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HiveLights

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Cover picture: Workshops are a way to encourage beekeepers to raise Queens during Summer, and develop nuclear colonies as a Strategy to improve overwinter survivability.

Photo supplied by James Campbell, Manitoba

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Hivelights - The Magazine of the Canadian Honey Council is printed with all natural vegetable based inks. Please recycle this magazine.

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Canadian Honey Council Report

Long since past are the days when the national average over-wintering loss numbers were 15-18%. It seems like now 30% is the average with some regions and provinces well below, others well above that mark. How, if ever, can we return to a time when beekeepers don't have the challenges of replacing stock to maintain or increase numbers? First, and foremost, the introduction of new varroacides is a necessity, as the industry sits on the precarious edge of disaster without new products in the toolkit. New varroacides would alleviate some of the pain, but not all of it. As research delves deeper into honey bee health, new pests and pathogens are identified and need to be dealt with effectively. Climate change impacts, nutrition, genetics and management all have a roll to play in lowering losses. An emerging threat, Tropilaelaps, has many beekeepers in North America concerned as reports have now been published showing its existence in western Russia.

The Canadian Honey Council has had one national call on the issue, and I expect many more will be coming as the question is not if, but when it arrives how we will deal with it. Certainly, prevention should be at the top of the list but when it arrives what's next? Quarantines and eradication are methods that are being discussed but just as important is whether the industry is willing to act with one voice or whether individual provinces will deal with it in their own way. I know I would like to see agreement at the national level but perhaps that is wishful thinking. As we learn more about Tropilaelaps expect more and more information to become available. As it stands now, very little is known as what its impact will be on North American honey bees and priority research needs to be conducted. It is very important, however, that this additional research should not supplant the research that is already being conducted but should be research with additional funds. The pot of money is already small, it does not need to be divided up even more.

The summer promises to be a busy one with CAPA's over-wintering report expected to be released as too will the CFIA risk assessment on US packaged bees. One consultation that the CHC will be focussing on is that on a new temporary foreign worker program for agriculture. In March of 2024, Employment and Social Development Canada announced that changes are forthcoming to the Seasonal (SAWP) and Ag Stream programs and that industry consultations will begin in the summer of 2024. I think most employers agree that the SAWP works well, and the department has indicated that what they are focussing on is renewing and updating country agreements and little other will be changed, but that is where close attention needs to be paid. The changes being examined include:

Rod Scarlett, Executive Director, CHC

- Ensuring that employers and TFWs who support Canada's food supply benefit from more consistent requirements;
- Clarifying roles and responsibilities of stakeholders with renewed country agreements;
- Occupational expansion of country agreements to include year-round primary agriculture work, and seasonal fish, seafood and primary food processing;
- Providing workers with increased labour mobility within the agriculture and fish, seafood and primary food processing sectors;
- Using market-based drivers for wages and deductions and,
- Updating housing requirements to ensure employer-provided TFW housing meets applicable Provincial/Territorial regulations in certain key health and safety areas.

As you can see, there are some big issues that could impact employers in the beekeeping sector so please feel free to contact me or your CHC representative with comments and suggestions. Our labour committee will most certainly appreciate any and all feedback. Have a great summer!

Regional Reports

Atlantic

Rodney Reid

Promising Signs for Atlantic Canada's Agriculture and Beekeeping.

Reports indicate that the region is experiencing favorable conditions this spring. As the season unfolded, consistent weather and pleasant temperatures prevailed. However, in Central Newfoundland (NL), June brought not only warmth but also slightly more precipitation than desired.

The agricultural sector is particularly optimistic. Crops requiring pollination are ahead of schedule, and the season is shaping up to be exceptional. Blueberry growers, fortunate to avoid frost during pollination, report robust yields. Cranberry producers echo this sentiment, claiming that their fields have never looked better.

Atlantic Bee Tour: A Must-Attend Event

Beekeepers across the Atlantic region eagerly anticipate the upcoming Atlantic Bee Tour, scheduled for July 26th and 27th, 2024. Hosted in the Bathurst and Charlo area of New Brunswick (NB), this biennial event promises valuable insights and networking opportunities.

Agenda highlights include:

1. Workshops on Hive Management Techniques: Seasoned beekeepers and novices alike can benefit from expert-led workshops. Topics will cover efficient hive management practices, ensuring healthier colonies.
2. Sustainable Beekeeping Talks: Learn about environmentally conscious beekeeping practices from industry experts. Discover ways to support pollinators while maintaining thriving hives.
3. Field Trips to Local Apiaries: Explore firsthand the fascinating world of beekeeping by visiting local apiaries. Witness the intricate dance of bees and gain practical knowledge from experienced beekeepers.

To participate, register through the New Brunswick Beekeepers Association, this year's gracious host. For additional information, visit their website at **www.nbba.ca.**

Québec

Maggie Lamothe Boudreau

Ouch!!! This year, the 2024 wintering of beehives in Quebec is far behind 2023 (18%) with a mortality rate nearing 40%. Several beekeepers find the start of the season financially difficult due to these losses, which are far too high for a sector as essential as beekeeping. Despite everything, some beekeepers are faring relatively well. According to certain sources, it will take us a few years to recover from 2022, mainly because of the increased presence of viruses that varroa quickly spread during that disastrous year.

Every year, the dandelion challenge, initiated by Miel&co, is growing in recognition in Quebec. This challenge encourages people to leave dandelions on their lawns until they have finished blooming, thus providing a food source for pollinators. The choice of the dandelion as the emblematic flower of biodiversity is explained by its bright colors and early blooming, offering bees an early food source at the beginning of the season.

Moreover, what a start to the season! We are easily ahead by about ten days. Unprecedented, beekeepers started entering blueberry fields in late May despite initial difficulties for some in securing contracts. However, as spring progressed, the majority of beekeepers managed to secure contracts and rent most, if not all, of their hives for pollination. The average rate is about $225 per hive, or more in some cases, with the inclusion of transport in the amount offered to beekeepers for the rental of their hives.

Currently, beekeepers have finished transporting their colonies for cranberry pollination, not without difficulties. Indeed, many beekeepers had to remove their hives from the blueberries, find a temporary apiary before transporting them again to the cranberry fields. Usually, the end and beginning of the flowering of these two crops coincide well, and the trip is direct. Adding to this a nice problem, the movements were more complex for some beekeepers due to the need to remove the excess blueberry honey, which is a pleasant surprise.

Watch out for varroa! Our provincial veterinarians have issued warnings about the presence and evolution of varroa in hives. Early heat episodes across the province have likely increased the risk of early mite reproduction, potentially leading to a drastic population growth, thus exceeding the critical threshold earlier this year.

On a positive note, our provincial veterinarians are closely monitoring the presence of small hive beetles, and fortunately, nothing alarming has been reported so far. With this encouraging news, I wish each of you and your hives a great season!

Ouch!!! Cette année, l'hivernage des ruches 2024 au Québec est loin derrière 2023 (18%) avec un taux de mortalité avoisinant les 40%. Plusieurs apiculteurs trouvent le début de saison financièrement difficile à cause de ces pertes beaucoup trop élevées pour un secteur aussi essentiel que l'apiculture. Malgré tout, certains apiculteurs s'en tirent relativement bien. Selon certaines sources, il nous faudra quelques années pour nous remettre de l'année 2022, notamment à cause de la présence accrue des virus que le varroa a rapidement propagés durant cette année désastreuse.

Chaque année, le défi pissenlit, initié par Miel&co, connaît une croissance en termes de reconnaissance au Québec. Ce défi encourage les gens à laisser les pissenlits sur leur pelouse jusqu'à la fin de leur floraison, fournissant ainsi une source de nourriture aux pollinisateurs. Le choix du pissenlit comme fleur emblématique de la biodiversité s'explique par ses couleurs vives et sa floraison précoce, offrant aux abeilles une source de nourriture en début de saison.

Par ailleurs, quel début de saison! Nous sommes facilement en avance d'une dizaine de jours. Du jamais vu, les apiculteurs ont commencé à entrer dans les champs de bleuets vers la fin mai, malgré les difficultés initiales pour certains d'obtenir des contrats. Cependant, au fur et à mesure que le

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printemps avançait, la majorité des apiculteurs ont réussi à décrocher des contrats et à louer la plupart, voire la totalité, de leurs ruches pour la pollinisation. Le tarif moyen est d'environ 225 $ par ruche, voire plus dans certains cas avec l'inclusion du transport dans le montant offert aux apiculteurs pour la location de leurs ruches.

À l'heure actuelle, les apiculteurs ont terminé de transporter leurs colonies pour la pollinisation des canneberges non sans difficultés. En effet, beaucoup d'apiculteurs ont dû sortir leurs ruches des bleuets, trouver un rucher temporaire avant de les transporter à nouveau dans les champs de canneberge. Habituellement, les fins et débuts de floraison de ces deux cultures coïncident bien et le voyage est direct. Ajoutons à cela un beau problème : les déplacements ont été plus complexes pour certains apiculteurs en raison de la nécessité de retirer l'excès de miel de bleuet, ce qui est une belle surprise.

Faites attention au varroa ! Nos vétérinaires provinciaux ont émis des avertissements concernant la présence et l'évolution du varroa dans les ruches. Les épisodes de chaleur précoce dans toute la province ont probablement augmenté le risque de reproduction précoce des acariens, entraînant potentiellement une croissance drastique de leur population, dépassant ainsi le seuil critique plus tôt cette année.

Sur une note positive, nos vétérinaires provinciaux surveillent de près la présence de petits coléoptères de la ruche, et heureusement, rien d'alarmant n'a été répertorié pour le moment. Avec ces nouvelles encourageantes, je souhaite à chacun de vous et à vos ruches une belle saison!

Ontario

Albert Devries

Weather again is the big challenge in southwestern Ontario. Spring arrived early this year, the ground dried out and it really looked like we were off to a good early start. Then it got cooler and it started to rain and rain and rain. Most of the land in my area is a little heavy. It takes several days for it to dry out and it needs to be dry to be worked or planted. Most farmers are weeks behind because three days in a row without rain has been hard to find. We have worked bees in rain gear several times this spring so our schedule could be maintained. Despite all the rain the bees have built up well enough. Swarming and poor mating has also been a problem because of the rain. Now dry warm days in a row are needed so we can get a honey crop.

The Ontario beekeepers association is still in need of a tech transfer lead. We've been able to hire two technicians as well as summer students. They are out in the field doing hygienic testing, and teaching workshops as well as getting ready to do research. I would really would like to acknowledge the extraordinary effort that Mel Kempers is putting in as she is now working as the tech transfer lead as well as her duties as the general manager for the OBA. Way to go Mel I don't understand how you can do it all so well.

Overwintering bee losses have been highly variable. Well not official it seems Apivar is no longer consistently effective controlling Varroa. Beekeepers are having to adapt and use different methods to control this pest.

Have a great summer I'm hoping for more honey and more sailing.

Manitoba

Osee Podolsky

On Saturday May 29th the Manitoba Beekeepers Association held our first Honey Bee Day event at the Little Brown Jug in Winnipeg. This event is mostly aimed to help promote the beekeeping industry to the general public and to inform them on beekeeping related issues and topics. Tops included Biodiversity, Pollinator Habitats in Ditches, Fraudulent Honey, and Safety nets in the beekeeping industry outside of AgriStability. The Honourable Ron Kostyshyn Minister of Agriculture, Food and Rural Development, attended to say some words and take in the festivities. A special thanks goes out to the Red River Apiarist Association for their volunteer support at the event along with their honey tasting table they had at the event. Overall the board was happy with the attendance and hopes are next years will be bigger with more people being aware of the event.

Following this on Saturday June 22nd the Manitoba Beekeepers Association held its beekeeper field day in southwestern Manitoba at Merv Malyon's. Merv Malyon is a highly regarded commercial queen breeder who has finally decided to retire thus making a nice farewell get together for Manitoba Beekeepers. Mathew Polinsky gave the KRTP update as well as the PA report as Derek was under the weather and unable to attend. Greenlight Biosciences gave a presentation on their RNAi mite control treatment, and Veto-Pharma gave a presentation on their new Apivar Flash treatment for mite controls. Samatha Muirhead's presentation on the cost estimate of break-even points and profitability for different overwinter loss rates in relation to honey production income was displayed for attendees to view. For being the first field day in several years the board was pleased with the turnout and the time to catch up with fellow beekeepers and friends.

Spring in Manitoba has been wet, extremely wet. With the beginning of spring starting very nicely the bees had a good flow from the willows, maples and poplars. Progressing later towards splitting season and the dandelion flow the perpetual rain began. This put many beekeepers in catch up mode as there were just not enough good working days to keep up with all of the required spring work to be done. Rains continued through the dandelion flow and into the end of June. Estimates of up to 20% of fields being unseeded across the province, with some regions being significantly above the provincial estimates. Canola crop stages vary vastly from south to north with a gradient of crops beginning to bolt in southern Manitoba, to crops just beginning to sprout in northern Manitoba. Overall it's hard to predict how this seasons honey flow will pan out but it may be a short intense main flow with straggling early crops and late crops on each end.

Saskatchewan

Jake Berg

At the time of writing this, at the end of June, it looks like finally we may have turned the corner to having closer to normal seasonal weather. The majority of our spring in Saskatchewan has been cold and wet, raining almost every 24 hours or so it seems. The weather has maintained at early April temperatures rather than May or June weather. It has been so cold, in fact, I've have heard of queen cells, chilling and dying overnight after they've been installed into new nucs. The cold weather has brought on a whole list of other problems and issues within the hives.

When we initially brought our bees out of the wintering building, they were looking fairly good. I even commented about how well they had faired over our brown winter and they were some of the better colonies I had seen in three or four years. We've been struggling with issues and basically, the hangover of a very large mite problem from two years ago. It really seemed like maybe we were over the hump when the bees were first moved out. But boy was I wrong. When the April cold, wet weather never warmed to May temperatures, the bees went backwards for a month and a half or maybe even two. Every time we went to look at them they shrunk up a little more and the spring dwindle took its toll at our place. One of the other major problems we had this spring was a fairly large outbreak of EFB, which we are still yet to determine how and why we went from having very little EFB last year to a wide range of EFB infection throughout the operation.

Overall, Saskatchewan bees had a very respectable 18.1% winter loss this past winter. The outdoor colonies came through winter very nicely at around 15% on average, where the indoor wintered colonies weren't as good. There were unfortunately a couple of wrecks with a couple different indoor facilities due to the fact it was so unseasonably warm all winter. The winter loss in the wintering buildings was around 37%. Nucs came through a lot more even at 18.2% for outdoor and 18.5% for indoor wintering.

The SBDC annual June field day was held at Sweetheart Pollinators in Eatonia, Saskatchewan. I would like to take this opportunity to thank Jeanine and Neil Specht and crew for hosting a wonderful field day. It is always great when we can get together.

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Alberta

Jeremy Olthof

As our summer bee work continues, CHC work inevitably takes a back seat. Our focus and frustration recently has been getting the registration of oxalic and glycerine pads into PMRA for approval. This process has been incredibly frustrating and while its easy to point fingers, the best we can do is ensure that it gets finished. Our work with the Farm Products Council has been ongoing to explore the development of a promotion and Research agency (PRA). We have developed a background document which outlines the reasoning behind the need for a PRA. We will be looking into different options for funding to continue this work as a consultant will need to be hired. Our expectation is that the risk assessment for importation of package bee from the US will be released very soon. As a result of the timing of this reports release, I imagine most discussion related to risk mitigation and steps forward will be delayed till the fall. CFIA officially closed all importation from the Ukraine and will be closely monitoring the spread of Tropilaelaps mite westward now that official reports have been released of findings in SW Russia. Central Alberta has received a healthy amount of rain and I am optimistic for a decent honey crop, but I am less optimistic about the price we will receive. I encourage everyone to reach out to their CHC delegates with any questions or concerns you have within the industry.

Alberta

Ryan Hicks

As I write this letter, the canola is starting to bolt in northern Alberta and we will begin to have bloom next week. The drought like conditions from the early spring have given way to a cool, wet June and there is hope that with some heat coming in July, the crops will be bountiful.

Although a rewarding occupation with many benefits, beekeeping has never been what people might call easy. Hard work, perseverance and dedication are all traits required to make a living in this industry. This has never been more important since I bought into our operation in 2008. Apivar seems to work for some, but not for others, formic acid is effective, but hard on queens and dangerous, Oxalic sublimation is effective when hives are broodless, but there are guys who are doing upwards of 15-17 rounds with this method. It is very, very time consuming, and with that, the labour bill makes it an exceedingly expensive varroa control. While there are several options being worked on presently, the process to get them approved is time consuming and arduous. There are options in the U.S. That Canada doesn't have access to from Veto Pharma. Is the beekeeping landscape so different down there that we need to duplicate their research into the effectiveness of the product.

With the questionable resources to varroa control available, access to viable stock becomes more important. With the finding of the Tropilaelopse mite in Russia and the conclusion that it has been there for 3 years, Ukraine access to stock has been suspended. The U.S is also raising questions about packaged bees from Australia over the T mite and concerns about it entering their country. They would like a North American Strategy, and as the spread of the T mite continues across the world, at some point maybe that option comes with the least amount of risk to the Canadian industry. In the meantime, we wait for the release of the risk assessment, and the possibility of risk mitigation. This should be released at some point this summer.

British Columbia

Jeff Lee

Someone once cautioned regional honey association representatives to not be focussed on weather when filing periodic reports. Weather changes all the time, and surely there must be other beekeeping issues to report.

But in this case, I think it is useful to start this report with a look at how significant weather patterns have changed beekeeping in B.C. this year, and may well affect us for years to come.

The honey-making summer is finally upon us, but in the northern parts - particularly the Peace region, where we can get bumper crops, beekeepers there faced highly unusual drought conditions early in spring. This brings higher risk of summer wildfires. But in the southern parts of the province we had a relatively mild and wet spring, which set back nuc-making, queen production and pollination.

Here in the south, we had an extended mild fall and relatively easy winter, until early January when a record freeze almost completely wiped out the cherry, apricot and peach crops. Farmers who have been here for decades couldn't remember a worse year.

For beekeepers that meant reduced or no demand for pollination services. In the Lower Mainland, home of a significant blueberry industry, things were better, but weather again affected pollination efficacy.

We normally experience a warm May and a mild, wet June, but for three weeks in May we were above average in precipitation.

Queen Breeding Issues

The wet May meant for many of B.C.'s queen breeders that they had reduced mating success on their second and third rounds. The first round, usually in late April, had reasonable success.

Queen breeders, particularly in the Okanagan and Kootenays, have also reported difficulty in getting grafts to hatch. The cells get to capped stage but the pupa dies before hatch. It does not seem to be related to Black Queen Cell Virus, but may be related to an as-yet undetermined virus.

As a result, some of the breeders are collecting and freezing samples for inspection and examination by researchers at the University of British Columbia.

BC Bee Breeders Workshop

In mid-June the BC Bee Breeders Association held their annual field day, this time in Salmon Arm. The association has been focussing on building capacity for overwintered queens that can be used to support commercial operators elsewhere in Canada.

This field day, which attracted some large-scale Alberta operators, dealt with various methods for using efficient mass-volume mating nuc systems, both for mating and overwintering.

There were also presentations from Alberta and BC researchers working on improving queen fertility, low varroa growth research and UBO (unhealthy brood odour) detection.

BC Honey Producers Association

The BCHPA continues to work on efforts to stabilize funding for its nascent Tech-Transfer program. The TTP has developed a number of research projects and is working closely with TTPs in other provinces so as to not duplicate work.

Our group has also developed some significant social media messaging that is targeted at new and hobbyist beekeepers. The program has put together some useful teaching aids and field guides designed to lift the level of competence in beekeepers.

Like all tech-transfer programs in Canada, ours is facing headwinds as government agriculture agencies focus on lower-hanging fruit when it comes to funding the ag sector. The federal government's decision to tie territorial and provincial joint funding programs to climate change initiatives has also made it a tougher sell for TTPs to access taxpayer support.

Our message to our governments has been the same, however; beekeeping represents a foundational sector in agriculture and we're having increasing challenges in keeping bees alive and the industry stable. These are not problems unique to BC, but we're concerned that a vehicle the BC go-

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vernment funded for improving colony health is going to collapse without additional support.

Initial Overwintering Mortality Survey Results

In late June the provincial apiculture department issued preliminary results of its annual overwintering survey. The results are mixed.

Only 18 per cent of the province's 480 beekeepers who run more than 20 colonies responded. (We have upwards of 2,500 or more beekeepers, but many are either small-scale or hobbyist, or, in a conspiratorial fit of pique refuse to register their hives or participate in surveys designed to assist the industry.)

Overall, the provincial average was 25% overwintering mortality. That is slightly better than last year's rate of 27.2%. BC has tended to be in the mid-20's over the last number of years.

Some regions fared better, some worse. The highest losses were in the Kootenays, the southeastern part of BC, where the rate was 45%. (In the table below, "Ret" means the number of responding beekeepers.)

BC Wintering Survey 2024

	Ret	Mortality (%)
Fraser Valley	24	18%
Vancouver Island	14	24%
Okanagan / Thompson	27	31%
Kootenays	10	45%
Cariboo	7	18%
Northwest	1	6%
Peace	3	30%
BC	86	25%

Participation Rate of 480 (18%)

Causes	1st	Weak Colonies in Fall
	2nd	Poor Queens
	3rd	Ineffective Mite Control
	4th	Weather

Interprovincial Friction Between BC Beekeepers and Other Provinces

For years some larger beekeepers in Alberta, Saskatchewan and Manitoba have overwintered large blocks of hives in the Okanogan and Lower Mainland. Most do it to take advantage of our generally milder winter weather, and to sometimes service the pollination needs of both soft tree fruit and blueberry growers, prior to repatriating hives to their home provinces for honey collection or the hybrid canola seed pollination season.

However, there is friction growing, particularly in the south Okanagan, over the large number of hives from other provinces being dumped into the area without consultation with local beekeepers or regional bee inspectors. There is growing concern that these thousands of hives are having negative effects on resident apiaries, and public perception about beekeepers in general. In one recent case, a Prairies beekeeper put over 1,500 colonies into a yard across the road from an established commercial apiary.

The issue came to a head this year when nine local commercial operators, including a former provincial bee inspector, wrote to the provincial government asking for limits to be placed on the number of in-bound overwintering colonies from other provinces.

B.C. requires out-of-province beekeepers to have their hives inspected by their home province and obtain movement permits, but doesn't intervene or limit the proximity of where those hives are placed relative to established beekeepers here

The beekeepers who wrote the letter to the provincial chief bee inspector copied it to the Minister of Agriculture, elevating this into an interprovincial concern. They pointed out that in the last few years there has been a dramatic increase in the number of out-of province hives deposited in the narrow Okanagan and Similkameen valleys. In 2023-2024 that number approached 15,000. This created conflicts with existing local operators, competition for forage, and potential for robbing and disease outbreaks.

The signatories have asked for the province to intervene and set limits on the number of out-of-province hives overwintered in the two valleys. So far there has been little response from the province.

The BCHPA is taking up this concern at a provincial level, asking the province to determine the conditions under which operators from other provinces can bring hives to BC for overwintering, and how to avoid conflicts and competition for finite resources. It is also raising the issue at the CHC level to convey the concerns of BC beekeepers.

Bee Maid

BeeMaid HONEY LIMITED

Marina Oirik

Exciting Product Collaboration: Bee Maid Honey and Farmery Estate Brewery

Bee Maid Honey is delighted to announce an exciting new product collaboration with Farmery Estate Brewery. This partnership brings together Bee Maid's premium Canadian honey with Farmery's innovative beverages, promising a delightful experience for consumers.

Farmery Estate Brewery, based on a family farm in Neepawa, Manitoba, prides itself on growing its own barley and hops. This practice ensures a minimal environmental footprint, supports a local supply chain, and generates jobs within the community.

Introducing Auntie Bea's Teas

Farmery Estate Brewery has launched two exceptional new beverage lines featuring Bee Maid Honey as the main sweetener. These offerings, Auntie Bea's Hard Teas, and Auntie Bea's Cold Brew Teas, blend natural ingredients from Farmery's farm with the distinct sweetness of Bee Maid Honey. Available in three refreshing flavors—lemon, peach, and blackberry—these beverages offer a smooth, natural sweetness that perfectly complements the robust tea flavors, creating a wonderfully balanced drink.

This collaboration not only highlights the versatility and quality of Bee Maid Honey but also opens up new avenues for the organization. By venturing into the beverage market, Bee Maid Honey enhances its brand visibility and reaches a broader audience.

"We are incredibly excited about this partnership with Bee Maid Honey," said Chris Warwaruk, co-founder of Farmery Estate Brewery. "Using their high-quality honey as the primary sweetener in our new lines of teas has allowed us to create unique and delicious beverages that stand out in the market. We believe that consumers will appreciate the natural sweetness of our new product lines."

Bee Maid encourages everyone to try Auntie Bea's Teas and share them with friends and family. This collaboration is a testament to the delicious potential of combining quality ingredients from true farm to table organizations.

Field Trials of a New Acaricidal Compound

Against *Varroa destructor* in Honey Bee Colonies
Year 3 Report

Stephen Pernal (Agriculture and Agri-Food Canada, Beaverlodge, Alberta)
Erika Plettner (Simon Fraser University, Burnaby, British Columbia)

Project Term:

June 20, 2021 – March 31, 2025

Objectives:

The objectives of this study are to perform a set of full-scale field trials of a new acaricidal compound, 3c{3,6}, to compare its activity to a known acaricide of similar physical properties, and to understand partitioning of the compound within bee hives over a full season. These factors will be evaluated for both fall and spring applications of 3c{3,6}.

To accomplish these objectives, field trials were conducted in Beaverlodge, AB and the lower mainland of British Columbia during the fall of 2021, the fall of 2022, and the spring and fall of 2023.

In this report, we will outline the results of our most recently completed spring 2023 trial in Alberta and the fall 2023 trial in BC, both of which followed a similar experimental design. The apiaries for each experiment consisted of 20 single-brood chamber colonies, with two treatment groups: 3c{3,6}-treated vs. control. Wooden treatment and control applicators mirroring those used in 2022 were selected for the 2023 experiment, as these exhibited the highest efficacy and structural integrity during the previous experiment. A 6-week treatment interval was used, with the per-colony dose of 3c{3,6} increased from 8 g in 2022 to 10 g in 2023.

Experimental Design:

This year, field experiments to evaluate the killing efficacy of our experimental compound 3c{3,6} against Varroa destructor started in May 2023 at AAFC's Beaverlodge Research Farm in Alberta, and mid-August in Southern BC. Robert Lu continued as a Master's student in the Department of Biological Sciences at the University of Alberta and assisted in the initial experimental setup in Beaverlodge, with Abdullah Ibrahim and David Ostermann conducting the experiment following Robert's return to Edmonton in late May. In BC, the Plettner lab had Carolyn Essaunce as the main beekeeper, with help from Nuria Morfin, Leilani Pulsifer(BCHPA intern), Heather Higo, Laura Chapman, Tanvi Haria (SFU undergraduate), Milena Wiatr (SFU undergraduate volunteer), Abigail Chapman (UBC, Foster lab), Julia Common and Xinyi Feng.

Single brood chamber colonies were used in the experiments. In Beaverlodge, these were untreated, overwintered hives originally established with local queens. In BC, colonies were established from untreated, overwintered colonies as well as a small number of New Zealand package bees. The latter were re-queened with Buckfast queens, imported through Urban Bee Supplies (Ladner, BC).

The generalized timelines and activities for our 2023 experiments are detailed in Fig. 1. The exact start date of each experiment (Day 0) was dependent on the colonies having appropriate phoretic mite levels consistent with treatment thresholds. For springtime, this is 1 mite per 100 adult bees, while in fall is 3 mites per 100 bees. Experimental Day 0 was 11 May 2023 in Beaverlodge and 15 August 2023 in BC.

For the trials, two treatments were applied: 1) 3c{3,6}, impregnated on 3 wooden strips hung between the central brood frames of each colony; and 2) a negative solvent control applied to identical wooden strips. Each treatment was replicated 10 times for a total of 20 colonies per experimental apiary. Wooden strips (24.0 L × 5.0 W × 0.5 cm thick) were suspended between frames by a fourth notched strip placed across the top bars. Strips were treated as described in previous years, by stepwise application of a solution of the active compound in isopropanol to one side of each strip, allowing the solvent to evaporate between applications. The total dose applied was 10 g of 3c{3,6} per colony, evenly divided across the three vertical strips of each release device, and left in colonies for 42 days.

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Six days prior to the start of the experiment in AB and four days prior in BC, natural "mite fall" was counted by installing a sticky board under each colony. The board was replaced on the first experimental day when the treatment devices were installed (Day 0). Also on Day 0, we performed an alcohol wash of workers to establish phoretic mite loads on adult bees and examined 100 cells of capped brood to determine infestations of varroa on pupae and levels of mite reproduction. In addition, we estimated areas of pollen, honey, open and sealed brood, and adult bees. After 42 days of experimental treatment, the devices were retrieved, a second alcohol wash was conducted, and the same set of assays performed.

As in previous experiments, killing efficacy of the mite treatments was assessed by comparing mite fall on sticky boards during the experimental treatment period against mite fall during a subsequent "clean-up" phase. In Alberta, because the clean-up phase occurred during the nectar flow, and Amitraz resistance was detected in local mite populations, 65% liquid formic acid was used to kill remaining mites after the treatment applicators were removed on Day 42. This was accomplished using into Dri-Loc® brand meat pads which absorbed ~20 mL of acid, with one pad applied once every five days between 22 June (Day 42) and 4 August (Day 85). Formic acid applications were discontinued between 9 August (Day 90) and 7 September (Day 119), and a third mite alcohol wash was performed on 10 August (Day 91) in Beaverlodge.

Starting in early September in Beaverlodge, oxalic acid was used to reduce mite levels in colonies prior to winter. Oxalic acid fumigation was performed using a ProVap applicator powered by an electrical generator, at a rate of 1 g per colony of oxalic acid dihydrate (99.6%). Oxalic acid fumigation was started on Day 119 (7 September) and continued on Days 125, 146, 154, 160, ending on Day 167 (25 October). After 25 October, oxalic acid treatments were discontinued prior to indoor wintering.

In BC, the 3c{3,6} treatments were continuously applied from 15 August to 26 September (Day 42). After treatment applicators were removed, one strip of Formic Pro (NOD Apiary Products, Ltd.) was installed per colony to start the post-treatment clean-up phase. Colonies were left with the formic acid treatment for one week until 1 October (Day 49), followed with two strips of Apivar® (Amitraz) starting on 3 October (Day 51). Apivar® strips were maintained in the colonies until 21 November (Day 98) and were followed by a drizzle of 7% oxalic acid w/v in 5 mL sugar syrup per inter-frame space. No further treatments were performed after this, and colonies were overwintered outdoors. An additional mite sticky board was installed on 21 November (Day 98), and removed on 17 December (Day 124), to continue monitoring mites across colonies.

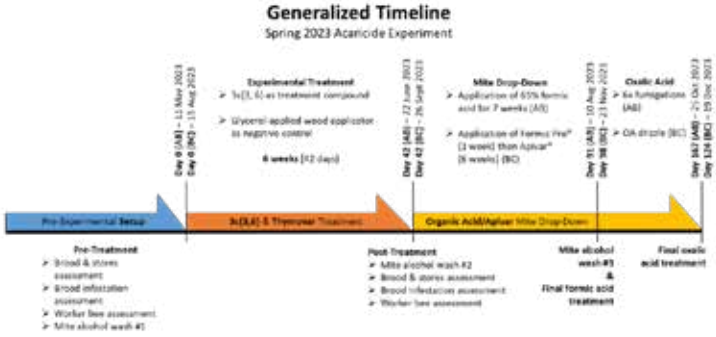
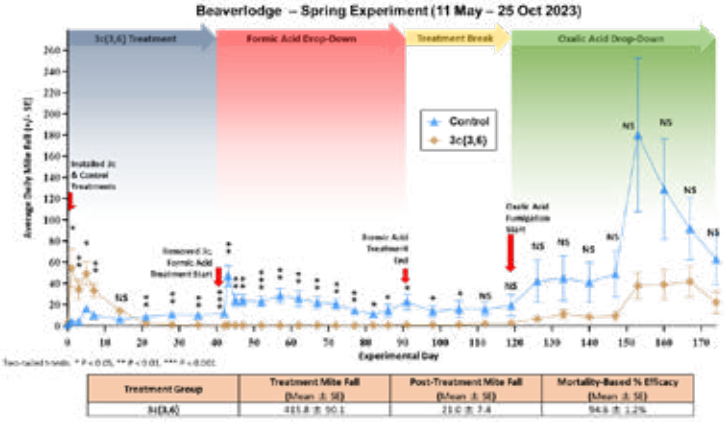
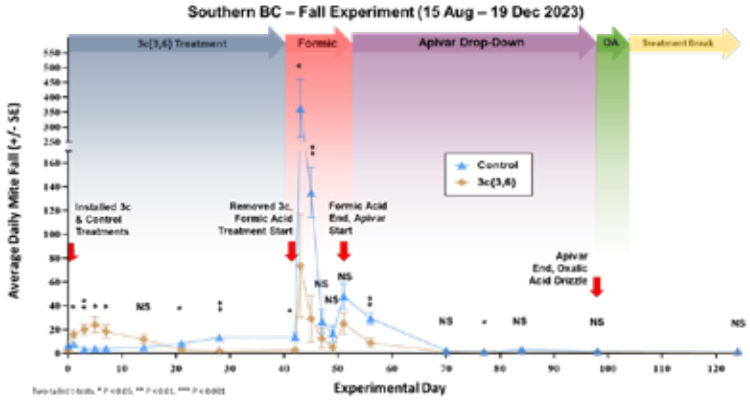


Figure 1. Generalized experimental timelines for the spring 2023 experiments located in Beaverlodge, AB, and Surrey, BC.



Treatment Group	Treatment Mite Fall (Mean ± SE)	Post-Treatment Mite Fall (Mean ± SE)	Mortality-Based % Efficacy (Mean ± SE)
3c{3,6}	411.8 ± 90.1	21.0 ± 7.4	94.8 ± 1.2%

Figure 2. Mite fall plot from the spring 2023 acaricide experiment in Beaverlodge, AB, Day 0 (11 May 2023) – Day 174 (1 Nov 2023). Points represent means ± S.E. of 10 replicates (two-tailed t-tests).



Treatment Group	Treatment Mite Fall (Mean ± SE)	Post-Treatment Mite Fall (Mean ± SE)	Mortality-Based % Efficacy (Mean ± SE)
3c{3,6}	308.3 ± 76.1	306.9 ± 142.4	52.2 ± 6.5%

Figure 3. Mite fall plot from spring 2023 acaricide experiment in the Southern BC, BC, Day 0 (15 Aug 2023) – Day 124 (17 Dec 2023). Points represent means ± S.E. of 10 replicates (two-tailed t-tests).

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Findings to Date:

1. Field Experiments

On Day 0, the mite infestation level in the AB apiary was 2.5 ± 0.37 (mean ± S.E.) mites per 100 adult bees, while in BC, the average was 0.6 ± 0.18 (mean ± S.E.) mites per 100 adult bees.

Figs. 2 and 3 show detailed mite fall data from the experiments in Beaverlodge, AB and Southern BC. The plots compare varroa mite mortality in colonies treated with 3c{3,6} versus the control over time. It is noteworthy that in both the Beaverlodge and Southern BC experiments, the average reported mite falls were higher for 3c{3,6}-treated colonies than control colonies during the first two weeks of the treatment phase. Daily mite fall for 3c{3,6}-treated colonies also remained consistently below that of the control colonies from that point until the end of the experiments.

Table 1 (below) captures many of the other parameters recorded in these experiments to date. On Day 0, there were no differences in phoretic mite loads between the 3c{3,6}-treated and control colonies. Beaverlodge colonies on Day 0 did not differ in any other measured hive parameter (brood infestation, brood, food). In BC, the control colonies had slightly more honey than the 3c{3,6}-treated colonies at the start of the experiment, continuing to Day 42, though no other factors differed significantly. The BC colonies did not have an adult bee population evaluation performed on Day 42.

On Day 42, reductions in phoretic mite loads appear to represent the relative efficacy of the 3c{3,6} treatment in killing varroa mites, versus the control. Similar patterns are reflected in mite infestation densities in brood when comparing Days 0 and 42. However, on Day 42 in AB, one colony from the 3c{3,6} treatment group was too weak to sample for a mite wash, possessing too few adult worker bees. Another 3c{3,6}-treated colony had insufficient brood levels to sample for brood-infesting mites.

In both brood infestations and mite alcohol washes, 3c{3,6}-treated colonies exhibited lower mite levels than the control colonies across both AB and BC experiments. However, it is noteworthy that the control colonies in AB had significantly higher adult bee populations on Day 42 versus their 3c{3,6}-treated counterparts when measured by frame sides ($P = 0.0085$). Food and brood reserves did not significantly differ between the two treatment groups.

In AB, a clean-up phase consisting of repeated formic acid applications took place as planned, with the last round of pads placed on colonies on Day 85. After this, formic acid treatments ceased, though mite mortality continued to be monitored using weekly sticky boards.

A third mite alcohol wash was taken on Day 91 in AB to continue monitoring the mite populations within the experimental hives. At this alcohol wash interval, it was discovered that two colonies in the 3c{3,6} treatment group had perished; no further mortality occurred in the AB experiment. The 3c{3,6}-treated colonies maintained significantly lower phoretic mite levels than the control colonies, though the phoretic mite loads in both treatment groups increased slightly when compared to the Day 42 alcohol washes.

In BC, similar to AB, control colonies had higher mite fall in the latter weeks of the treatment phase, with a large proportion of mites from control colonies being cleared during the formic acid treatment. Initial mortality-based efficacies calculated in the BC cohort showed a lower mite-killing efficacy of 3c{3,6} than the AB treatment group, though the gross mite mortality in the 3c{3,6} treated colonies was noticeably higher than the untreated control.

The lack of an adult bee evaluation of the BC colonies meant there were no direct comparisons between the size of 3c{3,6}-treated colonies versus the negative controls. Nevertheless, in the spring of 2024, 3c{3,6} colonies were qualitatively observed to be weaker on average than the control colonies. Furthermore, the only dead colony in the 2023 cohort (which collapsed during the winter) was in the 3c{3,6} treatment group. These observations tend to suggest the same weakening of colonies after 3c{3,6} treatment that we observed in AB. Post-wintering assessments have not yet been completed in Beaverlodge.

Overall, our results show that 3c{3,6} remains an effective anti-varroa compound, capable of reducing varroa populations in both the spring and fall. It would appear that 3c{3,6} application in the spring does not prevent the reemergence of varroa populations later in the summer, and therefore a follow-up treatment in the fall is likely still necessary. Additionally, the weakening of 3c{3,6}-treated colonies in both AB and BC suggests a dosage of 10 g per colony may lead to delayed colony growth.

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Table 1. Data for mites on adult bees (alcohol washes), in brood, and areas of brood and food stores (mean ± S.E.).

Location	Treatment	Alcohol Washes (Mites per 100 bees)			Brood Infestation (Mites per 100 cells)		Adult Bee Population (Frame sides)		Brood (Frame sides)				Food (Frame sides)			
									Day 0		Day 42		Day 0		Day 42	
		Day 0	Day 42	Day 91	Day 0	Day 42	Day 0	Day 42	Capped	Open	Capped	Open	Honey	Pollen	Honey	Pollen
AB	3c{3,6} Wood	2.49 ± 0.54	0.00[2] ± 0.00	0.24[2] ±0.13	4.90 ± 1.12	0.00[3] ± 0.00	5.60 ± 0.96	6.50 ± 0.98	1.99 ± 0.18	1.52 ± 0.36	2.60 ± 0.60	1.01 ± 0.24	8.77 ± 1.02	2.29 ± 0.37	5.83 ± 0.64	4.11 ± 0.74
	Negative Control	2.52 ± 0.53	1.63 ± 0.50	2.07[4] ± 0.52	4.70 ± 0.99	2.20 ± 0.92	5.15 ± 0.85	12.18 ± 1.60	2.03 ± 0.35	1.01 ± 0.21	4.30 ± 0.56	1.56 ± 0.35	8.53 ± 0.74	2.44 ± 0.36	4.53 ± 0.63	2.83 ± 0.65
	Significance	ns	**	**	Ns	*	ns	**	ns	ns	ns	ns	ns	ns	ns	ns
BC	3c{3,6} Wood	0.29 ± 0.09	1.1 ± 0.3	*N/A*	1.40 ± 0.40	4.29 ± 2.11	*N/A*	*N/A*	3.13 ± 0.44	1.69 ± 0.22	0.43 ± 0.41	0.14 ± 0.06	3.93 ± 0.53	0.95 ± 0.14	8.80 ± 0.85	0.25 ± 0.06
	Negative Control	0.98 ± 0.31	7.1 ± 1.0	*N/A*	2.00 ± 0.63	25.00 ± 7.55	*N/A*	*N/A*	2.56 ± 0.42	1.24 ± 0.30	0.49 ± 0.19	0.14 ± 0.05	7.46 ± 0.75	1.08 ± 0.23	12.82 ± 0.54	0.33 ± 0.13
	Significance	ns	***	*N/A*	ns	*	*N/A*	*N/A*	ns	ns	ns	ns	**	ns	**[5]	ns

* P < 0.05, ** P < 0.01, *** P < 0.001

1 This value was calculated based off 9 colonies (colony no. 12 had insufficient adult bee populations to sample on Day 42)

2 Due to two colonies dying by this time, the mean and S.E. values are based on the 8 surviving 3c{3,6}-treated colonies (Day 91)

3 This value was calculated based off 9 colonies (colony no. 59 had insufficient capped brood to sample on Day 42)

4 This value was calculated based off 9 colonies (colony no. 374 had insufficient adult bee populations to sample on Day 91)

5 There was no significant difference in the increase in honey over the 42-day treatment period.

2. Analysis of 3c{3,6} residues on wax

Previously, we established a method for the extraction of compound 3c{3,6} from wax samples. At that time, we noticed a compound present at low levels in blank samples that closely resembles 3c{3,6}. We have analyzed pure wax samples in a laboratory that has never contained 3c{3,6} and using new glassware that was kept separate from the Plettner lab, where variable quantities of 3c{3,6} are routinely handled. M.Sc. student Xinyi Feng used gas chromatography-mass spectrometry to analyze the extracts from wax samples.

Background testing results with purchased pure beeswax gave apparent levels of 0.0484 ± 0.0483 (mean ± SE) parts per million (ppm), while control colonies never treated with 3c{3,6} had levels of 0.0104 ± 0.0016 ppm in the spring. To be clear, the material detected in these samples is not 3c{3,6}. Because we do not know what this compound is, these detected values are merely an estimate of the background signal, not of actual levels of the acaricide. Based on these analyses, we can say that that samples with values ≤ 0.1 ppm do not contain reliably detectable levels of 3c{3,6}.

Using the method described above, we determined residual 3c{3,6} levels on wax comb of 9.31 ± 6.6 ppm at the end of the fall 2023 experimental treatment period in BC. This was subsequent to the application of 10 g of the compound to each treated colony.

Our previous work documented that 3c{3,6} disappears from the release devices, suggesting that is deposited onto colony components. The sorbent (Porapak-Q) cartridges used to passively measure the levels of 3c{3,6} in the hive atmosphere are known to adsorb the compound, which indicates that movement occurs partly through evaporation. The compound, being hydrophobic, then likely condenses on beeswax surfaces within the hive.

We have also addressed the question whether the levels of compound 3c{3,6} on wax decay over winter. The largest data set we have so far is for samples from AB, sampled in the spring of 2023 after being treated with 8 g of 3c{3,6} in the fall of 2022. We saw typical signals of the background compound from control-treated colonies receiving no 3c{3,6}, using either wooden (0.31 ± 0.45 ppm) or cardboard (0.10 ± 0.19) applicators, as well as colonies treated only with Thymovar (0.09 ± 0.08). We also observed that among the 14 wax samples collected from individual 3c{3,6}-treated overwintered colonies, 2 had decayed to background levels (< 0.1 ppm), 6 had > 0.1 ppm and < 1 ppm, with the remaining 6 had > 1 ppm but < 10 ppm. Overall, levels were somewhat lower than we saw immediately after treatment with 3c{3,6} in the fall of 2023 in BC where all 10 samples contained > 1 ppm; 3 had > 1 ppm to 5 ppm, 4 had > 5 ppm to 10 ppm, and the remaining 3 samples had > 10 ppm.

FUTURE WORK ON QUANTITATION OF RESIDUES

Given that the background compound shares ion mass-to-charge ratio (m/z) 109 with 3c{3,6}, we will reanalyze the data we already have by integrating the sum of m/z 151 + 192. We will continue to attempt identification of the background compound and its source, to understand

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VITA BEE FUMAGILIN - B POWDER 454g	141025	-	-
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why it is somewhat variable. Additionally, we are working with purchased wax samples and spiking known amounts of compound 3c{3,6}, to determine the limit of detection and the limit of quantification.

Accomplishments:

- Conduct of an additional two full-scale field trials (spring and fall) in two different geographic locations and further confirmation of treatment efficacy.
- Continued development of an GC-MS technique for the detection of 3c{3,6} in beeswax.
- Ongoing training of graduate students at AAFC and SFU. Robert Lu now writing his M.Sc. thesis.
- Publication of a peer-reviewed manuscript regarding 3c{3,6} discovery and field testing. (Dawdani et al. (2023) Scientific Reports 13, 11195. https://doi.org/10.1038/s41598-023-38187-6)

Summary:

In conclusion, we have completed two additional large-scale field trials in 2023 that are producing valuable data for evaluating the efficacy of compound 3c{3,6}. Our results appear to show consistency in the utility of using compound 3c{3,6} for varroa mite control in the spring as well as the fall. We also continue to examine deposition of the compound in beeswax and honey.

Our work is on track and is positioned to produce data to support the registration of 3c{3,6} in both Canada and the U.S. as a novel compound for controlling varroa mites. We thank the Canadian Bee Research Fund for support of this project.

Same concentration, different outcome: understanding variability in varroa mite treatments

Abderrahim HAMMAIDI (DVM), Europe Technical Manager at Véto-pharma.

The relentless assault of Varroa destructor infestations on honey bee colonies is a global concern, propelling a race towards new pharmaceutical interventions.1 While conventional wisdom often emphasizes medication concentration as the linchpin of treatment success, the reality is far more nuanced.

A myriad of interplaying factors – from pharmacokinetics and pharmacodynamics to the delicate balance of bee and varroa biology – converge to shape treatment outcomes.

Additionally, the potential impacts of increasing medication concentrations on bee health are significant, ranging from immediate effects such as bee mortality to long-term consequences2, including changes to gut microbiota, and cognitive abilities like olfactory learning and memory.3,4 Furthermore, increasing the concentration may result in higher residue levels in bee colonies, which can have serious consequences, including the potential development of resistance to the active ingredient.

1. A higher concentration does not guarantee greater efficacy

Medication concentration, the cornerstone of treatment formulation, defines the potency of pharmaceutical interventions against Varroa destructor infestations.5 However, reaching the optimal concentration levels does not necessarily ensure effectiveness against these infestations.6 Simply boosting medication concentration isn't the silver bullet either. Unfortunately, this is nevertheless what is regularly observed in the field.

In honey bee colonies, the effectiveness of treatment is influenced by a range of factors including application methods, hive complexities, and bee behaviors.

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Recent research by Pohorecka et al. (2021)7 highlighted the complexities of thymol concentration dynamics within honey bee colonies, revealing significant variations based on application methods and environmental factors. These findings underscore the importance of considering different factors in treatment efficacy assessments and formulation strategies. The importance of drug concentration also lies in managing the right balance between efficacy against parasites with the least impact on bee health in the colony ecosystem. Besides the active ingredient, galenic formulation8 plays a key role in determining the precise release necessary for effectiveness in the target species.[9]

To illustrate our point, here are two examples of internal studies (conducted by our R&D department), with identical concentrations of active ingredients but different formulations.

Our research and development team conducted these trials as part of a project to reformulate molecules already used in beekeeping, aiming to enhance their effectiveness, speed of action, or mode of application.

Study #1:
The trial aimed to compare both concentration and galenic form for a same active ingredient: 110 mg or 220 mg, on tab or plate (see photos below).

Treatment group #1:
1 tab of Flash 110 mg for 7 days.

Treatment group #2:
1 tab of Flash 220 mg for 7 days.

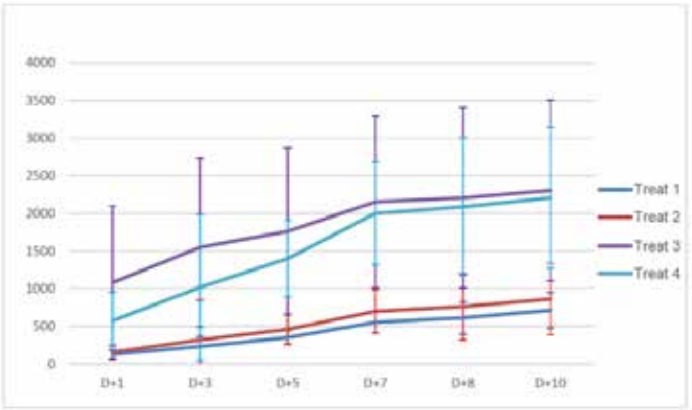
Treatment group #3:
1 plate of Flash 110 mg for 7 days.

Treatment group #4:
1 plate of Flash 220 mg for 7 days.

Central position of a tab (group 1 & 2)

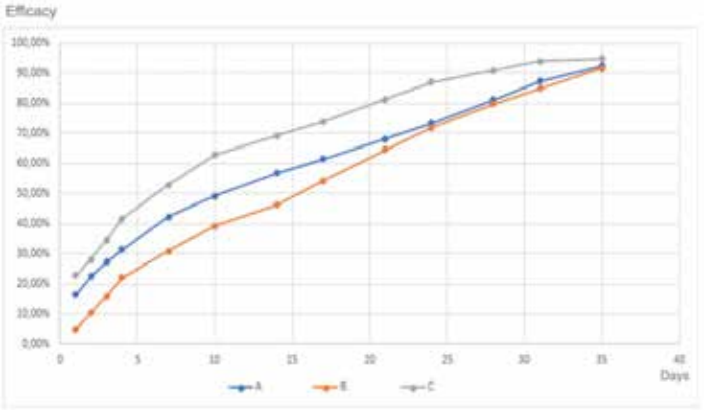
Central position of a plate (group 3 & 4)

Figure A:
Evolution of cumulative varroa motality.



The findings suggest a pattern of lower effectiveness in treatments 1 and 2 (tabs) for reducing varroa mites compared to treatments 3 and 4 (plates). This illustrates how the same dosage, but with different formulations, can yield markedly different outcomes. Conversely, doubling the concentration in treatment 4 resulted in lower efficacy compared to treatment 3.

Study #2:
Comparison of 3 different acaricide strips, based on the same active ingredient, with the same concentration in each strip.



On this graph, you can see three different acaricide strips based on the same active ingredient, with the exact same dosage. What's the only change? The global formulation of the strips. You can clearly see improved kinetics in strip C compared to strip A.

2. Identical concentration, divergent bee mortality rates

Beyond assessing treatment effectiveness, the formulation of a drug significantly impacts bee colonies. One straightforward method to evaluate this impact is by measuring bee mortality post-treatment.

Our R&D team has conducted numerous tests to work on reformulating active ingredients in varroa treat-

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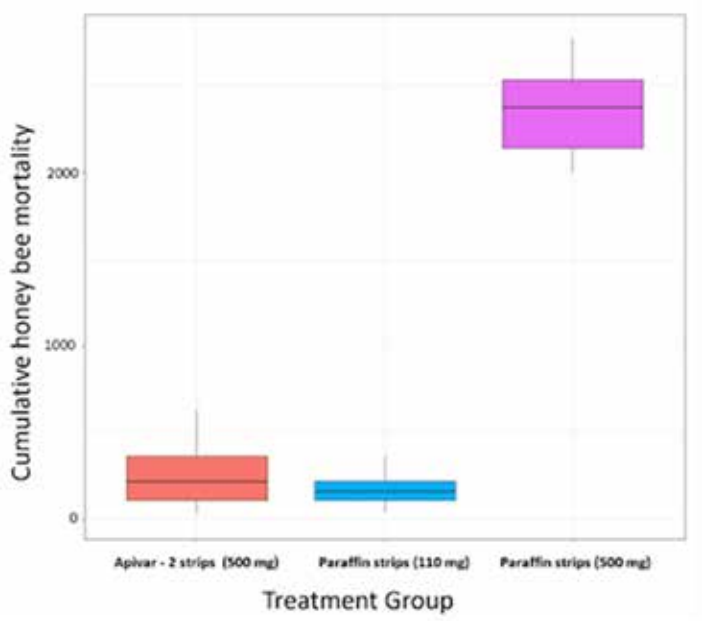
ments. For instance, in 2019, we conducted a trial at our R&D apiary in France using 24 colonies, divided into three groups:
Apivar strips (500mg)
Paraffin strips with amitraz (110mg)
Paraffin strips with amitraz (500mg)

Both the colonies treated with Apivar and those treated with paraffin strips at a 500 mg dosage per strip received the same amount of active ingredient. However, the graph shows a significant difference in cumulative honey bee mortality between the Apivar group and the 500 mg Paraffin strips group.



This inconsistency underscores the significance of the drug's formulation and the manner in which the active ingredients are released within the hive. It illustrates why selecting a treatment solely based on the highest concentration of the active ingredient can be misleading and why mixing homemade treatments can be hazardous, in addition to being forbidden.

3. Understanding the pharmacokinetics and pharmacodynamics

Pharmacokinetics and pharmacodynamics10 are critical in understanding how varroa mite treatments function within honey bee colonies and impact bee health.

Pharmacokinetics, the study of how medications are absorbed, distributed, metabolized, and eliminated within both mites and bees, is crucial for developing effective treatment plans that minimize bee harm, reduce residue, and lessen environmental toxicity. Key studies like those by Gregorc et al. (2020)11 highlight the need for treatment plans tailored to bee metabolisms, as formic acid affects worker bees differently from brood. Smart et al. (2023)12 emphasize aligning treatment timing with colony dynamics to optimize efficacy, integrating complex interactions between treatment concentration, pharmacokinetics, and bee biology.

Conversely, pharmacodynamics focuses on action mechanism of a drug while binding targeted receptors. For varroa control drugs, the bees' biological responses to these drugs is an additional challenge for evaluating treatment efficacy and safety. Research by Nazzi et al. (2022)13 on novel acaricides targeting varroa mites shows promising control strategies by affecting specific biochemical pathways. However, gaps in understanding the action mechanisms of common treatments pose risks of improper dosages and potential treatment failures.

Furthermore, interactions between acaricides and other hive and environment chemicals, such as fungicides, can complicate treatment effects due to synergistic toxicity, as shown in studies highlighting the role of enzyme induction and inhibition in modifying drug effects.[14,15,16]

4. The impact of residues on bee well-being and resistance development

Acaricides are crucial for controlling varroa mites but their residues in hive products pose risks to bee health, the quality of hive products, and the environment.17 The key challenge is to balance effective mite control with maintaining the health of honey bees. Residues that accumulate in beeswax, honey, and bee bread pose ongoing risks, affecting bee development, behavior, and overall colony health.18 These residues act as hidden threats within the hive, contributing to the global decline in honey bee populations.[19,20]

Research has demonstrated that acaricides like tau-fluvalinate, coumaphos, and fenpyroximate, when present in the hive and combined with other substances such as fungicides, can exacerbate toxicity, leading to higher mortality rates among adult worker bees.[13, 21]

A 2021 study by Benito-Murcia22 shows that residues of tau-fluvalinate in beeswax can lead to the accumulation of active ingredients in the fat bodies of honey bees. Since varroa mites primarily feed on the fat bodies, this could increase their exposure to sublethal dose of the pesticide, potentially enhancing their resistance to it.

▶ pag. 27

This finding underscores the importance of selecting active ingredients carefully and developing new varroa treatments that consider the impact of residue accumulation. Additionally, beekeepers can mitigate these effects by regularly replacing their brood combs.

Key points to remember

Concentration and dosage alone do not guarantee the effectiveness of the treatment. One treatment may be more effective than another, despite a lower dosage.

Striking the right balance between varroa toxicity and minimal impact on bee health is crucial, as high acaricide concentrations can lead to adverse effects like toxicity, disrupted instinctive and social behavior and the immune system.

Optimizing medication concentration dynamics and treatment efficacy demands careful consideration of application methods and hive real-life.

Integrating pharmacokinetic/dynamic principles with bee physiology can enable more targeted and sustainable varroa control strategies.

Monitoring and managing acaricide residue accumulation in hive products is essential to mitigate risks of chronic exposure, potential synergistic toxicity to bees, and the development of resistant mites.

Pharmaceutical companies are tasked with developing sustainable treatments for varroa mites, but beekeepers also play an essential role in keeping bee colonies below the damage thresholds caused by these mites. We encourage you to actively manage varroa through an integrated pest management (IPM) approach that incorporates mechanical, biological, and carefully chosen chemical interventions.[1,2,3]

Regular counting of varroa mite infestations, employing exclusively approved treatments, incorporating biotechnical approaches like colony splitting and drone brood removal, regularly replacement of brood combs, and continuously working to maintain low varroa levels throughout the season are fundamental strategies. These proactive steps significantly influence the vitality and productivity of bee colonies, safeguarding their welfare and output.

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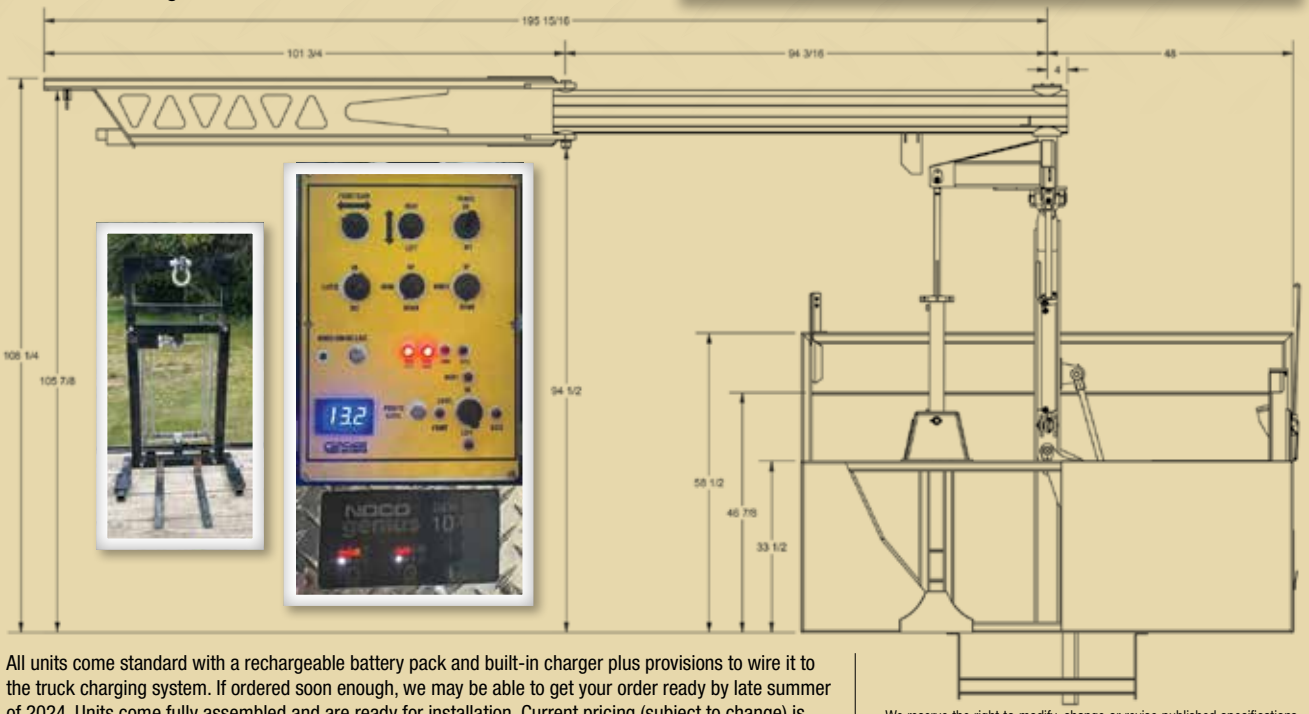

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