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FEATURE

Good News for Treatment-Free Beekeeping

Clive and Shân Hudson, Lleyn and Eifionydd BKA, North Wales

Natural *Varroa*-resistant bees: a queen with her attendants. Photo: Clive Hudson

Introduction

We are enthusiastic beekeepers and have been for 37 seasons. We enjoy hearing from other beekeepers about their experiences and sharing our own. Our good news is that we have just completed our 13th successful year of treatment-free beekeeping. We enjoy our beekeeping with National hives exactly as we did before *Varroa* arrived without using any treatments, and our bees are absolutely fine. We can support this statement because, in addition to our own judgement, all our 22 colonies were passed as healthy after a thorough inspection by our Seasonal Bee Inspector in August 2021.

It has been a good season for our association, Lleyn and Eifionydd BKA, North Wales, which resumed outdoor meetings. To the best of our knowledge members keep their bees without using any miticides and we know of over 500 colonies in north-west Wales that are treatment-free. One of our members, David Heaf, has written a book, *Treatment-Free Beekeeping*, published by Northern Bee Books, which includes a chapter on 'The Gwynedd experience.' We enjoy helping new beekeepers, who are delighted to discover they can keep our local bees without the need to use any chemicals to control *Varroa*.

Natural *Varroa* resistance

The really good news is that the key mechanisms used by bees to control *Varroa* mites have now been discovered. As ever with science there will be more details to be found, but, after decades of international research the way bees can manage *Varroa* has been explained. In the UK Prof. Stephen Martin, who has been researching the '*Varroa* problem' for over thirty years, and his colleague Isobel Grindrod at the University of Salford have co-authored a *BBKA News Special Issue* on *Natural Varroa-Resistant Honey Bee*, available at https://www.bbka.org.uk/shop/bbka-special-edition-natural-varroa-resistant-honey-bees. This excellent booklet explains how honey bees and *Varroa* mites can co-exist. The authors state in the foreword, '*The honey bee and natural selection have provided a lasting solution to the Varroa problem. Our aim is understanding this and helping inform beekeepers so they, in turn, can help their bees.*

In summary, it is now known that honey bees have developed and modified their innate hygienic behaviour to detect *Varroa*-infested cells, open those cells, uncap them and recap, and thereby disrupt the breeding cycle of *Varroa*. This behaviour reduces both the number of mites in a colony and the effect of the associated viruses. The booklet also gives a 'Practical guide to measuring recapping rates, mite removal rates and mite reproduction'. More detail on natural *Varroa*-resistance can be found in the supporting academic paper: https://royalsocietypublishing.org/doi/10.1098/rspb.2021.1375

An interview with Isobel Grindrod, available at https://www.bbc.co.uk/programmes/m000yfkv gives a very clear explanation of the behavioural traits being used by honey bees to cope with the mites. Our transcript of this interview is available at https://beemonitor.org/

There has been an increase in the number of treatment-free beekeepers in the UK over the last ten years, and four associations across the UK now have over 70% of their members treatment-free according to a recent survey: *Distribution of treatment-free and treating beekeepers in the UK* by Alexandra Valentine, University of Salford (pers. comm.).

What steps are necessary to become a treatment-free beekeeper?

Below are accounts of four beekeepers from different areas of the UK and Ireland, who have kindly agreed to share their experiences of becoming treatment-free beekeepers and to suggest ways into chemical-free beekeeping.

Joe and Chris Ibbertson are members of Northamptonshire BKA. When the brothers started beekeeping eleven years ago they read the scientific literature and decided they did not want to put chemicals into their hives; they were treatment-free beekeepers from 'day one'. After some higher than average losses in their third and fourth winters, their colonies have gone from strength to strength. Joe and Chris are not concerned about losing weak or failing colonies, saying: "*good riddance to them*". They are confident that they can replace losses by breeding from their best colonies and collecting swarms from feral or wild colonies. They currently have 22 colonies in National hives, and are taking an enthusiastic interest in wild living colonies with the Boughton Estate Honeybee Conservation Project (see: https://twitter.com/behchoneybee).

The capability of free-living colonies to survive for three years or more is a good guide to the viability of natural *Varroa*-resistant bees in your area. We take the perspective that successful adaptation in a natural situation is the optimum setting. Irrespective of your approach, there is only one thing to do: stop treating. In our opinion no meaningful adaptation will be made with treated colonies. Our recipe for success:

- Low density apiaries.
- No transfer of hive materials between colonies.
- No feeding; leave honey for wintering.
- No combining of colonies.
- Removal of weak or failing colonies.
- Reproduction from the longest surviving and best colonies.
- Work together with a like-minded group.

Moving to a treatment-free regime is possible for all beekeepers,

but your approach will determine the sustainability of your journey to success. See: Northamptonshire Treatment Free Beekeeping at: https://www.facebook.com/groups/1263819240358228/

Kaie Jones is Chair at Lleyn and Eifionydd BKA and over-winters seven National hives at two sites on the fringe of the Snowdonia mountains. When Kate started beekeeping, she did as advised and treated with Apiguard. Oxalic acid was never used because of an unease of opening hives in mid-winter. Kate has not treated her bees with miticides for ten years.

Kate can only ask you to consider her thought process in her move away from *Varroa* treatment; throughout this process the welfare of the bees was paramount. The decision was ultimately based partly on management themes drawn from other parts of her life, such as a move in agriculture to managing parasites with targeted anthelmintic use, rather than their complete elimination. A rudimentary understanding of population dynamics facilitated Kate's considerations; for example, that treatment creates the perfect conditions for the remaining *Varroa* to rebound in numbers, rather than achieve sustainable numbers within the hive.

Kate is lucky to have a husband to bounce ideas off and ultimately came to a decision not to treat. They took the leap of faith and stopped treatment; reassurance came when the bees continued to thrive. Initially, drone brood was removed when the *Varroa* levels were increasing, but they no longer do this and numbers of deformed wing virus cases have also fallen each year. This has been a personal journey, ultimately all beekeepers have the welfare of their bees at heart and, as such, need to decide whether to treat or not.

John McMullan is a member of Fingal, North Dublin BKA where he was Honorary Secretary for 25 years. He keeps five colonies in Modified Commercial hives at his home apiary and other hives at an out-apiary in Co. Galway. John studied parasitology for his doctorate and has taken a long-term interest in developing a regime that facilitates *Varroa* tolerance in honey bees. He started keeping bees in 1994 and became a treatment-free beekeeper in 2010. Noteable points are:

- All treatments stopped in 2010 and by 2020 over two-thirds of beekeepers in the area had stopped treating.
- Selection for *Varroa* tolerance and for all bee conditions was occurring within a largely fixed gene pool. There was no specific selection by beekeepers, including for low mite numbers. The colonies were left to find their own evolutionary path to tolerance.
- Initially there were some purges of bees with deformed wing virus in late summer, which is part of a selection process.
- All colonies are raised from existing stocks with little mass-production of queens.
- Drone congregation areas are seen as a local beekeeping resource, with each beekeeper contributing to their enhancement. John has always used solid floor hives and believes that it has contributed to reduced mite production in drone cells.*

[* McMullan J. Adaptation in honeybee (*Apis mellifera*) colonies exhibiting tolerance to *Varroa destructor* in Ireland. *Bee World* 2018; 95(2):39–43. doi:10.1080/0005772X.2018.1431000 Also see part 5: McMullan J. (2021) *Having Healthy Honeybees, the beekeeping and science.* NBB, UK, ISBN 978-1-912271-90]

- Recent imports of non-native, mainly Buckfast, bees by new beekeepers coming from outside the area has prompted the local association to commence a programme of small-scale production of black queens to try to offset some of the fallout from these importations.
- Over the past decade, colonies have become generally more docile and bare-handed beekeeping is common.
- Community co-operation is critical as beekeepers are dependent on each other for the health of their bees.

Steve Riley is Chair and Education Officer at Westerham Beekeepers, covering the Surrey/ Kent borders in the south-east of England. Since 2017, Steve and six other members have led a project to stop using chemical miticides and identify *Varroa* traits in honey bees. It is a cautious, step-by-step approach that is proving very successful. There are currently over 160 untreated colonies across thirty apiaries, including neighbouring beekeepers in

Left: Bees uncapping infested cells. Photo: Steve Riley, Westerham Beekeepers. Right: Uncapping and re-capping. Photo: T. Rudd, Westerham Beekeepers.

Croydon and Orpington. Their advice:

- Observe your bees for naturally occurring *Varroa*-resistant traits such as uncapping or chewing out infected larvae. Incorporate these traits into your hive record cards and breeding protocols.
- Work as a team with fellow beekeepers to support each other and share information. WhatsApp groups are very useful.
- Start cautiously with a small number of your hives. Either replace the summer miticide treatments with biotechnical measures such as queen frame trapping, or select colonies where you see resistant traits. Alternatively, buy a local nucleus from a beekeeper with proven *Varroa*-resistance or catch a swarm from a long-lived feral colony.
- Raise your own queens that are locally adapted to your climate and seasonal flora. Introducing external bees disturbs the adaptive genetics and risks vertical transmission of pathogens from queens, e.g. viruses.
- Encourage drone production from *Varroa*-resistant colonies; they are 50% of the genetics.
- Look for strong spring development in brood and foraging from non-treated colonies; these bees have over-wintered well and are your best breeding stock.

Westeram Beekeepers are happy to help with training through presentations or apiary visits for local groups. More information at: https://westerham.kbka.org.uk/identifying-varroa-resistant-bees/

Conclusion and acknowledgements

The experiences and suggestions described above show the variety of approaches and different paths to *Varroa*-resistant bees and treatment-free beekeeping; but there has been one constant. To our knowledge, all treatment-free beekeepers value and keep local bees. Following the example of many beekeeping associations in Ireland, our association, Lleyn and Eifionydd BKA, has made the case for a voluntary conservation area (VCA) to support the keeping of locally adapted bees in the area of our association. (see: https://e-voice.org.uk/llebka/vca-voluntary-conservation-a/) Both the Welsh and British Beekeepers' Associations formally support keeping bees from your local area. There is a widely held view that a stable population of locally bred bees will assist the development of their natural *Varroa*-resistance. Steve Riley has made the point that adaptation is happening and it is bee-led. He adds that the natural adaption of honey bees to deal with *Varroa* has occurred in the thirty years since its arrival in the UK and, as beekeepers, we are privileged to observe a bee-led solution. Special thanks to our contributors: Joe and Chris Ibbertson, Kate Jones, John McMullan, Steve Riley, Alexandra Valentine.

Is *Varroa* Treatment-free Beekeeping an Option for ALL Beekeepers?

By Prof. Stephen Martin, Salford University, Manchester

"The secret of change is to focus all of your energy not on fighting the old, but on building the new"

Socrates

Change is the key, and Socrates' words still ring true. Thirty years ago, when *Varroa* first arrived in the UK, beekeepers initially were very reluctant to put various chemicals into their hives to control *Varroa* populations. Naturally, putting an insecticide into a colony of insects, i.e. bees was against the entire ethos of beekeeping and this led to many beekeepers experimenting with a wide range of compounds and alternative treatment methods. Many beekeepers continued to ignore official advice on *Varroa* treatment and subsequently lost their colonies and gave up beekeeping.

It took many years until things settled down and *Varroa* treatment became universal. In 1997, the first officially UK-approved *Varroa* treatment, Apistan, became available. This product was very efficient at killing the phoretic mites i.e., those on the adult bees. However, in the late 1990s many of the feral colonies were succumbing to *Varroa* and unfortunately the workers from these collapsing feral colonies invaded other nearby colonies resulting in up to 1,000 mites arriving in a colony in a single day. This exacerbated the confusion around *Varroa* treatment and led beekeepers to treat twice per year. As *Varroa* treatments became accepted and the feral population largely disappeared, beekeeping entered a new stable period, where beekeepers were locked into long-term *Varroa* treatment, and that has lasted for over thirty years. In fact, the current generation of beekeepers may know of no other way to keep bees. However, things have slowly been changing in the background.

The first hidden change was the large drop in the number of mites circulating in the environment due to the combined loss of feral colonies and widespread use of very effective treatments. Many beekeepers say they never or rarely saw *Varroa* mites. Despite this change most beekeepers maintained the bi-annual treatment regime. Even today 40% of UK beekeepers treat twice a year. Is this necessary? Well, the 51% of UK beekeepers who treat annually or not at all would say two treatments are not necessary now.

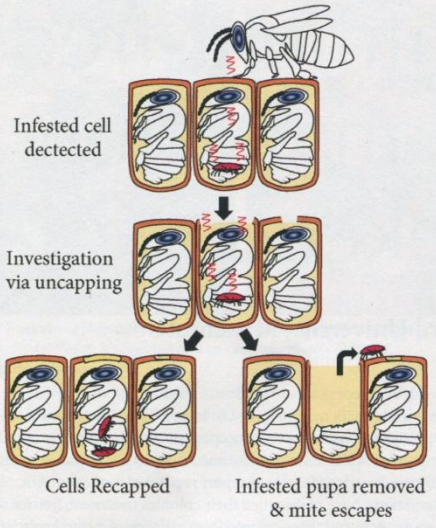
The second largely hidden change is the slow rise of the treatment-free beekeeper. Ron Hoskins of Swindon honey bee conservation, is the UK's longest known treatment-free beekeeper having not treated for *Varroa* for over 25 years. The UK has numerous long-term (six years +) treatment-free beekeepers who are starting to discuss their personal journeys and challenge the status quo. In fact, the BBKA annual Winter Survival Survey and the recent UK treatment survey by Alex Valentine both showed around 25% of British beekeepers are currently not treating, although many of these beekeepers may be forced to treat within three years of stopping treatment due to increasing mite levels. However, Alex's survey also indicated that an estimated 3,000 UK beekeepers, that is approximately 10% of beekeepers registered to the four UK associations, have maintained their colonies treatment-free for six or more years and these colonies have developed natural resistance to the *Varroa* mite. Currently, most bee associations have long-term treatment-free beekeepers among their membership, quietly going about tending their bees.

The final key change is that feral colonies have largely returned; this is likely to have happened at different speeds in various locations. As feral colonies lack any treatment, they either adapted or died. Once they become resistant they have a selective advantage over susceptible colonies and start to spread.

Currently, it is extremely difficult to determine the level of resistance in colonies where we cannot access their sealed brood. However, using feral colonies from regions where they are persisting is one of the quickest ways of becoming a treatment-free beekeeper. Clive and Shân Hudson in North Wales, Colin Rees from Cornwall and several beekeepers in Hawaii are just a few of the beekeepers using feral colonies as a source of *Varroa*-resistant populations.

This increase in treatment-free beekeeping has preceded the mechanism of resistance. However, in 2018 a key breakthrough in understanding *Varroa* resistance was discovered by a Norwegian PhD student, Melissa Oddie. Although, it had been known for decades that poor mite reproduction was present in resistant African and Africanised bee populations, how this came about was unknown. Melissa opened that door by showing that a behaviour called cell recapping was consistently elevated in resistant colonies relative to suspectable (treated) honey bee populations in Norway, Sweden, and France. During the last four years, my team have supported Melissa's original idea and found elevated recapping levels in all resistant populations. Izzy Grindrod, my PhD student, was able to link together all the key *Varroa* traits found in resistant honey bee populations to finally explain *Varroa*-resistance.

"Using feral colonies from regions where they are persisting is one of the quickest ways of becoming a treatment-free beekeeper."



The three key hygienic behavioural stages involved in natural *Varroa* resistance. Taken from: *BBKA News Special Issue Series: Natural Varroa-Resistant Honey Bees*, 2020.

Simply put, given the opportunity, any honey bee population, anywhere in the world, maintained by any type of beekeeper in any type of hive has the potential to develop *Varroa*-resistance. This is because the workers can learn to detect *Varroa*-infested cells using odours produced by the mite offspring. This leads to increased removal (cannibalisation) of infested cells. This prevents *Varroa* from reproducing and causes a decrease in the growth of the *Varroa* population. The recapping behaviour is a key behaviour to prevent mistakes from happing e.g., the removal of non-infested pupa, but it is error-prone, so not all infested cells are removed, although a very high proportion are investigated, as seen by the high recapping rates of infested cells in mite-resistant colonies.

The science now backs up what the beekeepers already know, resistant colonies can control the *Varroa* population without help from the beekeeper. Furthermore, investigation of UK resistant colonies finds the same traits as other resistant populations, be it in, Hawaii, Brazil, South Africa, Cuba, Norway, Sweden, or France.

"Melissa Oddie showed that a behaviour called cell recapping was consistently elevated in resistant colonies relative to susceptible (treated) honey bee populations in Norway, Sweden, and France. My team supports this finding in all resistant populations."

What are your options?

Firstly, think about your long-term *Varroa* treatment plan. Do you always want to be reliant on *Varroa* treatment or do you want to start to wean yourself off it? Change is difficult as we saw when *Varroa* first arrived, but now the consequences of not changing i.e., still treating, will not cause your colonies to die. The benefits of not having to treat are: saving money and time, although the journey to treatment-free beekeeping requires work and knowledge.

In this issue of *BBKA News* (pages 238 to 240) there are four different journeys by which long-term treatment-free beekeeping was achieved. Over the coming year the aim is to start putting together information on best practice for the various options available, based on the pooled expertise of UK treatment-free beekeepers. In the meantime, ask yourself a simple question: is it time to change or not?

"Think about your long-term *Varroa* treatment plan. Do you always want to be reliant on *Varroa* treatment or do you want to start to wean yourself off it?"

Chronological list for further reading

All scientific papers are free to download.

Oddie M, Büchler R, Dahle B *et al.* Rapid parallel evolution overcomes global honey bee parasite 2018; *Scientific Reports* 8: 7704. https://doi.org/10.1038/s41598-018-26001-7

Martin SJ, Hawkins GP, Brettell LE, Reece N, Correia-Oliveira ME, Allsopp MH. *Varroa destructor* reproduction and cell re-capping in mite-resistant *Apis mellifera* populations. *Apidologie* 2019; 51(3): 369–381. https://doi.org/10.1007/s13592-019-00721-9

Grindrod I. Honey bees are becoming resistant to *Varroa*. *The British Bee Journal* published in conjunction with *BBKA News* 2021; 7:1–3.

Grindrod I, Martin SJ. Natural *Varroa* resistant bees in the UK. *Bee Craft* 2021; 103(1): 9–11. ISSN: 0005-7703.

Webb G, Grindrod I, Martin SJ. *Varroa*-resistance: a team update. *BBKA News* October 2021; 228: 331–332.

Hawkins GP, Martin SJ. Elevated recapping behaviour and reduced *Varroa destructor* reproduction in mite-resistant *Apis mellifera* honey bees from the UK. *Apidologie* 2021; 52: 647–657. doi.org/10.1007/s13592-021-00852-y

Heaf D. *Treatment-free beekeeping.* IBRA & Northern Bee Books, 2021. ISBN 978-1-913811-00-6

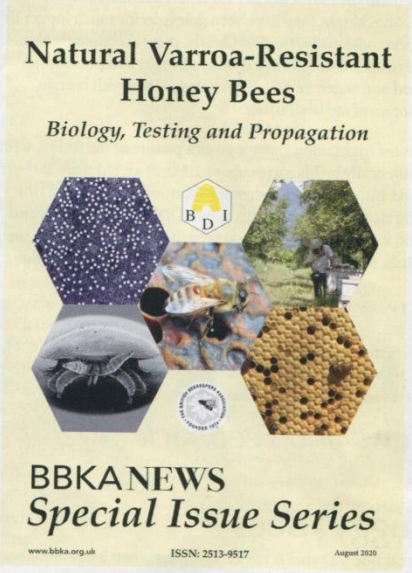
Grindrod I, Martin SJ. Spatial distribution of recapping behaviour indicates clustering around *Varroa* infested cells. *Journal of Apicultural Research* 2021; 60: 707–716. https://doi.org/10.1080/00218839.2021.1890419

Grindrod I, Martin SJ. Parallel evolution of *Varroa* resistance in honey bees: a common mechanism across continents? Proceedings of the Royal Society B 2021; 288: 20211375. doi.org/10.1098/rspb.2021.1375

An instructional video on how to measure recapping and mite removal is also available at: https://www.youtube.com/watch?v=Hfa9C1xvtec

Natural Varroa-Resistant Honey Bees – Biology, Testing and Propagation

Reviewed by David Heaf, author of *Treatment-Free Beekeeping*



Natural Varroa-Resistant Honey Bees – Biology, Testing and Propagation. By Stephen Martin and Isobel Grindrod, Salford University, UK.
A *BBKA News Special Issue Series* publication, August 2020, 16 pp.

Anyone wondering if beekeepers are doomed to treat against *Varroa* until eternity can take heart from this richly informative little publication, well-illustrated with photos and diagrams. Natural *Varroa*-resistant (NVR) *Apis mellifera* populations have arisen in Europe, the Americas and Africa. Furthermore, fifteen UK apiaries or apiary groups have contained untreated bees for between three and more than ten years, the largest group being in my locality, Gwynedd.

Varroa is the most serious honey bee pest, especially when combined with its most prevalent vectored virus which causes deformed wings (DWV). Two pages on the lifecycle of *Varroa* include interesting details such as its 'snorkel', which it uses for breathing when immersed in brood food. The section on DWV, describes a virus that only became a problem when *Varroa's* direct bee-to-bee transmission of it took hold. Of two DWV-free island populations of honey bees, the oldest was founded in 1984 on Fernando de Noronha, Brazil.

Two pages on hygienic behaviour, the main way bees resist *Varroa*, evidence the crucial point that treating for *Varroa* lessens colony natural resistance. Processes of chemical or physical detection of diseased pupae, cell uncapping and pupal removal or recapping are still undergoing research. Imbalance in the three tasks causes bald brood.

Three pages show the biology and behaviour of NVR populations. They have in common poor mite reproduction, increased mite detection and removal and increased recapping. NVR colonies are better than susceptible colonies at removing infested pupae resulting in a reduction of the number of viable female mite offspring per reproductive cycle to well below unity, thereby reducing infestation.

Recapping is discussed in greater detail including showing what recapped cell cappings look like. We read: '*Elevated recapping levels in a population is currently the best indication of an NVR population*'. This leads to, undoubtedly, the most useful part of the publication for the beekeeper, namely the methods for measuring not only recapping rates, but also rates of mite removal and reproduction.

The few tools needed for recapping rates are inexpensive, even the adjustable magnifying lamp. A page covers measuring infested and uninfested cell recapping rates. Then, for the more adventurous, we learn how to measure mite removal rates by first artificially infesting cells with mites, replacing the frame in the hive and checking after ten days how many cells have been emptied. The section on the even more challenging procedure of assessing mite reproduction, requiring a binocular microscope, refers us to an open-access online guide.

Someone told me that these measurements are too difficult for the ordinary beekeeper. However, anyone with a steady hand who is used to, for example, caging and marking queens, could easily cope with measuring recapping rates. This procedure would equip beekeepers with a valuable tool to assess NVR status during colony propagation and give them confidence in making a gradual, methodical change towards treatment-free beekeeping.

Treatment-Free Beekeeping (2021), by David Heaf, is available from Northern Bee Books.