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HONEYBEE NEWS

"The Voice of the Beekeeper"

Volume 9 Number 5
September - October 2016

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AUSTRALIA'S HONEYBEE NEWS

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COVER: Harold Saxvik checking his hives on seed canola at Darlington Point PHOTO: Doug Somerville

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PRESIDENT'S REPORT

Season
We wanted the drought to break, that's certainly happened .Now we are wishing for sunshine. Moisture aplenty, currently so much that accessing hives to do any procedure is almost impossible. One should not wish for dry weather after so many years of below average rainfall, but enough for now. Let's hope at least some future prospects eventuate from this excessive amount of moisture. Due to beekeepers limited access to their apiaries, swarming is becoming a problem in some locations.

Secretary
Most members have probably heard that our secretary Kate McGilvray gave notice of her intention to leave the position of NSWAA Secretary. Kate's last day was 13 October. The NSWAA Executive wish to thank Kate for her time as secretary and wish her well in future endeavours.

We have advertised for a secretary and have received several applications which are currently being processed. We hope to be able to engage a new secretary soon.

Resource
The current situation with regard to Forestry sites is that letters have been sent to beekeepers that have sites that fell due for renewal on 30 September.

A copy of that letter is published in this edition. The basis of the letter is to inform site holders that FCNSW is offering five year permits with the option for another five.

The initial price will be $145 + GST / year.

Negotiations are still underway as the current proposal is 5+5 years then EOI (expressions of interest).

This is unworkable and unacceptable to our members and apiculture in NSW.

On 5 September, Doug Somerville, Greg Roberts and myself led a group of personnel involved with the Apiary Sites Working Group and Petrina Apfel [Minister Blair's adviser] on a tour of bee sites on the South Coast which included both Forestry and National Park lands. We also looked at an apiary on National Park land. The aim of our adventure was to enlighten policy makers as to the vagaries of beekeeping in relation to sites and the utilisation thereof.

Greg Roberts and I met with Mick Veitch (shadow Minister for Primary Industries) on 15 September and discussed the apiary sites on Public lands issue.

Minister Blair visited my honey shed on 6 October and after a tour of the premises I discussed our industries concerns in relation to EOIs, especially concerns that the future of our essential industry was in real jeopardy due to the potential loss of floral resource by individual businesses.

The Minister has agreed to go back and revisit the necessity to call for EOIs.

Industry can only hope that the apiary site policy progresses to one where Apiculture's future in NSW is secured by allowing our resource base to be perpetually renewable. This will instil confidence in beekeepers, allowing continued investment which in turn will enable future pollination service requirements to be met.

Meetings
The next meeting of your executive council will be held on 2 December at Tocal.

Neil Bingley
State President

WATCH THIS SPACE

If you have an urgent matter while we await the appointment of our new Secretary please contact: President Neil Bingley or Vice-President Casey Cooper

GET WELL

Best wishes to Bruce White who is recovering from heart surgery.
Hope you are up and around soon.

NEW MEMBERS

A warm welcome to the following new members:

Mark Adams	Peel
David Best	Wallerawang
Martin Coyle	Borenore
Christine Dawson	Mullumbimby
Peter Duerden	Orange
Stephen Fawns	Deniliquin
Ron Frame	Orange
Ronald Grant	Oberon
James Hannah	The Whiteman
Rachel Hart	Ariah Park
Michael Holloway	Darbys Falls
Thomas Jephcott	Middle Dural
Karine Kennedy	Canowindra
Jeffrey Kynaston	Batlow
Suzanne Long	Maylands WA
Jenny Petrie	Orange
Phillip Roberts	Gobbagombolin
Linda Raills	Bathurst
Gordon Stamp	Yetholme
Gina Williamson	Wauchope

PREPARING LIVE BEES FOR EXPORT

28 September 2016

Well-known Tasmanian apiarist Lindsay Bourke has shared his knowledge in preparing live bees for export in the first episode of a series of industry best practice videos.

Mr Bourke, who is also the President of the Tasmanian Beekeepers Association, said Australia exports an average of 17 pallets of bees at the end of each season to beekeepers in Canada where *Varroa destructor* is prevalent.

"Australian bees are very valuable to Canada as they urgently need them," Mr Bourke said.

"Each pallet is worth around $110,000 dollars, so it provides extra money for us at the end of our season from our excess bees, but most importantly it's really good for our fellow beekeepers on the other side of the world," he said.

This season, Mr Bourke supplied eight pallets for export.

In the best practice video, Mr Bourke explains the process he uses to package live bees, including excluding his queen bees in the initial extraction phase, keeping the bees cool throughout both the smoking process, weighing the bees for packaging, as well as the biosecurity measures necessary to export to Canada.

Chair of the Honey Bee and Pollination Program's Advisory Panel, Michael Hornitzky, said the new series of videos will highlight the practices of some of the best apiarists in Australia.

"This is a great resource that will offer productive peer-to-peer advice," Dr Hornitzky said.

More best practice videos will be added to the RIRDC YouTube channel over the coming 12 months, including topics such as queen bee breeding, introducing queens in to hives, hygienic testing techniques and barrier systems for pest and disease management."

To watch the video, go to: https://youtu.e/6mGX6BwtS1s
For more information, go to: www.rirdc.gov.au/honeybee-pollination

Media contact: Megan Woodward 0487 352 859

The Honey Bee and Pollination RD&E Program is a jointly funded partnership with the Rural Industries Research and Development Corporation (RIRDC), Horticulture Innovation Australia Limited (Hort Innovation) and the Australian Government Department of Agriculture and Water Resources. RIRDC funds are provided by honey industry levies matched by funds provided by the Australian Government. Hort Innovation funding is from the apple and pear, almond, avocado, cherry, dried prunes, summer fruit and onion levies and voluntary contributions from the melon and canned fruit industries. Levies are matched by funds from the Australian Government.

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HAYLEY'S COMMENT

The role of the Bee Biosecurity Officer (BBO) in NSW has been very busy since I started in April 2016. My role so far has been focused on education but as the role develops, I will be actively involved in assisting the beekeepers implement the "Bee Biosecurity Code of Practice".

There have been many letters sent to NSW Apiarist and Amateur Beekeeping Associations, inviting them to make time to discuss components of the code and any issues they may have. I have also spent time with officers from Plant Health Australia, Bee Biosecurity Officers in other states and also, officers within NSW including Mick Rankmore, Liz Frost, Doug Somerville and Nick Annand.

I have spent time with beekeepers from the Southern Tablelands, the Northern Tablelands, Tamworth, Riverina and the Central Tablelands branch. Issues highlighted at these meetings include the recent incursion of *Varroa jacobsoni* in Far North Queensland, security of sites for beekeeping on public land, rising rates of American Foulbrood (AFB) and also, inappropriate use of oxytetracycline to treat AFB. Total attendance of commercial beekeepers at these meetings was 125.

There has also been considerable interest from the Amateur Beekeeping Associations (ABA) to learn more on the Bee Biosecurity Code of Practice and bee disorders. Amateurs managing a smaller number of hives, have the luxury of being able to inspect for pests and diseases more frequently. Because of this, amateurs are better placed to find new disorders much sooner than those with many hives to inspect. I have been to some of these meetings in Gosford, Sydney, Bega and Canberra. Total attendance of amateur beekeepers at these meetings was 225.

In May I attended the state conference and more recently, the Crop Pollination conference in Griffith. Emerging issues include concerns about pesticide use and particularly, systemic seed treatments that are applied to crops such as canola. Another concern is the increased demands on the bee industry for pollination, current remuneration per hive for pollination services, and the prevalence of pests and disease at large scale pollination events. I was fortunate to observe apiary officers from Victoria in action during these pollination events, where I visited almond orchards in Robinvale. From what I saw, the level of pests and disease in hives being transported from across Australia was dismaying. Not to mention, the large number of hives which were complete dead outs from AFB. This is something that needs to be addressed, in working with the industry to implement the code, I hope the overall level of pest and disease will be reduced in the future.

My role is primarily to promote the adoption of the Bee Biosecurity Code of Practice. There are up to 19 regulatory staff in NSW DPI engaged for some of their time on regulatory matters. So while I have the powers of an inspector to inspect hives and similar activities, the enforcement of the current or future legislation will not be my role. If the code is embraced by both the commercial and amateur bee keepers, there will be a declining need for regulatory enforcement. We are also likely to see better containment of some disorders such as American foul brood. Under the new legislation, disorder or disease "free" zones could be possible and allow easier access to interstate movement of bees or bee products.

But for the moment, as I continue to travel around NSW and meet a diverse group of apiarists in a challenging range of environments, I will continue to promote the benefits of the code to NSW apiarists. I look forward to meeting many more apiarists in the coming months.

If you would like assistance on the code, please feel free to contact me on the details below:

Hayley Pragert - NSW Bee Biosecurity Officer
Phone: 0438 677 195 Hayley.pragert@dpi.nsw.gov.au

TAMWORTH BRANCH

NSW APIARISTS ASSOCIATION INC.

BEEKEEPER FIELD DAY

Saturday 26 November 2016
Tamworth Agricultural Institute (DPI)
4 Marsden Park Road, Tamworth NSW 2340

Organized by the Tamworth Branch of the NSW Apiarists Association in collaboration with the NSW Department of Primary Industry's Advisory Officer Dr Doug Somerville

If you have an interest in beekeeping you are very welcome to attend this FREE Field Day

Presenters: Doug Somerville, Hayley Pragert, Ray Hull, Norm Maher and others

INSIDE SESSIONS

9.00 - 9.15	Introduction and Welcome
9.15 - 9.45	Biosecurity Update and Code of Practice
9.45 - 10.15	Training and knowledge opportunities
10.15 - 10.45	Pillars of Good Beekeeping
10.45 -11.00	Morning Tea

OUTSIDE SESSIONS

11.00 -11.30	How to open a hive, identify each cast of bee, check for disease and reassemble the hive
11.30 - 12.00	How to check for Varroa mite – sugar shake test, others
12.00 - 12.30	A look into a Native Bee Hive
12.30 - 1.30	LUNCH BBQ – (Gold Coin Donation) and Raffle Draw

INSIDE SESSIONS

1.30 - 2.30	Do I need to feed my bees? Bee Nutrition
2.30 - 3.00	What Makes a Good Queen?
3.00 - 3.30	Future Challenges. Sustainability
3.30	Coffee and Head Home

Enquiries: Contact: Ray Hull on 0407 469 176

To confirm your attendance email Norm Maher: normmaher@hotmail.com

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Technical Specialist, Apiculture - NSW Department of Primary Industries - Goulburn
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ANTIBIOTIC RESIDUES

From time to time, antibiotics are utilised in the world beekeeping scene to control and suppress various bee diseases. In the Australian context, the antibiotic oxytetracycline is 'registered' for use against the bacterial disease European foulbrood *(Melissococcus pluton)*.

European foulbrood (EFB) was first identified in Australia in 1977. EFB is highly contagious, with all stages of larvae development susceptible to infection. The incidences of this disease are strongly correlated with climatic and nutritional stress factors. Cooler, wet weather and poor nutrition will promote the incidence of this disease.

EFB can cause extensive losses in both recreational and professional apiaries. Management practices, such as regularly requeening with a resistant or tolerant strain, regularly replacing brood combs and maintaining a high level of nutrition in the form of nutritious pollens, will all assist in suppressing this disease.

EFB is highly contagious, but infections may remain without visible signs for a long period. Sudden outbreaks occur from time to time and can seriously weaken a colony to the point where it dies. At the very least, in these situations, a large number of the developing larvae are killed by the bacteria which prevent the colony from building its population. This situation may drag on for months and, as such, treating the infected hives may assist the colony to recover from this disease.

Oxytetracycline (OTC) is a broad-spectrum antibiotic, active against a wide variety of bacteria. OTC has been, and continues to be, used to treat a range of diseases affecting animals and humans. It is particularly effective against EFB and thus far there have been no cases of EFB bacteria resistant to this antibiotic in Australia. Unfortunately, the same cannot be said for other diseases for which the antibiotic has been administered.

Using OTC in a dry form to treat infected beehives is recommended. Various research work has identified this practice as causing less residue issues in subsequent honey crops harvested from treated hives, as compared to providing OTC in a syrup form. Any honey boxes are removed from the hive and the queen excluder removed, exposing the brood nest. This is where the disease is and any antibiotics should be applied directly to the brood nest and no other region of the hive. The antibiotic is dusted across the brood frames. The queen excluder and honey supers are then replaced.

Prophylactically applying antibiotic to every hive at certain times of the year, every year, is a practice which has largely been replaced with the use of antibiotics to treat individual hives when they have been positively identified as having an EFB infection.

When nutritional conditions are poor, combined with hives populated by older bees and with cooler weather prevailing, it may be prudent to treat all the hives in an apiary if at least 10% of the hives are demonstrating visual symptom of EFB disease. There is an increasing trend to only treat infected hives if, and when, they are positively identified as being diseased with the bacterium EFB.

Any use or application of OTC, or any substance, to a beehive will result in the high probability of leaving a detectable residue within the hive. From a marketing perspective, this is highly undesirable and a reason not to prophylactically apply antibiotics to all hives when the visual signs of EFB are not present. OTC is extremely unstable when exposed to heat and will deteriorate before it is applied to beehives if not stored correctly in a cool environment (preferably in a fridge or freezer). Likewise, it will deteriorate in a beehive once it has been applied. Even so, all honey from the first extraction after the treatment date, no matter how many months have elapsed, should be considered to have a detectable residue of antibiotic.

This does not make the honey unsaleable, but does restrict its marketability. Honey in this category could, for instance, be used in the food manufacturing industries. The exposure to heat when being mixed and processed into other products will significantly reduce any residual antibiotic to virtually negligible levels.

It is extremely important when supplying bulk honey to a honey buyer/packer that a statutory declaration be furnished. This is usually in the form of a vendor declaration, stating your details, when the honey was extracted, floral source, if hives were treated with OTC, when they were treated and if they may have been exposed to any other substances such as crop sprays etc.

Failure to be honest in these vendor declarations may seriously compromise the business of the honey packer who may utilise your honey in a blend for a specific market. Some markets have a zero tolerance of antibiotic residue and will reject any batch of product which tests positive. This may equate to a significant financial loss to the honey packer or buyer of your honey. If you, as the supplier of the original bulk honey, have not been honest and up-front with supplying the required information to the honey packing company, they may have cause to seek legal redress against you for lost income and lost markets as a result of any misleading information supplied in a vendor declaration.

The availability of OTC is no longer straight forward. In the distant past beekeepers, or anyone for that matter, could purchase OTC from a farm produce supplier business in most rural towns. OTC is now listed as an S4 poison under the Poison Standard Schedule 4 products. This

essentially means that the medicine or poison is available via prescription from a veterinary practitioner only. There is an exception in NSW which allows certain persons within the NSW Department of Primary Industries (DPI) to provide beekeepers with the authority to purchase OTC to treat infected beehives.

The criteria for providing this authority to beekeepers, as established by NSW DPI, include:

- The beekeeper must be a registered beekeeper
- The amount of antibiotic will not exceed the number of hives registered
- Proof of the disease in the hives must be demonstrated (usually by a positive laboratory report)
- Authority to purchase antibiotic can only be granted within two months of a positive diagnosis
- No American foulbrood must be present in the bee hives to be treated.

In most cases, even within private veterinary practices, proof of the presence of the disease will be required before the antibiotic is sold to a beekeeper.

There are several products based on the active ingredient Oxytetracycline Hydrochloride registered with the Australian Pesticide and Veterinary Medicines Authority (APVMA) for use in beehives against the disease EFB.

The APVMA is an Australian government authority responsible for the assessment and registration of pesticides and veterinary medicines. For an Agvet chemical product to be legally manufactured, imported, supplied, sold or used in Australia it must be registered by the APVMA – unless exempt by the Agvet Code. The registration process involves scientifically evaluating the safety and efficacy (effectiveness) of a product in order to protect the health and safety of people, animals, plants and the environment.

The APVMA regulates agricultural and veterinary chemicals in line with responsibilities described in the Agricultural and Veterinary Chemicals (Administration) Act 1992 and the Agricultural and Veterinary Chemicals Code Act 1994.

Thus, the APVMA regulates the sale and supply of specific veterinary products and medicines that can be applied to honey bee colonies. In this process the APVMA will identify any risks to markets and the animal (beehive) being treated. Whilst there are no known serious adverse consequences for bees when OTC is administered to beehives, there is a possibility of leaving a detectable residue in subsequent honey crops harvested from treated beehives.

To monitor and gauge the extent of any residues in Australian produced primary industry products including meat, eggs, vegetables, honey etc, a calculated number of samples are randomly obtained from the market place and tested for a range of potential residues.

The body responsible for this activity is the Federal Government Department of Agriculture and Water Resources. The National Residue Survey (NRS) was established in the early 1960s under the overriding management of the Department of Agriculture and Water Resources. In 1992 the NRS became an industry-funded activity when relevant legislation was established.

The core work of the NRS is to facilitate the testing of animal and plant products for pesticide and veterinary medicine residues and environmental contaminants. Product testing is done through either random or specifically designed sampling protocols.

Residue monitoring aims at:

- Providing an estimate of the occurrence of residues in products (using systems based on sampling and statistical probability)
- Confirming (or otherwise) that residues in products are below set limits
- Alerting responsible government authorities and industry if, and when, limits are exceeded so that corrective action can be taken.

Results of testing for each product are available on the Australian Government Department of Agriculture website. In the last report published a total of 167 honey samples were analysed for the 2013-14 period. All samples were tested for antibiotics, fungicides, herbicides, insecticides and environmental contaminants. The overall compliance with Australian Standards was 100 per cent.

The antibiotics tested for include the aminoglycosides, antimicrobials, macrolides, nitro furans, phenicols, sulphonamides and tetracyclines - of which OTC is one. A total of 21 antibiotics were tested for. Analytical findings for all tests were zero number of detections.

The same analytical findings of zero residues for antibiotics were reported for the 2012-13 and 2011-12 periods.

Thus, there is no evidence that there is any widespread problem with antibiotic usage in the Australian beekeeping industry. While other countries allow the use of OTC to control American foulbrood disease (AFB), this is not allowed on mainland Australia. OTC does not, in any shape or form, control the spore stage of AFB. It is effective against the vegetative stage of AFB. Unfortunately, AFB now has a resistance to OTC wherever in the world this veterinary medicine has been utilised as a treatment for AFB. Given this, and the likely risk of promoting increased dangers of antibiotic residues in Australian honey, it is unlikely that Australia, in the foreseeable future, will allow OTC to be registered for the control of AFB.

Due to the restricted availability of OTC and its scheduling as an S4 poison, it is not easily obtainable by beekeepers. Also, given that there have been no antibiotic residues detected in the last three years reported by the NRS, there is no reason to believe there is any significant problem or issue with the use of antibiotics within the Australian beekeeping industry.

Resources:
www.apvma.gov.au
www.agriculture.gov.au
European foulbrood and its control. Primefact No. 1000 available www.industry.nsw.gov.au

(Thanks to Vicki Saville for typing my notes and Annette Somerville for proof reading the final article)

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Dear Sir,

Renewal of Apiary Permits Expiring 30th September 2016

The Forestry Corporation of NSW (FCNSW) has been part of an all of Government initiative to develop a common policy framework for managing apiary sites on State forest and other public lands in NSW. The NSW Department of Primary Industries (DPI) has chaired a Working Group consisting of representatives from FCNSW, National Parks & Wildlife Service (NPWS), Local Land Services (LLS), DPI and the NSW Apiarists' Association (NSWAA). The Working Group has scoped a range of options for Government's consideration.

As an outcome of this process, the NSW Government recently approved a new policy framework for managing apiary sites on public lands in NSW. Information on the framework is available at:

http://www.dpi.nsw.gov.au/content/agriculture/livestock/honey-bees

The framework will apply across all apiary sites on public lands in NSW, including State Forests. Details of the framework are being determined in consultation with agencies and the NSWAA and will be announced over the coming weeks.

Implementing the Government decision, FCNSW has resolved to renew all Forest Permits, Beekeeping, expiring on 30th September 2016 for a period of 5 years until 30th September 2021. All Forest Permits renewed from this date will have a renewal option for a further 5 years beyond 1st October 2021.

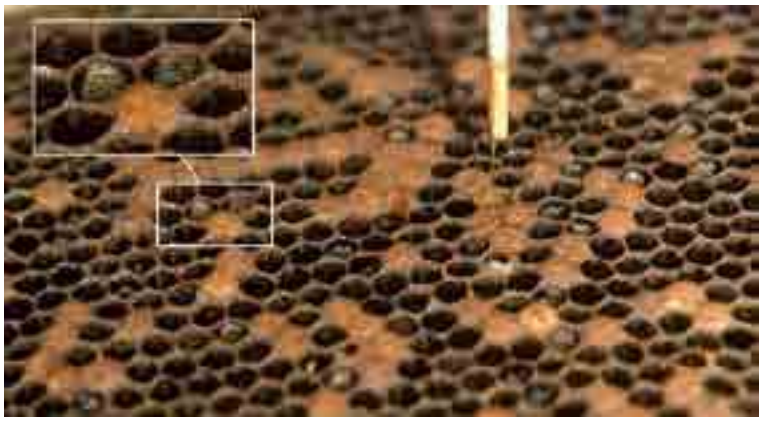
Renewed permits will attract an interim annual fee of $145.00 (plus $14.50 GST) with CPI increases. This interim fee will only apply until such time as DPI and the permit issuing agencies complete a comprehensive economic analysis to determine an appropriate price structure. Results of this analysis will then be applied to permit fees for the remainder of the Term.

All existing permits, not yet expiring, will be subjected to this process when the permit expires.

Attached is a list of your FCNSW Forest Permits, Beekeeping, that will expire on 30th September 2016. If you wish to relinquish any of the listed sites you will need to very clearly identify the permit number and site number in a response to FCNSW. FCNSW must be advised of any proposed changes within 21 days of the date of this renewal advice, either by email to jude.parr@fcnsw.com.au, or by post (to PO Box 168, Wauchope NSW 2446) only.

FCNSW will issue Invoices for payment based on your response to this renewal notice. If no response is forthcoming, you will be invoiced for all of your sites in the attached list.

Could this be happening to your beehives?



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Whether our service is used to eliminate current contamination or is used as a preventative measure, Steritech is always happy to help our beekeepers.

From beehives to medical applications, Steritech is there for you.

Steritech is a proud member of the NSWAA

Innovation is driven from ideas

The concept of using irradiation in the beekeeping industry all started with an idea on how to do things a bit differently.

We are constantly trying to develop ways to utilise our processes to help your industry in lots of new ways.

But without your ideas and input, gamma irradiation would not be where it is today.

Come and share your thoughts and ideas with us. You could hold the key to developing a new application that could alter the beekeeping industry forever.

Please contact us about any inspirational ideas you have

Steritech www.steritech.com.au

STERITECH NSW
Jamie Crighton
National Business Development Manager
Tel: 02 8785 4400
Email: jcrighton@steritech.com.au

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QLD General Manager
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Email: grobertson@steritech.com.au

STERITECH VIC
Raymond Bryden
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LETTERS TO THE EDITOR

A recent article published in Australia's *Honey Bee News* titled "Looking Forward Looking Back" by Laurie Dewar relayed that AHBIC's Australian Queen Bee Breeding Program (AQBBP) has officially been closed but that there is some exciting research underway with the program stock.

Foremost, we continue to develop these lines to prepare for living with Varroa. Working with Denis Anderson in the UAE, we have sent several dozen queens to be challenged with Varroa and we continue to select for and develop lines for hygienic behaviour as part of the RIRDC funded project "The selection and development of Australian hygienic honey bee lines".

This breeding effort has been named DGQs (Dewar Gerdts Queens) and will have inseminated breeder queens available for sale on a limited basis as the lines continue to be developed. Any profit from the sale of these queens is dedicated to Varroa preparedness efforts. As a point of clarity, this is not a business partnership but an acknowledgement of the people engaged in the continued development of these lines.

We look forward to continuing this work and will provide updates as we have them.

Yours sincerely,
Jody Gerdts
Bee Scientifics Ph: 0427 075 662
E: beescientifics@gmail.com
W: beescientifics.com

A BIG THANK YOU

A big thank you to the person who phoned me in June and told me my hives on Quart Pot Road Mogo had had a big tree limb land on them and also for straightening them up. It was appreciated. I was overseas but a friend checked them soon after and you had done a wonderful job.

Thank you again as I missed your name on my message bank.

Stephen Targett
Narrandera

AVAILABLE APIARY SITE

Would any member be interested in locating some hives on our farm which is located at Freemans Waterhole, about 40kms SW of Newcastle in NSW.

The farm adjoins the State Forest and the Watagans National Park. I am not looking for any payment except, perhaps, some honey!

Andrew Macpherson
Email: ajm@horticus.com.au
Mobile: 0419 673 889

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We would like to thank all our loyal queen bee customers for your support over the past 35+ years. We have decided to retire from producing production queens

10% of **all** sales will continue to go to Bees Down Under-for Varroa Preparedness Research-

(work has already commenced within the UAE with Dr. Denis Anderson testing Australian stock)

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HONEYBEE HEXAGONAL COIN FROM NEW ZEALAND

Hexagonal coin from New Zealand celebrates the industrious Honey Bee

The latest new coin from the New Zealand Post is now available, and it's a good one. Featuring the Honey Bee, one of the most important creatures on Earth for humans, it looks primarily at this amazing insects association with honey and the hive.

Struck in fine silver, this one ounce coin is hexagonal in shape, meant to mimic the shape of the honeycomb cell. The main design depicts a bee in flight over a partial background of honeycomb, some cleverly filled with an amber resin meant to replicate the look of honey. It's an innovative use of an adornment and far superior to just plonking a Swarovski crystal in the middle of the design.

It has a point. The use of negative space, a large open area carrying no detail, actually gives the coin an enhanced dimensionality, and also helps keep the inscriptions off the primary design.

Inscriptions on the reverse face constitute the insects name in English and Latin, along with a minimal denomination. Everything else, issuer (New Zealand), date, head of state, is kept to the obverse where they surround the effigy of Queen Elizabeth II by Ian Rank Broadley. With the current popularity of rimless designs, it's good to see a coin that not only has one, but has made it an integral part of the design, in this case the walls of a typical bee cell.

Overall, it's a clever, attractive coin by artist Hannah Stancliffe-White, well worth a look. Packaging is also very clever, heavily inspired by the honey-filled cell so alluded to in the coin itself. A numbered Certificate of Authenticity is included in the box. At $149.00 NZD ($106 USD/£81/€96) it isn't a cheapie, but there's enough here, combined with a 1,500 mintage, to make it a great one for the animal coin collection. Struck by BH Mayer in Germany, it has a good pedigree. Available to order now at: www.nzpost.com.nz.

MINT DESCRIPTION

The hexagonal shape of the coin is based on a cell of honeycomb in a hive. In the honey-making process, worker bees build a honeycomb structure of cells where nectar and pollen are stored, and larvae develop.

The honey bee is brought to life on the coin with three-dimensional engraving and colour printing. It's depicted sitting on the honeycomb, which has been partially filled with translucent amber-coloured resin – replicating real honey!

THE FROST REPORT

Elizabeth Frost
Honey Bee Education Officer
Tocal Agricultural College, NSW Dept. of Primary Industries
T: 02 4939 8821 M: 0437 731 273 E: elizabeth.frost@dpi.nsw.gov.au

Varroa jacobsoni mite response in Townsville

From 26 September to 30 September 2016 I volunteered as an industry representative for NSW to aid the Biosecurity Queensland Varroa Mite Response Team in Townsville QLD, alongside three other industry reps, one each from NSW, QLD and VIC. *Varroa jacobsoni* mites (5 total) were first detected in a nest of *Apis cerana* (Asian honey bee) found in a container stand at the Port of Townsville on 27 June 2016. The goal of the Varroa Mite Response Team is to eradicate *Varroa jacobsoni*, a parasitic mite of *A.cerana*, for a secure future for the Australian beekeeping industry and pollination-reliant industries.

The reference guide for all staff, contractors and volunteers working on the Varroa Mite Response Team

In order to eradicate *V.jacobsoni*, the Varroa Mite Response Team must first track down its host, *A.cerana*. For more information on *A.cerana* read Doug Somerville's Factsheet on the species: www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/382161/Asian-bees.pdf

For more information on varroa mite, both *V.destructor* and *V.jacobsoni*, read through this Bee Aware profile on the species: beeaware.org.au/archive-pest/varroa-mites/#ad-image-0
An excellent resource provided to volunteers is the *Asian honey bee manual*, pictured above, produced in 2013 by the National Asian honey bee Transition to Management Program (AHB T2M) and funded by the QLD and Australian governments and AHBIC. This manual is free to download here: asianhoneybee.net.au/wordpress/wp-content/uploads/2013/07/2423_AHB-manual_WEB.pdf

Varroa Mite Response Team detection methods

The response team has a variety of detection methods for determining the presence or absence of *A.cerana* in an area, tracking and locating *A.cerana* nests and swarms. These are:

Public reporting: Considered the most successful surveillance strategy in the Townsville *V.jacobsoni* eradication effort. Dissemination of flyers by post to Townsville residents informing them of the *A.cerana* and *V.jacobsoni* search, as well as newspaper ads, radio and Landline interviews, posters around Townsville libraries and public places and additional strategic public engagement are all being utilised.

The toll free reporting phone number for suspect *A.cerana* sightings in Townsville is:

13 25 23

An online reporting tool is located at: www.daf.qld.gov.au/animal-industries/bees/diseases-and-pests/asian-honey-bees/report-suspect-bee-sightings To report a suspect bee sighting, the reporter should supply their contact details, sighting address, description of the suspect bees, and a photo if possible.

Coral vine (*Antigonon leptopus*) is an attractive floral resource to *A.cerana*

Floral observations: A technique used to search for *A.cerana* foragers, for example, in a 2km area surrounding an incursion, report of a suspect swarm or nest or to confirm presence or absence of *A.cerana* in an area. Floral observations should occur early morning to mid/late afternoon when bees are most actively foraging. On suspect identification of *A.cerana*, the insect should be caught in a net and stored in a vial of 70% alcohol until a trained entomologist can identify the insect. This technique, as well as **aerial pheromone trapping** described below, are both first steps to confirm the presence of *A.cerana* in an area before moving on to **bee-lining**.

Trial pheromone trapping using *A.cerana* queen pheromone-infused cigarette filters as lures tied to sticky fishing line

Aerial pheromone trapping: A method of capturing *A.cerana* drones by luring them with *A.cerana* queen pheromone-infused cigarette filters tied to flypaper sticky fishing line and suspended at the tree line by a helium balloon. A jigging motion is used to agitate the lures while walking close to trees with the goal of luring *A.cerana* drones which will get stuck to the line and can then be collected and inspected by a trained entomologist to confirm species.

Rainbow bee-eater pellet analysis: Rainbow bee-eaters' (*Merops ornatus*) diet mainly consists of bees and wasps, parts of which they cannot digest. Roosting bee-eaters regurgitate this indigestible portion in pellet form. Response teams use this to their advantage, staking out white sheets under highly populated bee-eater roosts, and collecting the pellets. Once collected, the pellets are rehydrated and examined for bee wings by a trained entomologist. The entomologist examines particular characteristics of wing venation to determine whether the wings originate from *A.mellifera* or *A.cerana*.

Not picnic blankets, but bee-eater regurgitated pellet catchers!

Bee-lining: Once a sighting of *A.cerana* has been confirmed, bee-lining can be employed to locate the foragers' nest. In a simplified explanation of bee-lining, first a sugar syrup feeding station is employed to attract foragers away from a floral resource. Once the foragers are successfully converted from the floral resource to the feeding station it can be moved in 5 metre increments at whatever interval is necessary to regain a similar number of bees feeding at the station before the next move. Bees can be marked on the thorax while they're feeding to make for easier observation of their flight path and also to record the time it takes particular foragers to return to the feeding station. The *Asian honey bee manual* notes "very roughly, a return time of 1 minute indicates a nest distance of ~100 metres, 2 minutes of ~200 metres, etc." Find more in-depth information on bee-lining and all other detection methods in the *Asian honey bee manual*, linked in the second paragraph.

A feeding station complete with sponge and rocks for bees to stand on, previously attractive to *A.cerana* prior to nest eradication

Managed *Apis mellifera* hive sampling

To rule out the possibility of *V.jacobsoni* jumping from its *A.cerana* host to *A.mellifera*, the Varroa Mite Response Team, is also testing for Varroa in managed *A.mellifera* hives with the help of volunteer industry representatives. Testing undertaken involves the alcohol wash and/or the sugar shake, depending on the beekeeper's preference, and drone uncapping if any capped drone brood is present. All testing is done in the field with the beekeeper present. In addition, screened bottomboards with sticky mat inserts are being supplied by Biosecurity Queensland to proactive Townsville District Beekeepers to be involved with further Varroa monitoring.

Townsville Varroa Mite Response Updates

With persistent surveillance, detection and eradication work on behalf of Biosecurity Queensland staff, contractors, and volunteer industry representatives, this will be a successful eradication effort. In the event that volunteer industry representatives are still required at time of printing, consider joining the effort. More information on how to put your bid in to volunteer in the response can be found here: honeybee.org.au/volunteers-needed-in-townsville-for-varroa-eradication/

If you're not currently receiving updates on the status of *A.cerana* swarm and nest sightings in Townsville or lack thereof, sign up for free updates from the Australian Honey Bee Industry Council (AHBIC) or Queensland Department of Agriculture and Fisheries here:

- AHBIC: honeybee.org.au/
- QDAF (Tick "Honeybees" in the Biosecurity alert section):www.vision6.com.au/em/forms/subscribe.php?db=340734&s=74306&a=10433&k=23bf508

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NSW GOVERNMENT Department of Industry

What is the Code?

The Australian Honey Bee Industry Biosecurity Code of Practice (the Code) has been developed in consultation with beekeepers to provide a clear framework to engage in best-practice bee biosecurity.

The Code describes outcomes that you as a beekeeper must to achieve for effective pest and disease prevention and control. It is not a manual on how to keep bees; the Code explains what you must achieve, but how you achieve it will be up to you and will be influenced by your situation. Below describes standards set out in the code.

Standards set in the code:

- You must be a registered beekeeper.
- You must report notifiable pests and diseases.
- Your hives must be regularly inspected for the presence of pests and diseases.
- You must control or eradicate pests and diseases and must manage weak hives.
- You must maintain records of biosecurity-related actions and observations.
- Your hives must be appropriately constructed and branded.
- You must not allow your hives, or appliances to become exposed or neglected.
- You must allow your operation to be assessed.
- You must identify all apiary sites with signage containing contact information.
- You must maintain a barrier system of hive management.
- For beekeepers with 50 or more hives, you must demonstrate a minimum level of knowledge of pest and disease identification and management.
- For beekeepers with 50 or more hives, you must have your honey tested annually for American Foulbrood (AFB).

Bee Biosecurity in NSW:

My role as a Bee Biosecurity Officer is to encourage and support you with the implementation of the Code. I have been funded by beekeepers for beekeepers; so, if you require help or advice with any aspect of the above standards, make sure to contact me. I am able to assist in all aspects of the Code including pest and disease identification and inspections, controlling and eradicating disease like AFB and providing apiary identification signage. In promoting the code and working alongside beekeepers like yourself, the overall level of pests and disease will decrease and bee biosecurity in NSW will be enhanced.

Hayley Pragert | Bee Biosecurity Officer
Department of Primary Industries | 161 Kite Street | Orange
T: 02 6391 3652 | M: 0438 677 195
E: hayley.pragert@dpi.nsw.gov.au

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Contact **Mr Peter D Woodward**
CEO 0417 161 903, 03 8456 3543
peter.woodward@berringa.com or

Contact **Ms Clarissa Govic**
Customer Service Administrator
0491 340 092, 03 8456 3543
clarissa.govic@berringa.com

Medi Bioactive Honey Australia P/L
Unit 10, 198 Beavers Road,
Northcote VIC 3070, Australia

TYRE MANAGEMENT - THE TRUTH

There is some false information around about traction. Different people make different claims, or say that their product fixes everything. So who do you believe?

All traction travels through the flat spot where the tyre meets the dirt. The bigger this flat spot, the more traction. Make the flat spot more flexible, and you get more traction. This is why every smart four wheeler lets air out of his tyres when he goes bush.

Dropping the tyre pressure down until the tyre balloons out on the sides increases the length of this footprint or contact patch, and makes the tyre more flexible, letting it 'key' into the terrain, gaining more traction. By increasing the footprint size, the tyre won't sink into the ground, and it won't dig in as much, reducing drag, and adding mobility.

AIR CTI customers include trucks that operate on the Tanami corrugations, the Simpson Desert sand, Gelantipy snow, and Walhalla rock. B double log trucks pull full loads out of steep dirt tracks with 30 psi in the drive tyres where a single semi rig has to be towed out, while getting superb tyre life and doubling drive train life. Tyre manufacturers and Tire and Rim Associations recommend tyre pressures down to 25 psi for heavy duty trucks off road. Reducing tyre pressures improves traction better than any other tool, including cross locks, diff locks, and fancy suspensions.

Cross locks, diff locks, and walking beam suspensions are good tools, and have a purpose. But dollar for dollar, nothing matches simply letting air out of the tyres.

Keeping your tyres in contact with the dirt is important too. Some suspension systems don't articulate as well as they should. Walking beam tandem drive suspensions are the best for traction, but they don't ride very well. Some air suspensions are good, others are slow to articulate, but they ride far better. Reducing tyre pressures increases the tyre vertical deflection, vastly improving articulation, helping to keep the tyres on the ground making traction.

AIR CTI is simply a tool that makes changing tyre pressures easy and convenient. When on the highway, heavily loaded, select P1, the highest tyre pressure. Fully loaded on gravel roads, just push the P2 button, vastly improving ride quality and handling. For maximum traction, or running empty on gravel, push the P3 button for the lowest pressure. This is exactly what the tyre manufacturers recommend.

Added benefits are numerous. Better stopping ability. Less slipping and sliding. Less tyre wear. Fewer punctures and staking. Longer suspension life. Longer drive train life. Safer, greener, more comfortable, and more profitable. This is all totally proven, having been tested by many governments, and major companies throughout the world, along with our 20 years of feedback from our customers.

Prove it to yourself one day when you have a couple of hours. Start with your empty truck. Let the air out of your tyres until the rear tyres have a flat spot the same as your front tyres. Then go for a drive. Notice the vast improvement in ride and traction. The flat spot on all of your truck's tyres should be 150 mm long on all bitumen roads. Off road, the flat spot should be longer, 225 mm approximately. Don't forget to blow them back up for your next load.

Our pressure recommendations come from the tyre manufacturer Load to Inflation tables. Weigh the steer axle only then weigh the entire truck. Subtract the steer weight from the truck weight, and you now have the axle weights. Look up the tyre size and the axle weight on the table to see your correct cold tyre pressures. Weigh your truck empty, or as empty as you normally run, and fully loaded and check the tables for the optimal tyre pressures. We have charts for off road and lightly loaded axles to ensure your profitability and reliability.

AIR CTI works for you all the time, keeping you safe, comfortable, and profitable.

G'day to all our friends doing a great job looking after our smallest farmers.

Cheers
Chet Cline, AIR CTI

ADVERTORIAL

AUSTRALIAN HONEY BEE INDUSTRY COUNCIL

Executive Director: Trevor Weatherhead Phone: 07 5467 2265
Mailing Address: PO Box 4253 Raceview QLD 4305 Email: ahbic@honeybee.org.au

FOR THE LATEST NEWS GO TO THE AHBIC WEBSITE: **www.honeybee.org.au**

AHBIC NEWS UPDATE - Aug/Sep 2016

ASIAN BEES AND *VARROA JACOBSONI* IN TOWNSVILLE

We have had industry representatives go to Townsville to help out with the incursion. The main role for our industry volunteers is to teach the local beekeepers how to carry out sugar shakes, alcohol washes and drone uncapping. They also get to see the beelining and the use of the helium balloon to catch drones. This has been very successful and thank you to those who have already volunteered and been to Townsville. We have achieved a lot.

I have taken over the rostering of beekeepers from Craig Klingner. We do have some on our list for future deployment and I have been in contact with them. However if there are other beekeepers who would like to volunteer please contact me. You would need to supply me with details such as how many hives you have, how long you have been keeping bees and also if you have had experience with sugar shakes, alcohol washes or drone uncapping.

Email ahbic@honeybee.org.au or phone 07 5467 2265.

AHBIC pays the accommodation at Townsville plus refunds airfares up to $600 except for Western Australia which can be greater on negotiation with AHBIC. You look after your meals whilst in Townsville. The accommodation has cooking facilities so you can cook for yourself.

The funding for the volunteers is made available from the Producer Contingency Fund and we thank them for that contribution.

If you receive this newsletter you would have been receiving the updates on the progress in Townsville.

DROUGHTS AND FLOODING RAIN

When Dorothea Mackellar wrote about Australia being a land of droughts and flooding rain, I am sure there are beekeepers who will agree with her.

In recent months what were drought conditions have changed to flooding or boggy conditions.

Graham Beech has put on Facebook his loss of hives on canola. Many photos there.

There are reports of hives still not being able to be shifted off almonds because of wet conditions.

Also in the far west of Queensland hives had to be lifted out by helicopter because of the water.

So far no report of losses of hives in South Australia but it is expected that there will be losses once beekeepers can get to where their hives are

.

There are reports of flooding in Tasmania down around Hobart. No reports to date of any hive losses.

There are reports of more rain in the south over coming weeks. Not the news many beekeepers were hoping for. Maybe long term it will have benefits.

Also the low temperatures have not been favourable to honey production from canola in some areas of southern Australia.

BEE LOSSES DUE TO ZIKA VIRUS SPRAYING IN THE USA

There are reports of dramatic losses of honey bees in the USA due to spraying for mosquitoes to stop any spread of the zika virus.

See http://www.beeculture.com/catch-buzz-south-carolina-county-inadvertently-kills-millions-honeybees/? utm_source=Catch+The+Buzz&utm_campaign=61c46c7ee0-Catch_The_Buzz_4_29_2015&utm_medium=email&utm_term=0_0272f190ab-61c46c7ee0-256241481 and https://www.theguardian.com/environment/2016/sep/04/zika-mosquito-neurotoxin-kills-bees-livelihoodsbeekeepers

HONEY MONTH COMMITTEE CHAIR

No volunteers, as yet, for the position of Chair of the Honey Month Committee. If you are interested please let me know.

DRONE BEE SEMEN IMPORTATION

The latest negotiations with the Department of Agriculture and Water Resources seem to have achieved our industry's desired results. We are awaiting final confirmation.

DEAD *APIS DORSATA* IN PERTH

AHBIC has received advice for the office of the Chief Plant Protection Officer in Canberra that 25 dead giant honey bees (Apis dorsata) were found in the cargo hold of a plane from Malaysia on 20 September, 2016. No live bees were found.

Examination of the bees found no mites on them. No further action is required.

Over the years there have been several instances of dead giant honey bees being found in cargo holds of planes out of Malaysia. It would seem the bees are attracted to the lights around the airport.

TOP 40 EXOTIC AND UNWANTED PLANT PESTS

The Plant Health Committee have put out a list of the Top 40 Exotic and Unwanted Plant Pests.
See
http://www.agriculture.gov.au/pests-diseases-weeds/plant/pests-disease-list/

For the beekeeping industry we have two (2) in the top 40. They are internal and external mites of bees and exotic bees.

TRADEMARKING OF MANUKA

Some in New Zealand are attempting to trademark "manuka" and make it so that only honey from *Leptospermum scoparium* in New Zealand can be called manuka. We are watching developments here and will be objecting. Manuka is a term that has a history of use in Australia as well.

AHBIC can well understand the New Zealanders wanting to make sure that what is labelled as New Zealand manuka is in fact manuka. Australia is also on the same position. Some see it as NZ wanting to collar the market.

There is no reason why Australia and New Zealand could not work together to make sure that what is sold as manuka is manuka. There are many cases of fraudulent labelling of manuka around the world.

There has been some publicity on this. This is a recent article in the Wall Street Journal.

"New Zealand, Australia Fight over Manuka Honey Pot

Fearing the sting of competition in the market for the premium-priced superfood, New Zealand seeks to trademark the name

By Lucy Craymer - 31 August 2016

A sticky tug-of-war has arisen over the right to the "manuka honey" label—the name attached to a pricey variety whose superfood status has won it fans from TV's Kourtney Kardashian to tennis star Novak Djokovic.

New Zealand honey makers recently made a beeline for the country's Intellectual Property Office seeking exclusive international rights to "manuka," noting that it's the name their country's indigenous Māori people gave to the tree whose nectar is the basis of the honey. Their counterparts in Australia shot back that while they may mostly know the tree by the rather more prosaic name "jellybush" (in scientific nomenclature, Leptospermum scoparium), it is native there as well.

"They complain that they can't produce enough manuka honey for the world, and they forget about us," Lindsay Bourke, chairman of the Australian Honey Bee Industry Council, said of the New Zealanders.

"They are our closest friends, and they should be working with us."

The Australian council said it intends to file an objection to the trademark application, which was made by Unique Manuka Factor, a trade group representing most of New Zealand's manuka producers.

For the honey makers of New Zealand - No. 3 globally in honey exports at $227.6 million, around 80% from the manuka variety—the worries go deeper than Australia. They fear that anyone in the right climate could get hold of tree seedlings and start making their own manuka. At least one U.K. producer is marketing some of its honey as containing the manuka variety.

Winning a trademark would prevent producers outside New Zealand from labeling their honey manuka -much as wine producers outside France's Champagne region are barred from using that storied name for their sparkling wine, even if they make it with the same grapes and the same production process.
"It's about protecting the names and words that are of value to you as a country," said John Rawcliffe, spokesman for Unique Manuka Factor Honey Association. "Anyone could plant manuka anywhere. And the consumer is demanding to know it has come from here."

The incentive on all sides is fireweed-clear: While the export value of ordinary honey is about 20 US cents an ounce, manuka honey can bring $3.40, according to the New Zealand government. Its popularity is driven by scientific research showing it can help heal wounds, ulcers and burns—the U.S. Food and Drug Administration has approved the sale of manuka-honey dressings—and bolder claims by fans that its health benefits range from soothing a sore throat to boosting the immune system. The honey's antibacterial properties are the product of substances in the nectar produced by the tree's flowers, converted and accentuated by bee magic.

Mr Djokovic, ranked world No. 1 in men's singles tennis, has said he starts his day with two teaspoons of manuka honey and also eats it during matches. Manuka fan Ms Kardashian has been hired to front an advertisement for New Zealand-based cosmetics company Manuka Doctor.

The decision to apply for a trademark, Mr. Rawcliffe said, was partly prompted by signs that Australia's manuka industry while still small in comparison to New Zealand's, is busy getting bigger.

Australian researchers are working to determine which of the country's 86 jellybush varieties produce the right kind of nectar, new investors are looking to move into the sector and existing producers are increasing capacity.

"The market has really exploded and much of that has been driven by demand from China," says Michael owes, owner of Active Medicinal Honey Pty Ltd., who is looking to double the number of hives he has in Australia's New South Wales to 1,000.

Not everyone in New Zealand is upset by Australia's ambitions. New Zealand honey producer Comvita Ltd. has formed a joint venture with Australia's largest producer, Capilano Honey Ltd., to increase its access to Australian honey. Comvita looked to source from Australia because its manuka is cheaper -primarily because consumers dislike the taste. For Comvita, this isn't a problem, Chief Executive Scott Coulter said: It buys the honey mostly for medical uses.

As for the name, Mr. Coulter added, Australia has reasonable objections to New Zealand's monopoly hopes - beyond, that is, having a suburb of its capital, Canberra, called Manuka.

"They have the same type of plant and produce the same type of honey," he said, "so it's hard to argue that it's the sole rights of New Zealand to sell that type of honey."

The AHBIC Chairperson has also put out some information:

GRAND THEFT MANUKA
A recent application by the UMF Honey Association Inc of New Zealand to trademark 'Manuka Honey' is an affront to Australian producers.

Manuka honey has been produced here in Tasmania since the arrival of the European honey bee. There are numerous records of the word 'Manuka' in print and in place names dating back at least to 1884. The Manuka tree, or Leptospermum scoparium, originated in Tasmania and seed dispersed from there to New Zealand. Australia is home to over 80 species of Leptospermum to New Zealand's one, yet New Zealand apiarists wish to claim it as their own!

We could sympathise; they long assumed that Manuka was unique to New Zealand and much of the marketing and

research from which all Manuka producers now benefit was undertaken on that basis.

However, neither the name 'Manuka' nor the species Leptospermum scoparium are unique to New Zealand and Manuka should not join Kiwi Fruit and Bungee Jumping on the list of stolen and re-branded Kiwi products.

Australia will fight this application if necessary - but the point is we shouldn't have to!

Lindsay Bourke
Chairman
Australian Honey Bee Industry Council

LEVYABLE HONEY IN AUSTRALIA

Figures provided by the Department of Agriculture and Water Resources have shown a significant decline in the amount of levyable honey in Australia in recent years. From the figures below we can see that since 2012-13 the amount has decreased by around 33%.

Year	Kilos of honey on which levy was paid
2012-13	22,384,754
2013-14	21,762,399
2014-15	17,995,189
2015-16	14,810,747

This decrease has all sorts of ramifications for our industry.

Firstly, the amount of research levy has decreased which means that the amount of research will decrease because of the lack of levy receipts and the resultant loss of matching money by the Federal Government.

Secondly, funding of the Bee Biosecurity Officers (BBO) is also funded out of the levy collections and a loss of production will result in a reduction in the amount of money collected for funding the BBO's.

Thirdly, the National Residue Survey (NRS) levy receipts will be down. We are already using up reserves in this fund.

This comes on top of the European Union requirements, from their recent audit, that the NRS program be changed which will result in increased costs to run the program.

So we can only hope for better seasons so that our honey production gets back to a normal situation.

HILLSTON ALMOND POLLINATION

NSW BIOSECURITY OPERATION

By: Daryl Cooper NSW Biosecurity Officer & Apiary Inspector

NSW Apiary Inspectors are going Nuts

The locality of Hillston in the Lachlan irrigation area is home to the largest almond plantations in NSW. The two orchards in this area comprise of approximately 1800 hectares of producing trees. Standing olive orchards are being removed to make way for the growing demand for almonds.

Stone fruit & citrus orchards are being replanted with almonds and large tracts of arable irrigated land are being prepared for almond plantings in the Griffith area.

With industry expansion comes the need for an increase in strong healthy bee hives for pollination services. A broker is responsible to facilitate this service and they rely on commercial apiarists that can provide large numbers of healthy hives to complete pollination within the limited window of blossoming. (note: honey bees will not receive a large food source whilst performing almond pollination. They need to have ample food stores and be healthy to conduct their services adequately).

Apiary Inspectors are involved in operations in these orchards to monitor compliance with the *NSW Apiaries Act 1985*, and in particular to regulate that the movement of beehives onto these properties are of no disease risk to other apiarist's hives involved in the pollination process.
During our recent inspection of apiaries on these properties we were disappointed to find hives dead with a notifiable disease, American Foul Brood (AFB). This is a serious bacterial disease of the brood which is fatal to the colony). These hives were destroyed on site to manage the immediate risk of spreading the disease to other nearby colonies. Brokers were informed of the inspections and the resulting actions that will be taken to manage the future risk.

Operation Hillston highlighted the problems still being encountered with the presence of a notifiable honey bee brood disease in commercial apiaries, the lack of health certification for interstate consignments and the failure of beekeepers to identify hives. Almond property managers have shown notable enthusiasm in NSW Biosecurity Compliance Officers returning next season to conduct compliance activities within their properties. The efforts of the Compliance Officers will encourage the apiary industry to supply a biosecure product/ service and hopefully increase the productivity & yield of the NSW Almond Industry.

NEW BOARD and CEO - IT'S THE BEES' NEEDS

THE WHEEN BEE FOUNDATION

ABN 84 139 073 082

A focus on the urgent needs of bees and their role in pollination and food security underpins the recent addition of two new board members and a CEO to The Wheen Bee Foundation.

Robert Costa, of Costa Asset Management and Sam Malfroy, well known in the beekeeping industry, have joined the Foundation's board; and Fiona Chambers has been appointed CEO.

"*The Foundation is committed to working to raise funds to support co-investment in pollination capacity programs"* said Max Whitten, Chair of The Wheen Bee Foundation. *"The Board recognized that to support improvements to bee health and pollination security, we needed a broader range of skills to strengthen our existing capacity and influence*".

The appointments increase the number of Wheen Bee Foundation directors from four to six.

About the Wheen Bee Foundation
The Wheen Bee Foundation is a not-for-profit organisation established to improve awareness of the importance of bees for food security, and to raise funds for research that addresses the national and global threats to bees. Tax deductible donations to the Wheen Bee Foundation Fund help finance projects to improve honey bee health and maintain a viable beekeeping industry. Although the main focus of the Foundation is honey bees, we also support research on other pollinators, such as Australian native bees.

About Robert Costa
As a co-founder of Costa Group, Australia's largest grower and marketer of fresh fruit and vegetables, Robert managed the company's asset base and balance sheet, including working capital, liquidity and cash flow. Currently Chairman of Costa Asset Management, a privately owned Australian company with a large and diverse range of assets, Robert's exceptional financial and commercial sense, and his knowledge of Australia's horticultural industry, will be invaluable to the Foundation.

About Sam Malfroy
Sam brings a wealth of personal and professional skills and expertise to the Foundation. Coming from a commercial beekeeping family in the Blue Mountains, Sam studied horticultural science at the University of Sydney before moving to Canberra to work in plant exports with the Department of Agriculture, Fisheries and Forestry.

In 2011, Sam joined Plant Health Australia where he led and coordinated many national honey bee and pollination projects. Most notably, this included the National Bee Pest Surveillance Program, the Varroa Continuity Strategy, the establishment of the National Bee Biosecurity Program and the development of resources for beekeepers such as the BeeAware website and Bee Biosecurity Manual. Sam returned to the Department of Agriculture and Water Resources in 2016 and currently works in Trade and Market Access.

About Fiona Chambers
Fiona has 30 years business experience in the production and marketing agricultural and horticultural commodities both in Australia and overseas. For the past seven years Fiona has lectured in business management and marketing at Marcus Oldham College in Geelong, Victoria. As convener of the Marcus Oldham Rural Leadership Program and the APAL Emerging Leaders' Program, Fiona has extensive networks with leaders across a range of rural industries throughout Australia.

A unique mix of experience across business, marketing, animal and plant production, has Fiona well positioned to perform the role of CEO for the Wheen Bee Foundation and forge the necessary links between the bee industry and pollination dependent industries.

With the new appointments in place, The Wheen Bee Foundation is inviting industry contact through the CEO:

Fiona Chambers
Mobile: 0427 354 457
Email: ceo@wheenbeefoundation.org.au
www.wheenbeefoundation.org.au

Whats Happening to the Bees? - Part 4

The Genetic Consequences of Domestication

by Randy Oliver - ScientificBeekeeping.com

First published in: American Bee Journal, May 2014

I'm beginning this article at the point in time when beekeepers first learned to select for more manageable and productive bees. At the moment that humans began controlling the reproduction of honey bee stocks, the process of domestication was begun. This process has intrinsic genetic and biological consequences, some of which have come to haunt us today.

The Domestication of the Bee

As humankind comes to depend more and more upon domesticated species to feed our growing population, animal and plant breeders are realizing the value of the genetic diversity of the wild stocks from which our domesticated species were derived. Chaudhary [1] explains that:

The term "domestication" is often used to describe the process by which wild becomes stabilized… domesticated forms are by definition wild species with certain traits highlighted under human selection.

He also wondered:
Is such…transformation under domestication universally advantageous or [is it] accompanied with the loss of an "additional" benefit? What is the spectrum of consequences of having a set of important genomic loci selected under human selection?

This is an exceedingly difficult question to answer, in large part because "success" is an ill-defined term that can refer to anything from short-term proliferation of individuals to long-term effects on lineage diversification.

Referring to the domestication of crop plants, he warns that:
Recent large-scale microarray studies on the comparison of wild and domesticated forms of selective plant species confirmed that global gene expression had been radically altered by domestication…Using DNA technologies, the diversity of domesticated tomatoes is estimated to comprise [less than] 5% of the genetic variation as compared to the rich reservoir in wild relatives.

Though the successful application of breeding programs has produced high-yielding crop varieties, ironically the plant breeding processes have threatened the genetic basis upon which the breeding depends.

So How Does This Apply To Bees?

In recent years, I've heard beekeepers complain again and again as to how our bees aren't as "tough" as they used to be. A large part of this clearly has to do with the negative impacts of the varroa/virus complex, *Nosema ceranae*, and miticide contamination of our combs. But some recent visits to Southern California beekeepers made me suspect that there has been a more constitutional change in our bees in the aftermath of the varroa invasion.

SoCal beekeepers Rob Stone and Sean Crowley have generously taken time to allow me to inspect apiaries stocked with various combinations of commercial domesticated bees, local feral (partially Africanized) bees, or hybrids of the two—at the most stressful time of the season. I could not have been more impressed by the obvious differences between the races! Although I am familiar with the generally excellent performance of purchased bees under good management practices, the health and vigor of the feral bees ***under less than optimal conditions and management*** was striking. Although the hived ferals clearly exhibited "touchier" temperament, and focused their efforts more upon brood production than upon storing honey, I am haunted by the images of how fit and robust they were (Fig. 1), compared to the floundering domesticated stocks.

Figure 1. Sean Crowley holding brood frames from a typical Southern California hived feral colony (untreated for mites). This photo was taken on Sept. 27, at the end of the summer drought, shortly after a light fall nectar flow had begun. Nearby colonies of commercial stock at the same time had minimal brood, and were being eaten alive by varroa.

Those feral colonies reminded me of the bees of yore, which could be hived and then left to fend for themselves for years at a time, compared to the commercial bees of today, which are unable to survive without being coddled, fed, medicated, treated, and requeened on a regular basis. The question that occurs to me is, have our domesticated bees lost some of the innate vigor of their parental stocks?

Practical application: Two burning questions keep bugging me:

1. **Why are our bees such wimps compared to some feral stocks? And,**
2. **Why have the bees in their European homeland not yet evolved resistance to varroa, when some other races quickly developed resistance?**

Although I may be taking a circuitous route to get there, please keep in mind that these articles are simply my semi-organized and evolving notes to myself as I try to answer the above two questions to my satisfaction.

The Cost of Domestication

In the Mediterranean and Central European environments modified by human colonization, the reproductive success of the honey bee was put largely under the control of beekeepers,

by virtue of their controlling the supply of nesting cavities. And that changed the process of evolutionary selection for "fitness" from the ability of a colony to thrive in a natural setting, to its amenability to live as an animal domesticated by Man. "Fitness" now meant being gentle, productive, willingness to nest in manmade hives at ground level, and the ability to survive in close proximity to many other such hives.

Early in the domestication process, the selective process would have been little different from that exerted by Mother Nature, other than that humans would exert a strong negative selection against excessive colony defensive behavior (stinging). So at this point in time, the "semi-domesticated" bee population and the wild bee population would have freely interbred wherever there existed natural bee trees nearby. Later on, the selective processes for those two populations would diverge, a subject to which we will later return.

I was curious as to whether there is a price paid by a species (whether animal or plant) in the process of becoming domesticated, so I read up on the subject, and found it both fascinating and likely applicable to the domestication of the honey bee. Returning to Chaudhary, he asks:
What is the spectrum of consequences [in] genes and mutations underlying domestication transitions (colloquially called [the] "domestication syndrome")?

Selection by humans for what we consider to be desirable traits may come at a cost in fitness of that domesticated breed should it be forced to face the stresses of nature without human support. As a bee breeder, I find this subject to be worthy of deeper investigation. As a biologist, I'll start by going straight to the heart of the matter.

Genotype vs. Phenotype
If we're going to talk about breeding, then we need to discuss genetics, a widely misunderstood subject. So let's start off by defining some terms [2].

Population or more specifically, the "breeding population": a population of organisms within which free interbreeding takes place and evolutionary change may appear and be preserved. Mother Nature does not recognize "species;" species names are merely a human construct invented by those who wish to organize everything into categories. In nature, there only exist "populations" of interbreeding individuals sharing a common gene pool, and whether or not they are species, subspecies, or races is a matter of debate for the taxonomists.

The **phenotype** of an individual honey bee, a colony, or a population is the set of *observable* characteristics (size, color, honey production, wintering ability, defensiveness).

The **genotype** (the "genetics**"**) of a bee or colony is the set of inherited genetic instructions encoded in its DNA. But not all organisms with the same genotype look or act the same, because appearance and behavior are modified by environmental and developmental conditions. Likewise, not all organisms that look alike necessarily have the same genotype.

Genes: when we refer to two bees having different "genes," what we really mean is that they have two different forms (variants) of the same gene. Different forms of a gene are called **alleles**.

Both in natural selection and in traditional selective breeding, selection is applied to the expression of the *phenotype*, rather than the *genotype* [3], since it is the phenotype that directly interacts with the environment. Absent genetic techniques, all that we can describe as differences between any two bees, colonies, or races of bees are phenotypical variations. In nature, there is often a continuum (rather than discrete steps) of phenotypes, as well as of genotypes, in the individuals composing a species over its range [4] (Fig. 2).

Figure 2. Note the continuum of abdominal coloration patterns in the bees of this hive, ranging from black/gray to nearly all golden, with various widths and darkness of the banding. I'm happy to see such a mix of colorations (phenotype) in my hives, as a visible proxy for genetic diversity (genotype).

Taxonomists describe nearly 30 races (subspecies) of honey bee over the species' natural range from the tip of Africa, up through the Middle East and Mediterranean, and northward into Europe. Traditionally, these races were classified by physical characteristics, such as color, size, behavior, and morphometric analysis (measuring wing venation and body part proportions). More recently, we can use genetic tools to differentiate these races by comparing the variety of forms (alleles) of various selected genes [5]. In the various races of bees, certain alleles are said to be "fixed" (or "nearly fixed'); that is, only one form of that particular allele is found in that particular breeding population. (Note the lack of fixation in the coloration patterns of the bees in the photo above. In the identification of wasps (in which the coloration patterns are fixed), such differences would be found only in separate species [6].

When we speak of a population having genetic diversity, what we mean is that that population carries a diverse mixture of non-fixed alleles. This diversity is critical for species survival in the wild, since in nature, *things change*. There are droughts, heat waves, hordes of locusts eating all the forage, unusually frigid winters, late springs, pathogen epidemics, or other conditions that favor colonies of bees possessing certain combinations of alleles over others. It is only through this genetic and phenotypic diversity that a portion of a species' population is able to survive such extreme or unusual events, or adapt to other changes in the environment. This concept also applies to the individual bee colony:

Practical note: the success of a colony is dependent not only upon the genotype and phenotype of its queen (such as her ability to lay a great many eggs and her production of adequate pheromones), but even more so upon the combination of phenotypes of the various patrilines of workers (the collective offspring from each of the individual drones with which the queen mated). Colonies without a diversity of patrilines exhibit poor disease resistance and winter survival [7].

Now I've got one more term to throw at you:

Epigenetics: the heritable changes in gene expression that are not caused by changes in the DNA sequence; the term can also be used for an organism's regulatory responses to the environment that may be heritable for one or more generations.

So what does that mean? Every bee comes with a *genetic* manual encoded in its DNA. That manual contains

"instructions" with numerous options as to how to build every part of its body, how to make every physiological system work, and for every aspect of its behavior. Its *epigenetics* tell it which options to apply, based either upon the bee's heritage, feeding as a larva, its exposure to pheromones, or to other environmental cues. The end result is that the bee's *phenotype* (physical form) is a result of the epigenetic expression of its *genotype*. Let me use the epigenetic differentiation of the worker, queen, and drone bees as an example (Fig. 3):

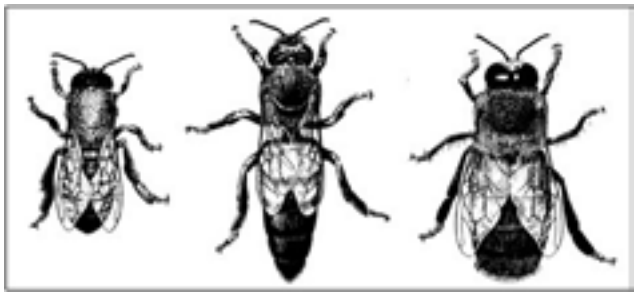

Figure 3. The obvious phenotypic differences between workers, queens, and drones are not due to genetics, but rather due to epigenetic regulation of the development of the immature bee. Illustration from [8].

The worker, queen, and drone above are clearly different organisms in size, physiology, morphology (shape and structure), longevity, reproduction, and behavior (only workers forage or sting in colony defense). The amazing thing is that a fertilized egg has to *genetic potential* to become any of the three. The difference in their developmental paths from egg to sexual adult is not due to genetics, but rather to epigenetics.

Unlike humans, in which maleness is determined by the inheritance of a sex-determining Y chromosome, in bees (which have no sex chromosome) the default development of any fertilized egg is to become a male (yes, fertilized eggs can develop into viable diploid drones [9]). The egg will become a female only if it inherited two different variants of the "sex allele" at one specific gene locus on chromosome 8 (the complementary sex determiner (csd) gene). Haploid (unfertilized) eggs would of course have only have one sex allele, since they'd have only a single set of chromosomes, and thus always become males. Surprisingly, the csd gene is not even directly involved in the feminization process—the presence of two different alleles at this "sex locus" is merely a trigger for the cell to epigenetically activate another gene (called *feminize*) [10], which *then* starts the process of feminization.

My point is that since the csd gene doesn't code for any proteins involved in actually growing the bee, that means that for all intents and purposes a worker, queen, or drone are genetically identical, and it is only the epigenetic regulation that makes them develop differently. In the female castes, this regulation is based upon what the larvae are fed by the nurses (who choose whether a larva will become a worker or a queen) [11].

In other words, the bee is akin to the stem cells in your body—it can develop into any number of forms. Such an organism is said to exhibit *phenotypic plasticity.* And the honey bee exhibits such plasticity at both the individual and at the colony level. As observed by Weiner and Toth [12]:
Phenotypic plasticity is an important biological phenomenon that allows organisms with the same genotype to respond adaptively to variable biotic and abiotic environments.

In some of my previous articles on pheromones and the division of labor in the colony [13], I showed how the colony responds to environmental cues such as nectar flows, pollen dearth, status of the queen, pheromones, and illness. Such day-to-day or region-to-region adaptability is largely brought about by the epigenetic up- or down-regulation *of the same set of genetic instructions*. Of considerable interest is Robert Paxton's experimentation (described in a fascinating video [14]) in which he found that one species of sweat bee can live either as a solitary bee or as a eusocial colonial bee, dependent upon the temperature of the environment!

Practical application: simple differences in regulatory triggers (e.g., influence of temperature [15], pheromones, components in the jelly fed to larvae, or the activation of a single regulatory gene) can result in major differences in the shape, structure, and behavior of genetically identical bees. My point is that it may not take much *genetic* evolution in order to result in big differences in the *phenotype* of the honey bee. To the early beekeepers selecting for better bees, they needn't have changed the genome to any great extent—they only needed to select for some minor epigenetic regulation of the existing genome.

A very recent study is of interest. Harpur, et al [16] undertook a comprehensive population genomic study of the honey bee by sequencing the genomes of 40 individual bees from different geographic regions. They found that the genes coding for proteins expressed solely by workers have evolved at a greater rate than those for queens, especially those associated with division of labor, the nursing of brood, worker behavior, worker sensory responses (such as to pheromones or other environmental cues), cognition, nervous system development, metabolism, and steroid hormones.

Practical application: so it is likely not important to select for queen characteristics (size, shape, color), but rather to select for the performance of the entire breeding population of colonies from which to pick your breeders (in my own breeding program, I don't even bother to see what the queen looks like).

Look, I'm at about my limit of understanding of all this, but every single aspect of bee reproduction suggests to me that it is set up for three things:

1. **Maintaining genetic diversity.** The ecological success and adaptability of the honey bee is all about its *genetic diversity*, not only at the population level, but also at the colony level.
2. **Rapid adaptability.** The high genetic recombination rate of the species [17] coupled with the haploidly of the drones (which effectively weeds out maladaptive allelic combinations [18]), the multiple matings by the queen, the amazing epigenetic adaptive plasticity of the species, and the rapid rate of subspeciation all cry out *adaptability.*
3. **Recovery from decimation events**. Catastrophic events such as drought, forest fire, extreme winters, unfavorable seasons, or epidemics of infectious disease can decimate a regional population of bees. But due to the genetic reservoir of any surviving colonies (stored in the diverse semen in the queens' spermathecas), the swarms issued from the survivors have the potential to reestablish much of the original genetic (and epigenetic) diversity of the former population—each colony of bees is essentially a "genetic ark." Estoup [[19]] observes that "the average heterozygosity [genetic diversity] of a population [of honey bees] can be estimated from a single colony with fairly good precision."

Practical application: when we practice selective breeding of the honey bee, we are fighting the nature of the beast. The extraordinary ecological success and adaptability of the honey bee is all about maintaining genetic diversity; selective breeding, on the other hand, results in loss of such diversity. Perhaps we should seriously question whether we have been helping or hurting the honey bee as a species. Again, I will return to this subject later.

The Gene Ocean

Apis mellifera doesn't just have a gene pool—it has (or had) a "gene ocean" to draw from. Those many races of bees stretching from South Africa to the Baltic form a continuum of shared genetics [20]. Hepburn [21] explains:

Populations of honeybees previously thought to be homogenous and thus defined as races or subspecies, actually emerge as a potpourri of independently oscillating traits within a continuous metapopulation. In this respect, honeybee populations confirm the tendency noted for other animals and plants in which genetically independent characters show independent geographical variation and have the capacity to recur in more than one geographical area.

Just as the waters of the ocean swirl and slowly mix, there is a flow of alleles (commonly called "gene flow") throughout the vast population of *Apis mellifera*. And as new mutations, viral integration of genes [22], novel genetic recombinations, and heritable epigenetic factors occur, these may meld into that flow and add to the overall genetic diversity of the species as a whole. Within any race of honey bees, there are subpopulations that noticeably differ; and in the areas between any two races of bee, there are zones of hybridization in which novel genetic combinations are continually tested for fitness.

OK, you ask, what's this got to do with the domestication of the honey bee? I'm getting to that. The process of domestication directly affects the…

Size and Genetic Diversity of the Breeding Population

Now we get to the crux of the issue:

Practical application: the ability of a *population* of bees to adapt to changes in the environment or to novel pathogens is largely dependent upon its genetic diversity (see sidebar [citations [23]).

In interest of simplicity, I'm going to use the term "genetic diversity" to refer to all heritable factors, genetic and epigenetic.

At this point in time, there is a paradigm shift going on in biology as we begin to understand that the interpretation of genome into phenotype is done by epigenetic regulation [a].

The genetic code is like having the mind-boggling 74,000-page US tax code sitting on your lap. Epigenetics is like having a business consultant, accountant, attorney, and tax advisor there to tell you how to apply that code to your advantage.

Epigenetic factors may be temporary (the responses to pheromones [b], for the life of the organism (effects of pesticide exposure or larval temperature or nutrition), or transgenerational (for one or more generations; or "fixed" for all generations)[c].

And there are sometimes huge differences in transgenerational epigenetic inheritance dependent upon the sex of the contributing parent [d]. We are only beginning to understand the complexity of epigenetics, and I am no expert; but they certainly play a large role in honey bee biology and breeding!

The maintenance of the genetic diversity in a population is dependent upon several factors, notably:

1. The rate of mutation and recombination (the swapping of genes in the process of germ cell formation),
2. gene flow within the breeding population (and from without, including hybridization), and
3. the total "Effective Population Size" (N_e).

I've already mentioned that bees have a high rate of mutation and gene flow. But what do I mean by Effective Population Size?

When the gene pool of a population of interbreeding organisms is reduced in size (even for a single generation), either due to decimating catastrophic events, geographical isolation (as by climate change isolating populations between oceans, mountains, deserts, or glaciers), or the invasion of a breeding population into new territory, the genetic diversity of that gene pool is often reduced to a "gene puddle" (not a scientific term). Such an event is called a "genetic bottleneck" [24], which reduces the "effective population size."

To illustrate these bottlenecking processes, I've modified a visual illustration from a paper by Wang [25] (Fig. 4).

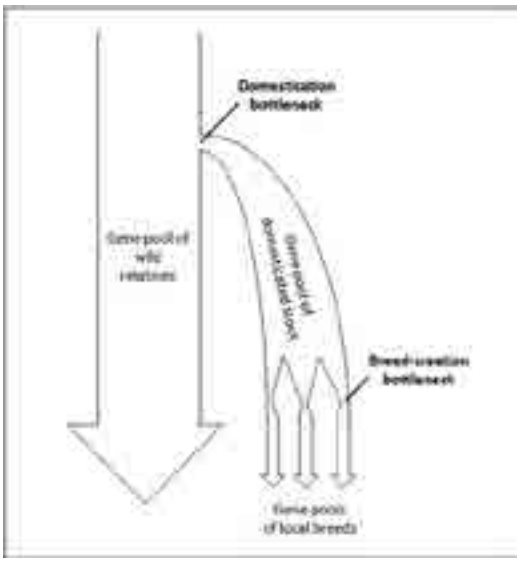

Figure 4. A generic model of the genetic bottlenecks resulting from the selective breeding involved in the process of domestication. At each bottleneck, the effective population size is reduced. The question then is, to what degree have our current breeds of bees lost genetic diversity? Graphic modified from [26].

The Consequences Of Bottlenecks

Following any bottlenecking event, the population must rebuild. The problem is that such rebuilding is limited by the genetic diversity of the *founding population* (which was only a portion of that of the original population). Even worse, as the population rebuilds from the founders (either due to natural causes or human selection), at each generation, some alleles, due to either randomness of matings or human selection, tend to be lost. This phenomenon is termed *genetic drift*, the result being that populations established from small founder populations tend to suffer from loss of genetic diversity - the smaller the original (and the maintained) population, the greater the loss of diversity. One resulting negative effect is called ***inbreeding depression***, due to the expression of unmasked deleterious recessive alleles (a subject to which I will return).

Such reduction in the effective population size is especially problematic with species that have haploid males with a sex determining gene (case in point, the honey bee) [27]. Colonies headed by an inbred queen suffer from low brood viability [28], due to the development of "diploid drones" when a fertilized egg did not inherit two different sex alleles from its parents. Since a queen is limited in the number of eggs that she can lay a day, reduced viability of the resulting brood can greatly reduce the ability of a colony to grow and store honey.

Practical application: this is why you want to see solid brood patterns in a hive.

But that's not the half of it! A far more important deleterious effect of inbreeding is that the resulting population has a greatly reduced ability to fight infectious diseases (for an overview of this phenomenon, I suggest [29]). The beneficial effect of genetic diversity to slow the spread of infectious diseases is commonly used in agriculture [30]. In a worst-case situation, in which all organisms in a population are genetically identical (as in typical monocultures of cloned cultivars) the first pathogen able to infect one individual can quickly spread to all others in epidemic fashion (think of the Irish potato famine, the Gros Michel banana, or the decimation of the Inuit by the Spanish flu). On the other hand, if a population of organisms is genetically diverse, slight differences in proteins and immune responses among individuals inhibits the transmission rate of pathogens, limiting the progression of epidemics.

Practical application: of major and direct importance to beekeepers, especially in these days of globalization and the transport of pathogens and parasites from one bee population to another, is that bee populations with a limited genetic toolbox exhibit less vigor, decreased ability to fight epidemics of parasites or infectious diseases [31], and less ability to evolve and adapt.

Cases in point:

- The vigorous untreated Southern California colonies that so impressed me.
- The rapid natural evolution of varroa resistance in both unmanaged races of bees in South Africa (taking place in 4- 6 years, as compared to not yet happening after decades of varroa presence in Europe) [32].

So How Much Genetic Diversity Have We Lost?
Good question! This is a theme that has been raised for a number of years by Steve Sheppard, Sue Cobey, and Debby Delaney (I'll return to their findings later).

One possible indicator of genetic diversity is to look at the number of sex alleles in the population (since these are all variants of a single gene). I'm not sure if this is the best indicator, since this gene appears to mutate at a relatively high frequency (on an evolutionary time scale). Given that caveat, the diversity (or lack thereof) of sex alleles in our domestic bee populations may be an indicator of the degree to which our selective breeding has narrowed down the gene pool.

So how much genetic diversity was lost as *Apis mellifera* migrated into Europe to found the current races of bees, and then further lost as beekeepers selected specific manageable stocks?

Early estimates [33] of the number of sex alleles present in the various races of bees ranged from 8–12. Later, Adams [34], sampling 90 Brazilian colonies consisting of freely-mated hybrids between *A. mellifera adansonii* and *A. mellifera ligustica,* with at least 500 other hives within flight range, came up with an estimate of about 20 sex alleles for this larger hybrid population.

The above estimates suggest that the presence of 8–20 sex alleles may be the norm for managed populations of European bees. So how does that compare to the diversity in the wild bee population as a whole? Lechner [35] took on this task, stating that:

When studying the population dynamics of csd alleles in honey bees, one is faced with the history of enormous anthropogenic influence (bee management) in many parts of the world. As detailed herein, we circumvented this problem by sampling csd sequences from localities in Kenya (East Africa), where the anthropogenic influence is negligibly low.

She sampled 2 workers each from 10 hives, from three regions in Kenya, as well as hives from 3 U.S states, Brazil, Israel, and Australia. She found that the calculated number of sex alleles was 53 on a local basis, and likely about 90 worldwide, suggesting long-term effective population sizes ranging from 12,000 to 34,000 colonies.

The above findings are worth thinking about. If the norm for wild bees in their homeland is to have a diversity of 50 sex alleles (with a possible 90 in the entire *Apis mellifera* population), and if we (prior to varroa) were finding only about 10 alleles, what other genetic diversity have we lost in the process of domestication?

Practical application: Let me jump ahead about 3000 years for a moment, to our current stocks of bees in the US, founded from the limited original importations of a few races of bees (bottleneck 1), then selected over the years by breeders (bottlenecks 2), then having the effective population size again greatly reduced when tracheal and varroa mites wiped out most of our domestic and feral stocks (serious bottlenecks 3). How have those three bottleneck events affected the vigor of the bee populations that we keep nowadays?

Final Notes
I'll end this article with the above open question about the loss of genetic diversity in our bee stocks. But I'll continue next month with another question: Is there really a difference between domesticated and wild honey bees?

Again, I'm doing my best here at attempting to summarize our state of knowledge of this extremely interesting but complex subject—please let me know if I've made any errors in my interpretation of the science (some of the genetics papers read like Greek to me)!

I also wish to reiterate that I am not criticizing our queen breeders or domesticated stocks in any way (if I wanted milk, I sure wouldn't want to try to get it from wild goats). But I think that it would be wise for us to fully grasp any inherent negative consequences of the selective breeding of the honey bee, especially with regard to its adaptation to the varroa mite. I will of course continue next month.

Acknowledgements
Thanks as always to Peter Borst in research assistance. And thanks to those who donate to ScientificBeekeeping.com to allow me to continue my research and writing.

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[3] Recent advances in technology now allow us to use Marker Assisted Selection and/or genetic engineering to directly select for specific alleles (forms of a gene) or even to swap genes between species.
[4] This is called continuous, as opposed to discontinuous, variation over a range.
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These articles were originally published in the American Bee Journal. All of Randy's bee articles can be found at: www.scientificbeekeeping.com. If you find these articles of use Randy appreciates donations to fund his efforts.

MEDICINAL HONEY

- what do all the numbers mean?

Dr Nural Cokcetin and Dr Shona Blair

Manuka honey is one of the most well known honeys in the world. And its fame is the result of the work of Professor Peter Molan in New Zealand, who discovered the unusual antibacterial (germ-killing) activity of this honey in the 1980s. Professor Molan showed that the activity of manuka honey is effective against a wide range of different infection-causing germs. Since his discovery, and all of the research he and other scientists have conducted since, the demand and price of this honey have grown considerably.

Manuka honey comes from the nectar of *Leptospermum scoparium* plants, but Australia has more than 80 species of *Leptospermum* compared to New Zealand's one. We already know that a handful of our *Leptospermum* honeys have similar levels of activity to New Zealand manuka, but many of the other Australian varieties have not been tested. Our research team is running a nationwide study looking for more sources of medicinal Australian *Leptospermum* honey (a.k.a. jelly bush, or Australian manuka).

What makes this honey so special?
In most honeys the antibacterial activity is due to the high sugar content, low pH and production of hydrogen peroxide, which comes from a component added by the bees as they ripen the nectar into honey.

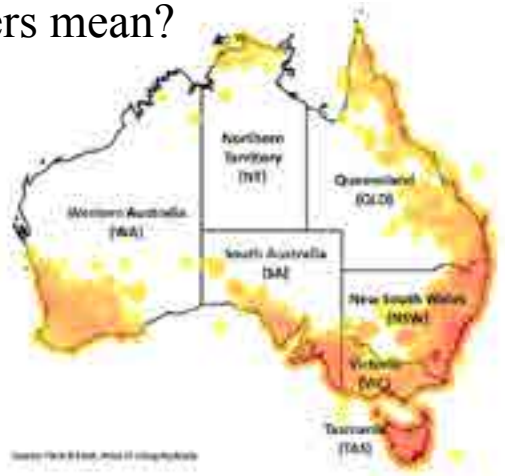
However, manuka honey has extra "non-peroxide activity" (NPA). Initially, the compound responsible for this NPA was unknown, and Professor Molan termed the phrase "unique manuka factor" (UMF®) because this type of NPA appeared to be unique to manuka honey.

Then in 2008 scientists found that a chemical compound called methylglyoxal (MGO) is responsible for much of unique activity in manuka honey.

It has since been established that MGO results from another compound called dihydroxyacetone (DHA), which occurs naturally in the nectar of flowers of some *Leptospermum* species native to New Zealand and Australia.

Measuring the activity of honey
The fame of manuka honey has led to increased prices and various producers and companies using different systems to describe and rate its activity. In general, they can demand higher prices for honeys with higher activity.

There is currently a confusing array of labels and terminology on different honey labels, like UMF® (unique manuka factor), NPA (non-peroxide activity), MGO or MG (methylglyoxal), Active + and TA (total activity).



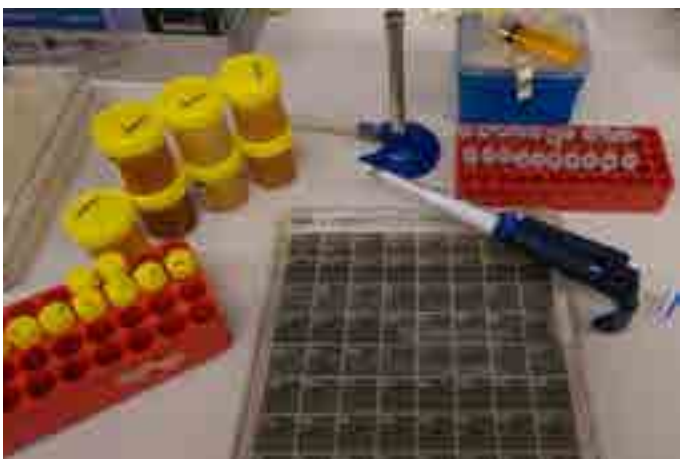
Occurrence of *Leptospermum* around Australia

UMF® and NPA
When Professor Molan discovered the unique activity of manuka honey from New Zealand he and his colleagues also developed the first robust lab test to enable the comparison of many different types of honey. This test measures the antibacterial activity of honey by comparing it to the activity of a standard antiseptic (phenol) against *Staphylococcus aureus* (a germ related to "Golden Staph").

Usually when this test is performed it is run in two different ways:

- One way to test the total activity of a honey (which will include the effects of any hydrogen peroxide activity)
    - This will give the "total activity" of the honey
- Another to see if the honey has any significant antibacterial activity after the hydrogen peroxide is removed
    - If the honey has this type of activity it is UMF® or NPA activity

The NPA or UMF® ratings are used to describe the unique type of antibacterial activity shown by certain *Leptospermum* honeys (a.k.a. manuka or jelly bush) from New Zealand and Australia. The NPA and UMF® ratings are derived using the test described above, and the numbers put onto the jars refer to the activity that remains even after the hydrogen peroxide has been removed. For example, NPA or UMF® 5+ has the same activity in the test as a 5% solution of phenol against the test germ, after the hydrogen peroxide has been removed.



Although the NPA and UMF® ratings are equivalent, the "Unique Manuka Factor" (UMF®) is a trademark registered by the UMF Honey Association. UMF® is only available for use under license by honey producers using correctly tested manuka honey from New Zealand. Some other active *Leptospermum* honeys from New Zealand and Australia (with similar antibacterial properties to New Zealand manuka) are sold with the NPA ratings.

So NPA and UMF® are directly comparable, and are equivalent of each other.

MGO (or MG)
Since it was discovered that methylglyoxal (MGO or MG) is responsible for much of the unique activity in manuka honey, a number of products on the market are labelled directly a MGO concentration. The MGO rating used on labels is a direct measure of the amount of this single compound in the honey and expressed as parts per million (ppm) or mg/kg. These numbers are often much higher than the NPA/UMF® ratings.

How do the number compare?

There is a relationship between MGO concentration in honey and the NPA/UMF® of the honey. However, it is important to remember that the numbers are derived from totally different types of tests, and there is more to the activity of *Leptospermum* honeys than just MGO content.

It is understandable that people tend to think the higher the number the more active the product. However, comparing some of these labels is a bit like comparing apples and oranges. For example, a UMF® 16+ manuka honey is much more active than another manuka honey labelled with MGO 100. And a jarrah honey with total activity of 10+ TA is active, but for different reasons than a manuka honey labelled 10+ NPA or UMF®.

The relationship between MGO and NPA/UMF® isn't completely straightforward, but as a rough guide:

NPA/UMF® 5+ = MGO 83
NPA/UMF® 10+ = MGO 263
NPA/UMF® 15+ = MGO 514
NPA/UMF® 20+ = MGO 829

Finding more liquid gold

We want to identify which Australian *Leptospermum* plant species make the most therapeutically active honey and where they are located in Australia, as well as find more sources of this honey and understand more about its medicinal properties.

We are asking beekeepers with access to *Leptospermum* honeys from anywhere in the country to provide samples to include in our research project. The honeys are tested for antibacterial activity and we are also investigating the relationship between the activity and the plant source.

Nural and Shona are involved in this project as part of a team of microbiologists and chemists. The team includes Professor Liz Harry (University of Technology Sydney), Professor Dee Carter (University of Sydney), Dr Peter Brooks and Simon Williams (University of the Sunshine Coast). The project is being supported by a research grant from the Rural Industries Research and Development Corporation (RIRDC).

To find out more about the study, including how beekeepers can become involved, visit our website - http://ozhoneyproject.wordpress.com/ or contact the team:

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ALMOND POLLINATION - 'OPERATION UNITE 2016'

By Victorian Bee Biosecurity Officer Jessica Hartland

In a first, Apiary Officers from New South Wales, South Australia and Tasmania all converged on the Sunraysia region in North West Victoria to participate as observers in *Operation Unite* with Victorian Apiary Officers. Apiary Officers had the opportunity to observe the undertaking of apiary audits involving passive external and in-hive surveillance techniques, share knowledge and experience a first-hand account of the scale of the almond industry in Victoria.

Agriculture Victoria's Executive Director of Agriculture Services and Biosecurity Operations joined Select Harvests orchard managers in attending a honey bee biosecurity forum hosted by Agriculture Victoria. Apiary Officers Joe Riordan and Daniel Martin delivered a presentation with a focus on diseases and pests that present biosecurity risks and challenges during the almond pollination season. In addition, Victorian Bee Biosecurity Officer Jessica Hartland discussed the 'Biosecurity Code of Practice' and suggested how the Code could be implemented in future pollination operations for the benefit of the honey bee industry in partnership with the almond industry.

An interesting introduction to the session was provided by Ben Brown from Select Harvests. Ben delivered an insightful overview of the almond industry, stating that approximately 305,000 bee hives being potentially required for almond pollination in Australia by 2022, with Victorian almond orchards being potentially required to provide 195,000 of these hives.

Managed honey bee dependent pollination in the Sunraysia region of Victoria has recently gained significant media attention across Australia in 'The Age' and on ABC radio. This media attention and visit from Agriculture Victoria's Executive Director of Agriculture Services and Biosecurity Operations has highlighted the recognised contribution of honey bee pollination and the value of the almond industry.

It has also highlighted present and future honey bee biosecurity challenges and bee biosecurity training opportunities.

Operation Unite apiary surveillance focused on endemic and exotic pests and diseases in relation to compliance under the *Livestock Disease Control Act 1994* in addition to interstate movement certificates and registration. The widespread endemic disease American Foulbrood (AFB) was detected in some apiaries located on almond orchards as a result of surveillance efforts. All hives within these apiaries were inspected for AFB and compliance operations were conducted on-site to mitigate the immediate biosecurity risk to other nearby apiaries.

With approximately 120,000 bee hives in the area, there was significant risk to hives being exposed to disease, particularly AFB. This highlights the importance of beekeepers who deliver hives to almond pollination taking responsibility and appropriate action to ensure they effectively manage disease in their apiaries before delivering their hives for paid pollination services. Beekeepers need to be on the front foot and proactively inspecting their hives for AFB prior to almond pollination, practicing good biosecurity and using tools such a honey culture tests (HCTs) and follow-up hive disease inspections to identify AFB well before hives are delivered to almond orchards.

Since almond pollination 2016 reports have surfaced that Nosema disease has been a significant contributor to poor quality Victorian hives delivered for almond pollination, in some instances claiming that 30-40% of Victorian hives have been adversely impacted by Nosema, likening this situation to colony collapse disorder (CCD) experienced overseas. Agriculture Victoria acknowledges that such claims are unfounded due to the absence of required scientific sampling from Victorian beekeepers' hives.

Beekeepers can improve their endemic disease management by working towards compliance with the recently endorsed 'Biosecurity Code of Practice' and by contacting Apiary Officers for more information on disease management.

Overall *Operation Unite* was a success with interstate Apiary Officers gaining a greater appreciation of the almond industry in Victoria and sharing knowledge, particularly in relation to the real biosecurity issues facing the honey bee industry.

Victorian Bee Biosecurity Officer Jessica Hartland conducting apiary inspections during 2016 almond pollination

Victorian Apiary Officers Joe Riordan and Daniel Martin presenting a honeybee biosecurity session to staff from Agriculture Victoria and Select Harvests

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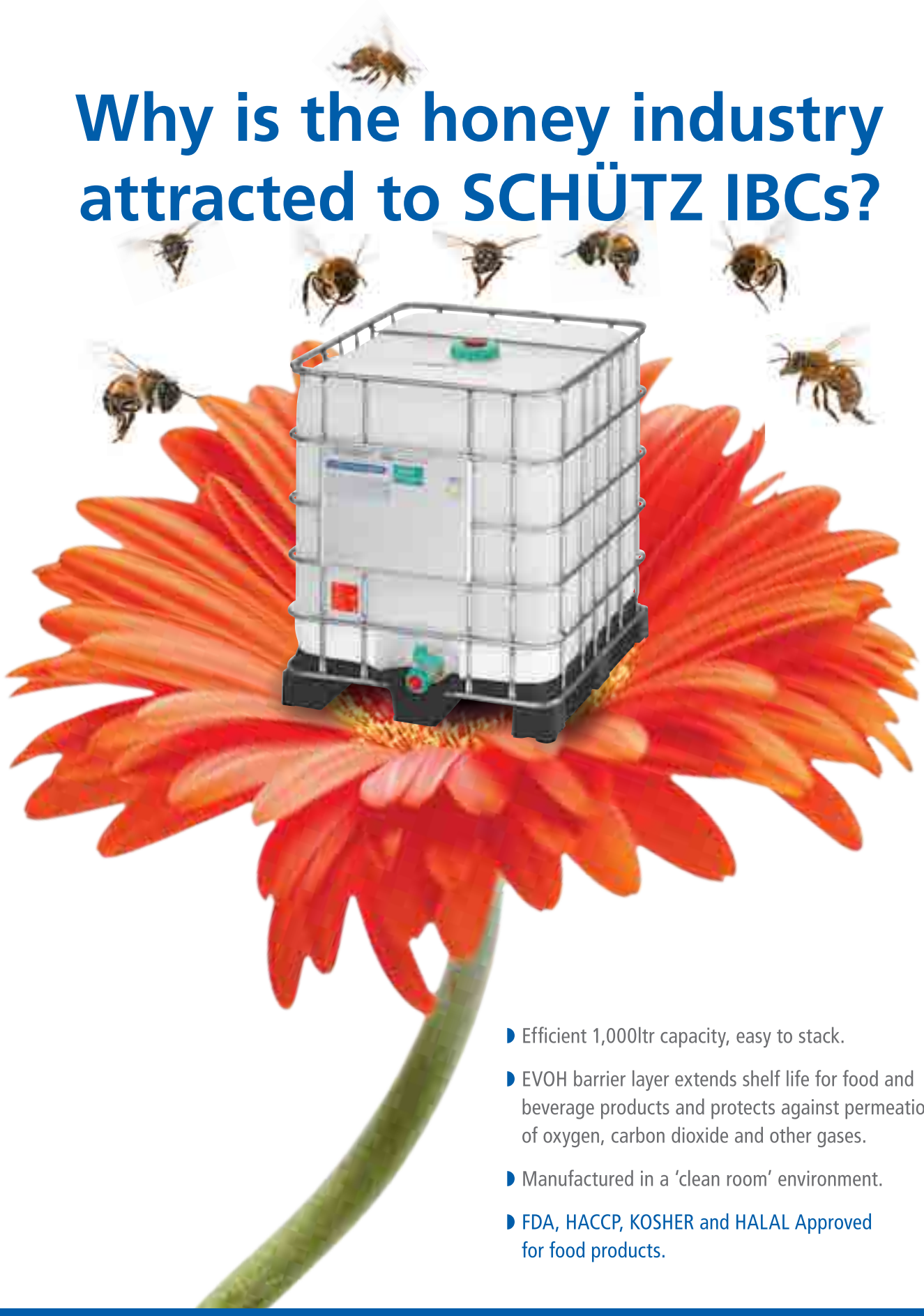

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