cape Town in 1997. I asked him how long it had been there. "Not long" he told me "two years at the most. When we first found it, it was confined to the Cape peninsula in an area about 40km by 40km." Most likely it was a ship-borne swarm, or was in a container. "Lots of bees move around the world this way" he said. "In 1997 the highest density of *Varroa* in the Cape was right near the dock area."

This was probably where *Varroa* first entered sub-Saharan Africa. "By 2001 it had spread pretty much throughout South Africa, and crossed into neighbouring countries" Mike told me; but nobody has monitored its movement. (It's been in North Africa for more than 30 years, courtesy of beekeeping development programmes; and the Scientific Note mentions *Varroa* is also present in parts of West Africa. The mite has also been found in Sudan.)

What might happen?

What is the potential impact in East Africa? Tom said "It depends how long it's been here". If *Varroa* has been around for a while with little observed decline in populations, production and behaviour, then East African honeybees might be tolerant. "It's possible that our bees can live with it."

Peter Paterson told me "there is still a strong wild population. Around Nairobi there seem to be fewer swarms" but he pointed out that this can be attributed to many things, not least urban development, the destruction of woodlands, and the spread of cultivation.

There are wider concerns. "Let's suppose *Varroa* is new to East Africa and will cause havoc. It won't just affect agriculture and the ecology. The other really big issues are livelihoods and poverty" Tom explained.

In the main, beekeeping is the preserve of poor people that "often have little or no land, no employment and few resources" he says. "How will they be affected?" If colonies die, as

swarms diminish and as feral colonies disappear “a lot more people will go hungry”. It’s not just how *Varroa* will affect the ecology of a region and the pockets of a hobby beekeeper. The mite might also deprive impoverished smallholders, pastoralists and slum dwellers of their last opportunity for making some kind of honest living. “Even if chemicals treatments were available, the vast majority of beekeepers could not afford the cost of using them” Tom said.

What happened in South Africa?

The South Africans took a philosophical approach to the arrival of *Varroa*. Mike Allsops told me how they “prepared for the worst and hoped for the best. Because it was entirely possible that our bee population would collapse, we tested varroacides for efficacy.” A couple of products were registered.

“Most of the commercial beekeepers used varroacides for a short period on at least some of their hives - but they were all encouraged to leave some of the bees untreated to see how they would do” he said. “Pretty quickly it became clear, from research data and beekeeper observations, that the population was not collapsing.” Beekeepers stopped using the varroacides, and they were pulled from the market as sales dropped to zero.

Apart from the commercial products, some South African beekeepers “threw the most wonderful things into colonies to control *Varroa* - Deep Heat, menthol, peppermint essence, thymol, formic acid.” Mike told me “My own favourite (a South African invention I think) was thymol in disposable nappies - pretty effective.” But only a few beekeepers tried such methods, and the bees managed to deal with *Varroa* despite their best efforts.

Some beekeepers removed drone brood, but Mike reckons this is totally impractical as a long term solution. In Europe we know that drone cells have the most substantial infestations of *Varroa*, but South African colonies have more drones than European bees, and for a longer period - ten months of the year. (African bees also have a shorter post-capping period than European bees – two days less.)

“There were substantial impacts on colonies and production, but these were quite variable” Mike told me. “*Varroa* got into every colony, and mite numbers in commercial hives were huge. I estimate about 30% of colonies died due to *Varroa*; a very small percentage of colonies were hardly affected at all; and the rest were negatively affected for two or three years. In that two or three year period colonies were just weak and poor. They had all kinds of other ailments - chalkbrood, worse-than-normal EFB, hive beetle problems and so on. You could almost do beekeeping without veils.” Honey production fell dramatically.

But bee populations recovered quickly. “Mite numbers in colonies decreased rapidly and reached close to zero, and the colonies were back to pretty much normal in three or four years.”

Mike has also looked at bee diseases associated with *Varroa*. “We were unable to find any substantial virus relationship with our *Varroa*. The large amount of chalkbrood was just an indication that colonies were struggling.”

South Africa now

South African races of *Apis mellifera capensis* and *Apis mellifera scutellata* are now, essentially, tolerant of *Varroa*. Some colonies die, but the bee population easily shrugged off the mite. “Our bees hardly notice *Varroa*. There is little evidence of grooming” Mike explains. “The key factor might be hygienic behaviour but not in the classic pin-killed-brood-pattern sense. We are also finding our bees are free of AFB. I think they have the ability to detect disease and parasites. They open the cells and chuck out the larvae before they are infectious. This isn’t the same as removing dead bees. Perhaps they recognise *Varroa*.”

And the feral colonies? “There were little if any losses” he says. “Wild colonies were much less affected than commercial colonies.”

The Kenyan perspective

Now *Varroa* has been found, it is important is to ensure East Africans learn from the most relevant experience. Tom Carroll says “The first message must be don’t panic. Kenyans, Tanzanians and Ugandans will gain nothing by importing chemicals to control *Varroa*.” He says “The South Africans have shown that *Varroa* can become incidental.”

Tom echoes the thoughts of Humphrey Langat (one of the Kenyan beekeepers I spoke to). Humphrey knows there are insecticides to control some pests, but says “I think we should let the bees develop resistance themselves”. Similarly, Cornelius Kasisi has learned a little about how European beekeepers control it. “I don’t know if the Kenyan government will try to control *Varroa* with imported chemicals” he said. “The first step is to establish policies and have a thorough study on *Varroa*. Chemicals have their own negative effects on the environment but at the same time bees have to be managed. The most important thing is to do things which are not harmful.”

Eluid Muli a researcher at ICIPE, the International Center of Insect Physiology and Ecology in Nairobi, said “we plan to go natural and let the bees fight on their own”, but “non-chemical controls will be evaluated”. I asked him if East African governments will import treatments. He felt that was unlikely. When asked if East Africa should prevent the import of chemical treatments he said “I would highly recommend it. In any case how many beekeepers would use them correctly and how many would afford varroacides?”

Patience and tolerance

Perhaps East African bees are already beginning to cope with *Varroa*. Given the observations of beekeepers, experts and researchers, the mite might not be quite the ogre anticipated. In fact, the mite might be a blessing.

It would seem that a diverse, unmanaged African bee population can survive *Varroa* mites. Natural selection can deliver permanent tolerance. “Once we had data that populations weren’t collapsing it was not an issue for us” said Mike Allsops in South Africa.

“We did things differently here” Mike explained. “Beekeepers should leave the bees to survive or die and then look for the characteristics that were important”. Some research elsewhere has selected characteristics (like hygienic behaviour, cell size etc) and bred for those to see what happened. That’s like buying lottery tickets and hoping for the best. Mike said “Rather than put all your money on one characteristic and run that (test), leave them alone to survive - and then find out why they survived.”

In fact there were benefits from *Varroa*’s appearance in South Africa. It showed the value of not interfacing with the natural population. “It’s important not to jeopardise what we actually have” Mike says. “Since the 1990s I’ve thought that our diverse, unselected wild population is our strength. We have not affected this with queen breeding and the selection of highly productive breeding lines or artificial insemination. If you select against swarming or defensive behaviour or for yield, you get all sorts of unintended consequences. We have the best selection process in the world – we get only the best because they select themselves.”

Just a mite?

There is more to this than living with *Varroa*. Africa has vast areas of agriculture-free habitat where bees can migrate, forage and make honey without the risk of contamination by pesticides. If only the certification of ‘organic’ could be handled (logistically), the quality of

Africa's honey would make it a premium product. Chemical-free hives are clearly part of such a scenario.

And the so-called problems of beekeeping in East Africa may also be part of the answer to living with *Varroa*. Genetic variability is huge with half a dozen or more indigenous races overlapping in different ecological areas. The researchers (in their Scientific Note) suggest that swarming and absconding are also likely to account for levels of tolerance. They leave the *Varroa* behind. (Shook swarm, anybody?) Perhaps this is a wake-up call to development workers in Africa to build on the behaviour of African bees and support the evolution of traditional beekeeping husbandry systems, rather than replace them with western ideas and inputs.

So there are potential benefits - provided the right things are done by the right people at the right time. It's great that the ecology of East Africa is unlikely to be decimated; and it's nice that export veggies will be pollinated. Just as important, it's good news for East African smallholders with their field crops and fruit trees; it's good news for pastoralists with their riverine woodland and dry-montane forests; and it's also great for a few of those one million slum dwellers of Kibera who keep a few hives in Nairobi's Ngong Forest. If the right strategies are adopted, all will continue to have bees as an important and often essential part of their livelihoods.

The message to East African governments, NGOs and donors is simple. Anticipate that resistant bees will develop, help local people understand *Varroa* and ensure beekeepers anticipate and survive a few years of difficulty. Beekeepers need to know what is going on so they won't despair and give up, or be tempted to use their own concoctions to control the mite. The message must be: avoid importing chemicals, learn from the South Africans, listen to the advice of ICIPE, and take note of what your own beekeepers (like Hamphrey Langat) are saying.

Afterthought in Britain

Our own chemicals and solutions

If the only long-term solution to bee pests and diseases is natural tolerance, we in Britain may have to go this way. Chemical use should only be a short-term intervention to protect the bee population - to buy time. As Mike Allsops said "It's easy to develop tolerant bees, but the hard part is to let susceptible bees die". Both must happen.

Mike stressed that the key to maintaining healthy bees is maintaining a diverse and substantial wild population. "Look after the wild bees and what they need" he said "and the commercial population will be looked after as a consequence."

So all those imported queens posted to Britain in spring and summer - have they broadened or narrowed the genetic base? Perhaps we could import more queens from even more exotic locations, bringing in bees that have developed tolerance. But to what extent has importation, selection and breeding limited the ability of our own races to adapt and evolve? Are there any feral colonies anywhere in Britain?

It is time to reassess the UK disease and pest issues and strategies. Perhaps we might even feign to learn something from Africa. There seems to be some really good thinking going on there - some really good experience. Let's hope the East Africans learn from the South Africans (not us). Let's hope that we do too.

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ⁱ Apidologie: INRA/DIB-AGIB/EDP Sciences, 2009 - available online at www.apidologie.org

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