Issue 22 · April 2026

NO BEES LIFE

EBA MAGAZINE

32 COUNTRIES

FROM WHICH EBA HAS MEMBERS

(61 beekeeping organizations)

In order of confirmation of the Statute of EBA

420.179 beekeepers

Serbia
Slovenia
North Macedonia
Bulgaria
Greece
Romania
Malta
Germany
Hungary
Ukraine
Montenegro
Lithuania
Bosnia and Hercegovina
Sweden
Croatia
Czech Republic
Poland
United Kingdom
Netherlands
Italy
Ireland
Belgium
Cyprus
Türkiye
Switzerland
Prishtina*
Portugal
Spain
Slovakia
Austria
Albania
Iceland
Estonia

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SAVA
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SILVER SPONSOR

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EUROPEAN BEEKEEPING ASSOCIATION

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A NEW ERA FOR EUROPEAN BEES: THE EBA'S FIRST TWO YEARS OF SUCCESS

Since its ambitious founding on February 10, 2024, the European Beekeeping Association (EBA) has rapidly evolved from a fledgling organization into the definitive voice for bees, beekeepers, and consumers across the continent. Headquartered in Slovenia– a country famous for it's beekeeping tradition - the association spent its first two years of operation dismantling the barriers that previously left the beekeeping sector fragmented. By strategically waiving membership fees through 2025, the EBA fostered an unprecedented level of inclusivity, allowing a diverse tapestry of national organizations (62 organisations from 32 countries) to unite under a single banner. This growth was not merely numerical; it was foundational, creating a central European platform representing more than 420 thousand beekeepers at the moment, capable of challenging major threats that undermine the foundations of beekeeping.

At the heart of the EBA's mission is a fierce commitment to the integrity of the honey market. The association has moved beyond simple advocacy, actively embedding itself within the halls of the European Commission and the European Parliament. Through the Honey Platform and direct engagement with DG AGRI and both the EU commission and the EU parliament members, the EBA has fought for rigorous standards and sophisticated traceability systems. These efforts reached a historic milestone in 2026 when the EBA successfully secured the regulatory framework for direct subsidies per hive. This achievement marks a revolutionary shift in European policy, finally recognizing and compensating beekeepers for the invaluable pollination services their bees provide to the ecosystem.

The EBA is powered by its specialized scientific committees, which tackle everything from bee health to the complexities of apitherapy and quality of bee products, all whilst promoting beekeeping amongst youth. By publishing articles and hosting high-level webinars on major problems facing beekeeping (fake honey, invasive hornets), the association ensures that European beekeepers are armed with the best possible data. EBA's vigilance extends to the environment as well, as they have consistently lobbied against the deregulation of pesticides and the rise of harmful substances like acetamiprid.

Beyond the technical and political, the EBA recognises public engagement and international solidarity as one of it's main goals . Through the publication of the "No Bees, No Life" magazine and the widespread "Europeans Choose European Honey" campaign, the association has bridged the gap between the apiary and the consumer. EBA's presence is felt at major global events, from sponsoring the International Honey Commission symposium and being involved in the panel on the problematic of fake honey to partnering with organizations like Apimondia and Kings of Mead. Whether standing in solidarity with beekeepers in France and Greece during times of crisis or pushing back against the EU-Mercosur agreement, the EBA has proven that these first two years were just the beginning of a long-term movement to protect the soul of European agriculture.

EBA is inviting all european beekeeping organisations to become members and fight for the cause – free of charge!

EBA ANNUAL GENERAL ASSEMBLY SCHEDULED FOR 8 APRIL 2026

The European Beekeeping Association (EBA) is pleased to announce that its Annual General Assembly will take place on 8 April 2026 at 19:00 (CET).

All EBA member associations are invited to participate, along with representatives of the EBA Scientific Committees. In addition, other beekeeping organizations across Europe are welcome to attend as observers, without voting rights, to follow EBA's work and discussions.

A professional interpreter will be provided to ensure smooth communication during the Assembly.

The meeting link and full agenda will be shared with all participants in the coming days.

This is an excellent opportunity for members and observers alike to gain insight into EBA's activities, priorities, and ongoing initiatives, as well as to explore opportunities for future cooperation within the European beekeeping community.

EBA AT IHC SYMPOSIUM 2026:

ADDRESSING THE CHALLENGE OF HONEY FRAUD

As part of the 7th International Symposium on Bee Products and the Annual Meeting of the International Honey Commission (IHC), held in Poreč, Dr. Nik Lupše, Head of the Scientific Committees of the European Beekeeping Association (EBA), delivered an opening address highlighting key perspectives from the scientific community on the major challenges currently facing the honey sector. Particular emphasis was placed on the issue of honey authenticity and market integrity, as well as the need to strengthen science-based methods for quality control and origin verification. Following the opening remarks, a panel discussion was held under the title:

"Is Honey Fraud a Systemic Weakness or a Chosen Policy?"

The panel brought together leading experts in the science of bee products, regulatory representatives, and industry stakeholders to examine the underlying drivers of honey fraud and to identify solutions aimed at improving transparency and trust across the market.

The discussion, held within the framework of the IHC Symposium 2026, was widely regarded as highly successful, fostering an open and constructive exchange among participants.

A clear message emerged: addressing honey fraud must remain a priority for the entire sector.

Strengthening transparency, advancing science-based solutions, and enhancing cooperation between the scientific community, institutions, and industry are essential steps toward protecting both beekeepers and consumers.

Panelists:
Andreas Thrasyvoulou
Miguel Vilas-Boas
Nik Lupše
Dario Lasić
Dražen Lušić

The European Beekeeping Association (EBA) is proud to support this important initiative as a sponsor of the International Honey Commission, contributing to strengthening dialogue and joint efforts to tackle one of the most pressing challenges in today's honey market.

EBA has emphasised the importance of supporting local beekeepers by buying quality local honey. In addition to scientific support and research, informing and educating the consumer holds the key to sustainability of the european beekeeping.

BUY LOCAL HONEY

European Beekeeping Association

EUROPEAN BEEKEEPING EVENT IN SLOVENIA

Dear Members of the B-THENET Network,

We are pleased to invite you to the European Beekeeping Event co-organised by the European Project B-THENET, the European Beekeeping Association (EBA), and the Slovenian Beekeepers' Association (SBA).

This three-day event will be held on 27–28–29 August 2026 at the heart of the Slovenian Beekeeping Association (Location: Slovenian Beekeeping Association, Brdo pri Lukovici, Slovenia). It offers a valuable opportunity for knowledge exchange, collaboration, and celebration of Europe's vibrant beekeeping community.

The event is designed to provide beekeepers with the most up-to-date knowledge on best practices to address both emerging and long-standing threats to honey bees, while also fostering discussion on key policy issues relevant to the European beekeeping sector.

27th Thursday

Afternoon sessions

14:00 - 15:00
Plenary Lecture on *tropilaelaps mite*

- **Speaker:** Dr. Fani Hatjina
- **Format:** Hybrid (Up to 200 participants)

15:00 – 19:00
Practical Workshop for beekeepers: Best Practices for Varroa monitoring

- **Location:** Slovenian Beekeepers' Association apiary
- **Facilitators:** B-THENET Advisors + BEEXPERT experts
- **Format:** In-person/Practical (50 participants, registration required, free entry)

Evening

Social Dinner

28th Friday

Morning Sessions

09:00 – 11:00
Plenary Lecture on invasive vespids & stressors

- **Speakers:** Prof. Dirk de Graaf, Dr. Karen Power
- **Format:** Hybrid (Up to 200 participants)

11:00 – 13:00
Event for Beekeepers: Free Distribution & Presentation of the Best Beekeeping Practices Manual: 101 Practices Adapted to 13 EU Beekeeping Contexts

- **Speakers:** Apimondia
- **Format:** Hybrid (100+ participants)

Afternoon Parallel Sessions

14:00 – 18:00
Policy Dialogue for Sustainable EU Beekeeping

- **Policy Recommendations on:**
  - Generational renewal and Gender balance
  - Organic beekeeping and regulatory perspectives
  - Availability of veterinary medical products for bees
- **Speakers:** BeeLife
- **Format:** Hybrid (100+ participants)

14:00 – 19:00
On-field demonstration for beekeepers: Best Practices on how to manage *Vespa orientalis*

- **Location:** Field excursion to Koper
- **Facilitators:** B-THENET Advisors + BEEXPERT experts
- **Format:** In-person/Practical (50 participants, registration & small fee apply)

Evening

Social Dinner

29th Saturday

All Day sessions

Technical tours and excursions to Slovenian apiaries and cooperatives

Format: In-person/Practical
(50 participants, registration & small fee apply)

Travel Information for Participants

Event Location:
Slovenian Beekeepers' Association,
Brdo pri Lukovici, Slovenia.

Suggested Accommodations:
Apartments Bukor | Hotel Kronа | Ambient

Closest Airport:
Ljubljana Airport

Shuttle Transfer to Hotels:
A daily shuttle service will be offered on 26, 27, 29 and 30 August (approx. 40-minute transfer to hotels, around 30 km). The exact timetable will be confirmed.

Taxi Transfer:
Taxis are available at the airport
(approx. 40-minute transfer to hotels, around 30 km).

Join the European movement!

Connect with fellow professionals, share experience and expertise, and contribute to a growing movement for sustainable and resilient beekeeping.

Register now

THIRD INTERNATIONAL FORUM FOR ACTION ON SUSTAINABLE BEEKEEPING AND POLLINATION

Dear Sir or Madam,

It is our great pleasure to invite you to the Third International Forum for Action on Sustainable Beekeeping and Pollination, which will take place on 20–21 May 2026 in Maribor, Slovenia.

Held under the theme _“Science, innovation and policy actions for a more sustainable future”_, the Forum will bring together a diverse group of international stakeholders to exchange knowledge, share best practices and advance concrete actions for the protection of pollinators and the development of sustainable beekeeping.

The event is jointly organized by the Government of the Republic of Slovenia and the Food and Agriculture Organization of the United Nations (FAO), in cooperation with the Ministry of Foreign and European Affairs of the Republic of Slovenia.

It will also include the Golden Bee Award ceremony, to which you are cordially invited.

Please find attached the official invitation, the information note and the provisional agenda. Kindly confirm your participation via the following link:

https://dogodki.vlada.si/3rd-international-forum-registration

We look forward to welcoming you.

Yours sincerely,

Bee Forum Team
REPUBLIC OF SLOVENIA
MINISTRY OF AGRICULTURE, FORESTRY AND FOOD
European Affairs and International Cooperation Service
Dunajska cesta 22
SI–1000 Ljubljana, Slovenija
+386 (0)1 478 90 77
beeforum.mkgp@gov.si
www.mkgp.gov.si

Food and Agriculture Organization of the United Nations

REPUBLIC OF SLOVENIA

International Forum for Action on Sustainable Beekeeping and Pollination

Science, innovation and policy actions for a more sustainable future

20–21 May 2026 Maribor, Slovenia

The Food and Agriculture Organization of the United Nations (FAO) and the Republic of Slovenia are jointly organizing the Third International Forum for Action on Sustainable Beekeeping and Pollination with the theme "Science, innovation and policy actions for a more sustainable future", to be held at the Habakuk hotel in Maribor, Slovenia, from 20 to 21 May 2026.

Bees and other pollinators are essential to food security, biodiversity conservation, ecosystem resilience and sustainable livelihoods. At a time when pollinators face increasing pressures from land use change, the indiscriminate use of agrochemicals, climate change and other environmental challenges, coordinated scientific, policy and practical responses are urgently needed.

Building on the outcomes of the previous forums, the Forum in 2026 will provide a platform for dialogue among policymakers, researchers, beekeepers, farmers' organizations, civil society and private sector representatives. Discussions will focus on strengthening the science–policy interface, scaling up pollinator-friendly agricultural approaches, enhancing international cooperation and addressing emerging challenges in honey quality and trade.

The Forum will also mark the celebration of World Bee Day 2026 and include the Golden Bee Award Ceremony. The Forum will be held in English and will be webcast.

For further information regarding the Forum, please visit the event's webpage or contact: beeforum.mkgp@gov.si.

QU Dongyu
Director-General
Food and Agriculture Organization of the United Nations

Mateja Čehulić
Minister
Ministry of Agriculture, Forestry and Food
Republic of Slovenia


Food and Agriculture Organization of the United Nations
REPUBLIC OF SLOVENIA
Third International Forum for Action on Sustainable Beekeeping and Pollination
Science, innovation and policy actions for a more sustainable future
Maribor, Slovenia | 20 – 21 May 2026
Practical information note

The Third International Forum for Action on Sustainable Beekeeping and Pollination will be jointly organised by the Republic of Slovenia and the Food and Agriculture Organization of the United Nations (FAO), and will take place from **20 to 21 May 2026** at the Habakuk hotel in Maribor, Slovenia.

Participants are expected to **arrive on 19 May 2026** and **depart on 22 May 2026**.

ACCREDITATION

Register by 30 April 2026 *(for visa applicants: 13 April 2026)*
Register at: https://dogodki.vlada.si/3rd-international-forum-registration

Kindly ensure that all required information is filled in accurately, in accordance with the instructions in the form.

Before starting the registration process, please have a recent photo of yourself ready for upload.

Badges can be collected at the registration/information desk at the Habakuk hotel on 19 May from 17:00 to 20:00 hours and on 21 May from 9:00 to 9:20 hours.

VISA APPLICATION PROCESS

Slovenia is part of Schengen Area. The participants need to check if they are required a visa to enter Schengen Area/Slovenia.

This information can be found at: https://www.gov.si/en/topics/entry-and-residence/ or at https://home-affairs.ec.europa.eu/policies/schengen/visa-policy_en#which-countries-nationals-need-a-visa-to-enter-the-schengen-area

In case a participant holds a valid Schengen visa (with multiple entries), (s)he will not need a visa to enter Slovenia. For all others, please check at which diplomatic mission you can apply in case there is no Slovenian Embassy in your country at:
https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fhome-affairs.ec.europa.eu%2Fdocument%2Fdownload%2F0a7b2e97-025c-4c1a-be13-2bef5329f2c1_en&wdOrigin=BROWSELINK

You are advised to apply early as the visa issuing process may take time, depending on the workload of the concerned diplomatic mission. In addition to other required documents, the applicant also needs to have an invitation letter from FAO and/or Ministry of Agriculture, Forestry and Food of Slovenia to participate at the Forum.

In case further clarifications are needed, email your inquiries to: beeforum.mkgp@gov.si

MEALS

Participants are invited to attend a welcome cocktail on 19 May, starting at 19:00 hours. For logistical purposes, please confirm your participation through the registration form.

Lunch and coffee breaks will be provided for all participants on the meeting days. On 20 May, a reception will be held as part of the World Bee Day celebration and Golden Bee Award ceremony.

HOTEL ACCOMMODATION

All participants are encouraged to stay at https://habakuk.si/en/

To facilitate this, the organisers have pre-booked a sufficient number of rooms at a preferential rate, which will be held until **30 April**. After this date, neither room availability nor the preferential rates can be guaranteed.

Participants are kindly requested to make their reservations directly by emailing booking@hotel-habakuk.si. To benefit from the negotiated rates, please indicate that you are attending the **Beekeeping Forum.**

Room prices	Included	Additional charges
Standard Double Room – Single Use: €120.00 per room/night **Standard Double Room:** €140.00 per room/night **Superior Double Room:** €170.00 per room/night **Superior Double Room – Single Use:** €150.00 per room/night	• Bed and breakfast • Access to the wellness area • Access to the fitness center • Wi-Fi	**MANDATORY** Tourist tax: €3.13 per person/night **OPTIONAL:** Parking: €5.00 per day

TRANSPORT

Participants are advised to travel to Slovenia via one of the nearby international airports (Vienna, Graz, Ljubljana or Zagreb), followed by onward transport to Maribor

Recommended flight routes

Participants may consider the following general travel options:

- Via Istanbul, with onward connections to Ljubljana or Zagreb
- Via major European hub airports, with onward connections to Vienna, Graz, Ljubljana, or Zagreb

Transfers to Maribor

- **Private or shared transfer:** A recommended provider is https://www.gosafi.com/en/, a reliable transfer company offering door-to-door services. Prices may increase closer to the event date.
- **Train from Vienna, Graz, and Ljubljana:** To buy tickets from Austria, you can use https://www.oebb.at/en/. To buy tickets from Ljubljana, you can use

https://potniski.si.si/en/. The journey from Graz takes about an hour, from Vienna three to four hours, and from Ljubljana two hours.

- **Bus lines from Zagreb, Vienna, Graz, and Ljubljana:** For international routes, you can use https://www.flixbus.co.uk/ and book tickets on their website. For bus lines from Ljubljana, you can use https://www.ap-ljubljana.si/en.

Please keep in mind that the train and bus stations in Maribor are not in the immediate vicinity of the hotel. There is a public transport bus line G6 running from the train station to the hotel, you can also book a taxi.

DRAFT PROGRAMME OUTLINE

Date	Programme
19 May 2026	Arrival of participants Welcome cocktail
20 May 2026 **DAY 1**	Morning: Opening of the Forum and high-level panel discussion Afternoon: Technical discussions Evening: World Bee Day celebration and Golden Bee Award Ceremony
21 May 2026 **DAY 2**	Morning: Technical discussion and closing Afternoon: Field visit
22 May 2026	Departure of participants

CONTACT DETAILS

For any questions related to travel, accommodation, transfers, or on-site arrangements, you may contact the designated event focal point.

The focal point will be available to provide support before and during the Forum, including assistance with logistics, arrival coordination, and general organisational matters.

E: beeforum.mkgp@gov.si
T: +386 (0)1 478 90 77

OTHER INFORMATION

- Working language: English
- Time: Central European Summer Time (CEST), which is UTC +2
- Currency: EUR
- Area code: +386
- Emergency number: 113 (Police) and 112 (Emergency Medical Services, Firefighters)
- Running water from the tap is drinkable in Slovenia

DAY 1		20 May 2026	
Time (CEST)		Topics	Speakers
09:30	10:00	Opening	
09:30	09:30	**Introduction & videos**	
09:30	09:40	**Opening remarks**	High-level representative, Slovenia
09:40	09:50	**Opening remarks**	Senior Representative, FAO
09:50	10:00	**Opening remarks**	Senior Representative, European Commission (TBC)
10:00 – 10:30		Coffee break and group photo	
10:30	12:30	High-level session: Linking science, agriculture and biodiversity	
10:30	10:45	**Session keynote:** The role of multidisciplinary research for sustainable beekeeping and the conservation of pollinators	
10:45	11:00	**Case study**	
11:00	12:00	**High-level panel discussion**	
12:00 – 13:00		Lunch	
13:00	15:00	Technical session I: Towards a global pollinator platform	
13:00	13:15	**Session keynote:** The global pollinator platform	
13:15	13:30	**Case study**	
13:30	14:45	**Facilitated discussion with panellists and forum participants**	
14:45 – 15:00		Coffee break	
15:00	17:00	Technical session II: Scaling crop production practices that protect pollinators	
15:00	15:15	**Session keynote:** Redesigning agriculture: How landscape-scale agroecology can reverse pollinator decline and strengthen food security	
15:15	15:30	**Case study**	
15:30	16:30	**Facilitated discussion with panellists and forum participants**	
18:00 – 20:00		World Bee Day celebration and Golden Bee Award Ceremony	
		Gala reception hosted by the Minister of Agriculture, Forestry and Food, in the presence of Her Excellency the President of the Republic of Slovenia.	

DAY 2	21 May 2026	
Time (CEST)	Topics	
09:00 – 11:15	Technical Session III: Honey quality and trade: Challenges on the rise	
09:00 – 09:15	**Session keynote:** Addressing global issues in honey quality and trade	
09:15 – 09:30	**Case study**	
09:30 – 10:00	**Facilitated discussion with panellists and Forum participants**	
10:00 – 10:15	Coffee	
10:15 – 11:15	**Facilitated discussion with panellists and Forum participants (continued)**	
11:15 – 12:00	Closing	
11:15 – 11:40	**Forum conclusions: Key messages for action**	
11:40 – 11:50	**Closing remarks**	*Representative, Slovenia*
11:50 – 12:00	**Closing remarks**	*Representative, FAO*
12:00 – 13:00	Lunch break	
13:00 – 19:00	Field trip *Guided visits to points of interest (Bee Centre, local beekeeper, apitourism site)*	

Third International Forum for Action on Sustainable Beekeeping and Pollination

Science, innovation and policy actions for a more sustainable future

Maribor, Slovenia | 20 – 21 May 2026

Provisional agenda

URGENT MEASURES REQUIRED TO PREVENT THE INTRODUCTION OF TROPILAELAPS MITES INTO THE EU

The European Beekeeping Association is sounding a critical alarm regarding the westward spread of the Tropilaelaps spp.mite, a parasite that reproduces faster and causes more devastating colony losses than the well-known Varroa mite. Recent detections in Georgia and Russian regions bordering Ukraine, alongside unconfirmed reports from Belarus, have signaled an immediate biosecurity threat to the European Union. Because the mite can travel through queen shipments, used equipment, and bee products, current import regulations are deemed insufficient to protect the European bee population.

In more detail, the EBA is urging the European Commission to take emergency action by temporarily removing Ukraine, Turkey, and Russia from the list of approved third countries for bee imports. They are also calling for a ban on unprocessed apiculture products and used equipment from these regions. Beyond trade restrictions, the EBA advocates for intensified health screenings in border Member States and the urgent development of environmentally friendly

treatments, as no specific veterinary products are currently authorized in the EU to combat this pest. This proactive stance mirrors recent protective measures taken by Canada and the United Kingdom to prevent a potential collapse of the European beekeeping.

Subject: Urgent Measures Required to Prevent the Introduction of *Tropilaelaps* Mites into the EU

For several years now, the *Tropilaelaps spp.* mite has been spreading westwards across Asia. Due to its enormous reproduction rate, *Tropilaelaps* mite. can cause higher colony losses than the well-known bee parasite *Varroa destructor* (Chantawannakul et al. 2018[1]). Infestation with this pest is therefore a notifiable animal disease of categories D and E in accordance with EU Regulation 2018/1882 and the Animal Health Law (EU Regulation 2016/429).

The high infestations with *Tropilaelaps mercedesae* mite have been detected in honey bee colonies in Georgia (Janashia et al. 2024[2], Urunov et al. 2026 [3]) and in the Russian regions of Krasnodar and Rostov (Brandorf et al. 2024[4]) on the border with Ukraine. Populations are established there, leading to colony losses in beekeeping.

In addition, there are several unconfirmed reports from Ukraine and Belarus. The European Reference Laboratory for Bee Health (EURL) points to the geopolitical situation in Ukraine, which currently makes it impossible to obtain an overview of the situation there[5]. In addition, due to the lively illegal trade in bees between Georgia and Turkey, the EURL considers the risk of *Tropilaelaps* spp. being introduced into the EU via this route to be "significant".

Scientific studies have shown that Tropilaelaps can potentially be introduced via bee transport, including queen shipments, as well as used beekeeping equipment and bee products (Gill et al. 2025[6]). The current import conditions do not provide sufficient control to prevent the introduction of *Tropilaelaps* into the European Union (EU).

[1] https://www.sciencedirect.com/science/article/abs/pii/S2214574517300810

[2] https://reference-global.com/article/10.2478/jas-2024-0010

[3] https://academic.oup.com/jee/advance-article/doi/10.1093/jee/toag027/8512780

[4] https://doi.org/10.1017/S0021853824000038

[5] https://sitesv2.anses.fr/en/system/files/Scientific_note_EURL_Geographical_distribution_TropiLaelaps_march_2025.pdf

[6] https://ojs.mtak.hu/index.php/Apisatisticta/view/21253

The Canadian Food Inspection Agency (CFIA) decided in 2024 that no more package bees and queens may be imported from Ukraine[7]. Previously, in January 2024, the CFIA had sent a questionnaire to the competent Ukrainian authority to gather up-to-date information on beekeeping there and the status of *Tropilaelaps* spp. infestations. This process followed the recommendation of the World Organisation for Animal Health (WOAH) manual on import risk analysis for animals and animal products. Based on the information received, the CFIA concluded that Ukraine is not guaranteed to be free of *Tropilaelaps* spp. infestations.

Last year, the United Kingdom also concluded that monitoring of *Tropilaelaps* spp. infestations in Ukraine are currently very limited, and the introduction of these mites cannot be ruled out. The United Kingdom has therefore temporarily banned the import of honeybees[8], unprocessed apiculture by-products, used apiculture equipment and apiculture products in combs.

Our request to you:

EBA requests clarification on the status of Ukraine and Turkey. Pending confirmation of their disease-free status, temporary restrictions should be put in place according to Article 261 of (EU) 2016/429, by removing Ukraine and Turkey from the list of countries, from which bees may be imported into the EU (Implementing Regulation (EU) 2021/404, Annex VII). The import of unprocessed apiculture products and used apiculture equipment must also be prohibited. Russia should also be removed from Annex VII due to the detection of *Tropilaelaps* spp. infestations in several regions.

We would also like to kindly ask you to advocate for increased health checks in all Member States bordering Ukraine and Turkey in order to detect the possible presence of *Tropilaelaps* spp. infestations. All Member States should be asked to check their control plans with regard to *Tropilaelaps* spp. infestations and to brief the competent authorities on the existing risk.

Furthermore, we would like to point out that there are currently no authorised veterinary products in the EU to specifically combat Tropilaelaps. Some products used against Varroa may also be effective, but an increased use of synthetic products in particular carries the risk of higher levels of residues in bee products and the development of resistance in both Tropilaelaps and Varroa.

For this reason, promoting on-field studies to focus low environmental products to register in EU against Tropilaelaps should be recommended.

[7] https://fsrn-ednet.ca/wp-content/uploads/2024/08/CFIA_ACIA-2127548-v2-Response_Letter_Bee_Imports_from_Ukraine_2024_Stakeholders-PDF-Original-2129691.pdf

[8] https://www.gov.uk/government/publications/official-veterinary-surgeon-ovs-notes/8-october-2025-tropilaelaps-mite-restrictions-ukraine

The EBA and its Scientific Committee on Bee Health remain at your disposal for any further information or technical discussions required to safeguard the health of European honeybees.

Respectfully,

President Boljan Noc – President of European Beekeeping Association

Dr. Nik Lapše –Head of EBA Scientific Committees,

Prof. Dr. Aslı Özkırım – President of EBA Bee Health Scientific Committee

Dr. Giovanni Formato – Vice-President of EBA Bee Health Scientific Committee

Sent for information to:

- Directorate-General for Agriculture and Rural Development (DG AGRI)
- Directorate-General for Health & Food Safety (DG SANTE)

Members of the EU Parliament

Published on the EBA website and social media

SWEDISH BEEKEEPERS HAVE PLAYED A CRUCIAL ROLE IN IDENTIFYING SUSPECTED CASES OF FAKE HONEY ON THE MARKET, HIGHLIGHTING BROADER CONCERNS ABOUT HONEY ADULTERATION ACROSS EUROPE

According to representatives of the Swedish beekeeping sector, the Swedish central food authority conducted investigations in cooperation with Biodlingsföretagarna. All findings are now public: the product “Hilltop hot honey,” sold in retail stores, has been confirmed as adulterated with sugar and has been removed from all shelves. Authorities have publicly communicated the brand name.

The investigation involved advanced testing by two independent laboratories, Food QS and Eurofins, both of which confirmed that the tested honey was fake. One laboratory identified sugar profiles inconsistent with pure honey, while the

other detected bacterial enzymes, indicating processing techniques that allowed the addition of sugar syrups. According to Yngve Kilhberg of Biodlingsföretagarna, this represents the first use of such modern analysis methods in Skåne and one of the first in Europe.

The case illustrates the increasing sophistication of honey fraud, where products may still contain some real honey, making traditional detection methods insufficient. It also demonstrates the important role beekeepers play in monitoring the market.

Discussions within the beekeeping community have emphasized the value of timely public communication. With this case now public, authorities and stakeholders aim to increase awareness and prevent further circulation of adulterated products.

The situation highlights wider challenges in the EU honey market, including unfair competition from adulterated imports and risks to sustainable beekeeping and pollination. From 14 June, new EU rules will require clearer labeling of honey, including the country of origin, to improve transparency and market integrity.


Malmö Lund

Fusk-honung avslöjad med ny testmetod – Malmö först ut

There is link on the original text: https://www.sydsvenskan.se/malmo/normals-fusk-honung-avslojad-av-ny-testmetod-malmo-forst-ut/

There is artificial translation:

Friday 13 March 2026
Malmö Lund

Fake honey revealed with new testing method – Malmö first out

The store chain Normal in Malmö has ended up in a honey scandal. Their Hilltop hot honey has been revealed to be adulterated with sugar.

“You can also buy fake honey,” says Yngve Kilhberg at Biodlingsföretagarna, who tipped off the environmental administration inspectors.

According to Yngve Kilhberg, cheating with sugar is widespread and most of the honey imported into Sweden is fake. Several analyses have shown that it is diluted with various sugar solutions.

“Most of it comes from factories in China where it is processed and then shipped into Europe, where it is mixed and sold as honey,” says Yngve Kilhberg.

Can you yourself determine if it is real honey or fake?

“No, actually not. These have become so clever that it is not possible to detect anything by looking.”

As long as producers have a certain amount of real honey in the mix, it can slip through controls, says Yngve Kilhberg. In Great Britain, authorities have tightened controls.

Therefore, Biodlingsföretagarna chose to report the packaging from British Hilltop honey.

The environmental administration received tips about the products. They bought the packages from Normal’s store at Triangeln in Malmö. This time, they decided to test something new: the honey was sent to two different laboratories that use advanced analysis methods.

One of the laboratories tested different sugar products in the honey. They created a type of chemical fingerprint and compared it with

samples. Warning signals appeared immediately – it was not pure honey.

The second laboratory tested which enzymes were present in the honey. They found enzymes that come from fungi, without being naturally present. Its probable true that the honey had been filtered, but the test result didnt show filtration just foreign sugar and foreign enzymes.

“I was very surprised. This is the first time in Skåne that we use such modern analysis methods. It is also the first time in Europe,” says Yngve Kilhberg.

Last year, the organization conducted its own investigation into a dozen honey products in Sweden.

The problem has been that the EU’s existing legislation has not kept up with new fraud methods.

“But the new methods are good and should be able to start being used on a large scale.”

“We will continue to test more honey and develop this further,” says Yngve Kilhberg.

The Malmö Environmental Administration has decided to report the company behind the product, Hilltop, to the prosecutor. The products must be removed from the shelves.

Another problem is that imported fake honey pushes prices down. It has made it difficult for beekeepers to survive in many European countries. “In certain areas, entire production has been shut down. This also applies in Sweden, even if it is less visible,” says Yngve Kilhberg.

This in turn leads to fewer pollinators in the landscape. Which in the long run can lead to even higher food prices.

This summer, new, clearer rules will come into force regarding what may be called honey. From 14 June, all honey must be labeled with the country of origin.

Normal states that they have guarantees from their suppliers that the product is genuine honey.

They have now removed Hilltop hot honey from their stores.

QUOTE:

“If the honey is very cheap, you can suspect that something is wrong with it.”

QUESTION:

What is the problem from your perspective? Why is sugar used instead of honey in the jar?

ANSWER:

“Because it does not contain all the fine substances that are good for the body, for example flavonoids. But you can buy syrup instead, which is much cheaper.”

IMAGE CAPTIONS:

The fake honey Hilltop hot honey was sold here at Normal’s store at Triangeln in Malmö. The

environmental administration bought three packages.

EU rules are clear: honey sold may not contain any additives at all – it must be 100 percent pure honey directly from the beehive.

Here is one of the packages of Hilltop hot honey that the environmental administration in Malmö bought in Normal's store at Triangeln to test.

There is Swedish authorities press release translation:

Malmö City
Environmental Administration
Delegation Decision
ENVIRONMENTAL ADMINISTRATION
Bergsgatan 17
205 80 Malmö

State the case number when contacting the environmental administration.

Decision on prohibition of placing food on the market Normal Sweden AB (5591189617), is prohibited as operator of the food establishment Normal Förstadsgatan, Södra Förstadsgatan 31, from placing food on the market that does not meet the requirements in the honey directive 2001/110/EC. The prohibition applies to the following food:

• Hilltop Hot Honey. Two packages of 340 g with batch number JUN 2027 25102 If the products are to be destroyed, returned to the manufacturer or used as food, this must be approved by the environmental committee. If the product is destroyed, the company must submit proof that destruction has taken place.

Background

The environmental administration received on 2026-02-06 a complaint from the industry organisation Biodlingsföretagarna. According to the complaint, Biodlingsföretagarna had had honey of the brand Hilltop Hot Honey analysed for authenticity and obtained the results that the honey did not meet the requirements in the honey directive 2001/110/EC.

Because of this, the environmental administration carried out on 2026-02-11 a purchase of three packages of Hilltop Hot Honey in your shop at Södra Förstadsgatan 31 to investigate the complaint.

Samples were submitted to Eurofins (analysis of enzyme, proteomic) and Food QS (analysis of sugar, LC-HRMS and NMR), a total of three different analyses.

From the analysis reports it appears that the sample contains foreign enzyme and sugar. The level of natural enzymes from the honey bee is very low. The conclusion from the three analyses is that the honey does not meet the requirements in the honey directive.

During inspection in the store on 2026-03-02, the store manager had the opportunity to comment. No information emerged that leads to this decision not being taken. This decision has been communicated with quality responsible Jesper Sølling by telephone on 2026-03-03.

Motivation

As a food business operator you are responsible for ensuring that the food is safe and that you comply with the requirements in food legislation. This means that you are responsible for correcting any deviations, maintaining safe food handling and having procedures to prevent and correct deficiencies.

According to the honey directive 2001/110/EC Article 1, honey shall meet the requirements set out in Annex II of the same regulation. According to Annex II, no food ingredients, including food additives, may be added to it, nor may anything other than honey be added.

The analysis results showing foreign enzyme and foreign sugar indicate that the honey has been manipulated and is not authentic, which means that customers who buy the product are misled.

There is therefore reason to decide on prohibition of placing the product on the market.

Legal basis

Council Directive 2001/110/EC relating to honey, Article 1 and Annex II Swedish Food

Agency regulations (LIVSFS 2003:10) on honey.

1. Food information shall not be misleading, in particular

a) as to the characteristics of the food, especially its nature, identity, properties, composition, quantity, durability, country of origin or place of provenance, method of manufacture or production. Regulation (EU) 1169/2011 on food information Article 7 point 1

In Article 138 points 1 and 2 of Regulation (EU) 2017/625 on official control it is stated that if non-compliance is established, the control authority shall take

a) all measures necessary to determine the cause and extent of the non-compliance and determine the operator's responsibility, and

b) take appropriate measures to ensure that the operator concerned remedies the non-compliance and prevents further recurrence.

When the competent authorities act in accordance with point 1 of this article they shall take into account the nature of the non-compliance and the extent to which the operator has previously complied with the rules.

The environmental committee may according to Section 22 of the Food Act (2006:804) issue the orders or prohibitions that are necessary for the law, regulations issued pursuant to the law or the EC regulations supplemented by the law to be followed. The environmental committee has delegated (decided) decision-making authority to the environmental administration.

For the environmental committee
Thomas Hägvall
Food inspector
Department for food control
(Dg 5.2.3)

This decision has been confirmed digitally and therefore lacks a handwritten signature.

Next step

Sign and send in the attached acknowledgement of receipt via email or post, so that we know that you have received the decision.

Attachments

- Inspection report 2026-03-03
- Analysis reports

How to appeal

You can appeal this decision to the County Administrative Board Skåne in writing no later than three weeks after the day you received the decision.

Do as follows:

• write to the environmental administration which decision you are appealing

• state the decision's case number, decision date and what the decision concerns

• explain why you think the decision should be changed and what change you want

• attach what you consider important for the decision to become correct

• finish with name, address and telephone number and possibly email address

The appeal shall be sent to miljo@malmo.se or to Environmental Administration, 205 80 Malmö.

If your appeal has been received by the environmental administration in time it will be forwarded to the County Administrative Board, if the administration does not itself change the decision in the way you have requested.

Do you have questions? Call the case officer stated in the decision.

Postal address:
Environmental Administration
205 80 Malmö
Visiting address: Bergsgatan 17, Malmö
Reception is open Monday–Friday 09.00–12.00, 13.00–15.30.

Texts submitted by:
Johannes Sjöstedt, Peeter Matson

HONEY QUALITY STANDARDS IN CLINICAL RESEARCH: CURRENT CHALLENGES AND FUTURE DIRECTIONS

In recent years, the therapeutic potential of natural substances has garnered increasing attention, driving a marked rise in clinical investigations exploring honey as an intervention for a broad spectrum of health conditions. These include gastrointestinal disorders, wound healing, respiratory ailments such as cough, metabolic syndromes, and infectious diseases. Beyond its health-promoting properties, honey holds a distinguished place in traditional medicine systems across diverse cultures, reflecting its historical and ethnomedical significance. Yet, despite encouraging clinical signals, outcomes from honey-based trials remain highly inconsistent. Such variability is believed to stem largely from differences in the quality and composition of different honey types used across studies.

Clinical interpretation is further challenged by inconsistencies in honey's botanical origin, and bioactive composition complicate clinical interpretation, as these physicochemical variables directly influence therapeutic outcomes. Majtan (2024) underscores critical oversight: the vast majority of clinical studies fail to report fundamental quality metrics, such as diastase activity or hydroxymethylfurfural (HMF) levels, and do not include in vitro assessments of biological functionality. This lack of standardization in quality control not only undermines scientific reproducibility but also contributes to conflicting results. As

Majtan argues, only raw, unprocessed honey of known botanical origin and verified bioactivity should be employed in clinical settings to preserve functional integrity. Without harmonized testing protocols, honey's integration into evidence-based medicine remains constrained (Abuelgasim et al., 2020; Majtan, 2024; Deglovič et al., 2022).

Discrepancies between the labelled and actual contents of commercial honey products pose additional challenges. Reviews have revealed that antioxidant and enzymatic activities often fail to meet declared specifications, raising concerns about both consumer safety and scientific validity (Kwakman & Zaat, 2011; Deglovič et al., 2022). These inconsistencies further justify the need for harmonized analytical frameworks capable of reliably assessing honey's pharmacological potential prior to clinical use.

Evaluations of clinical trial protocols listed in major registries reveal limited transparency regarding the honey used - its botanical source, compositional integrity, and quality assessments are often unspecified or insufficient. Such gaps compromise replicability and raise ethical questions, especially when unverified products are administered to sensitive populations (Carnevali et al., 2021; Crespo et al., 2024). Addressing this requires not only a cultural shift toward rigorous pre-trial validation but also the development of standardized checklists for analytical quality assurance.

Although numerous studies support honey's therapeutic benefits - particularly for paediatric cough and upper respiratory infections - robust evidence remains elusive. The implementation of a universal testing panel is urgently needed. Such a panel would ideally confirm botanical and geographic origin, screen for adulterants, and evaluate antioxidant and antimicrobial activities (Nishimura et al., 2022; Cohen et al., 2012). Moreover, appropriate handling, including controlled storage and transport conditions, must be ensured to prevent degradation of functional compounds.

While honey offers a compelling case as a functional therapeutic agent, widespread clinical adoption is hampered by fundamental challenges in quality assurance and study design. The diversity of honey composition, combined with the absence of standardized protocols, poses significant barriers to the reproducibility and reliability of clinical outcomes. To move forward, coordinated efforts among scientists, regulators, and clinicians are essential to develop minimum quality benchmarks and usage guidelines. Only through such collaborative measures can honey's therapeutic promise be fully realized in modern medical practice (Bilir et al., 2016; Demir et al., 2011).

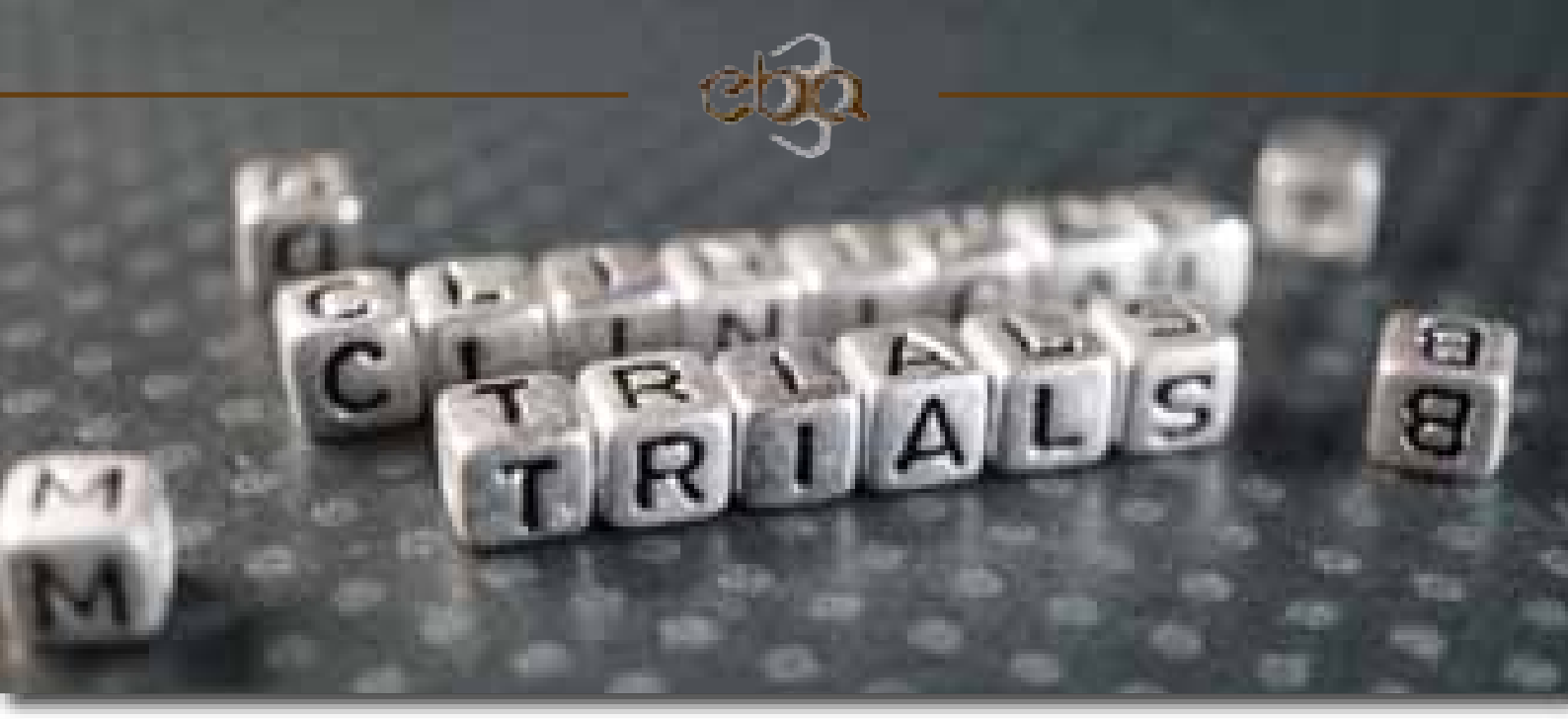
Identifying the weaknesses of current parameters, missing parameters related to honey biological activity

Due to its rich bioactive compound profile, honey exhibits a wide spectrum of health-promot-

ing properties, including antioxidant and anti-inflammatory effects, antimicrobial and wound-healing capabilities, and significant effects on metabolic, cardiovascular, neurological, and immune-related conditions. Moreover, honey plays protective roles across various organ systems—such as hepatic, renal, respiratory, and gastrointestinal—and shows promise in areas ranging from reproductive health to oncology and dermatology, and even radioprotection. Notably, its prebiotic and emerging probiotic potential, supported by the presence of beneficial microbial strains and fermentable sugars, further highlights honey's role in supporting gut microbiota balance and mucosal immunity. This multifaceted bioactivity positions honey as a valuable natural agent in preventive and therapeutic medicine (Rahmani and Babiker, 2025).

Despite the growing recognition of honey as a functional food with diverse therapeutic properties, the standard analytical parameters currently used in honey quality control remain insufficient to characterize its biological potential fully. Current regulatory standards, including those set by Codex Alimentarius and the EU Honey Directive, primarily focus on authenticity, moisture content, sugar content, and the absence of contaminants. However, these frameworks largely overlook critical parameters related to bioactivity, such as phenolic compounds and enzyme content - components fundamental to honey's medicinal promise. Studies have also highlighted gaps in understanding how storage conditions and environmental exposure may alter these functional properties over time, thereby influencing trial results (Ayazi et al., 2017; Ugusman et al., 2022). Most routine analyses focus primarily on physicochemical properties such as moisture content, electrical conductivity, diastase activity, HMF levels, and sugar composition, while key bioactive compounds are either partially evaluated or completely overlooked.

For example, the total phenolic content, a major determinant of antioxidant capacity, is not routinely quantified using standardized assays such as the Folin-Ciocalteu method and is rarely



reported in relevant units (e.g., mg GAE/100 g honey). Similarly, the flavonoid profile is often absent from commercial analyses, despite its well-established anti-inflammatory, antioxidant, and antimicrobial effects.

Likewise, phenolic acids such as gallic, caffeic, and ferulic acid, which play a critical role in antimicrobial and antioxidant activity, are not typically measured. While some enzymatic markers, such as diastase or invertase, are tested, others with direct biological relevance, such as glucose oxidase (which generates hydrogen peroxide), are rarely assessed. This is notable considering that hydrogen peroxide is one of the primary agents responsible for honey's antibacterial activity, yet it is not included in standard testing.

The total antioxidant activity of honey, which can be estimated using assays like DPPH, FRAP, or ABTS, provides an integrated view of its redox-modulating potential, yet it is rarely performed in routine evaluations. Additionally, prebiotic activity - linked to the presence of functional oligosaccharides like erlose, melezitose, and raffinose - is virtually ignored, although this property may support gut microbiota modulation and immune health.

Finally, plant-derived bioactive compounds with potential phytoestrogenic or neuroprotective properties are insufficiently explored, especially in polyfloral honeys or those derived from botanicals with known therapeutic value (e.g., acacia, linden, coriander). The neuroprotective effects of honey are increasingly being explored in the context of preventing and managing neurodegenerative diseases such as Alzheimer's disease and Parkinson's disease. These conditions are characterized by complex pathogenic mechanisms, including oxidative stress, mitochondrial dysfunction, chronic neuroinflammation, toxic protein aggregation (e.g., β-amyloid and tau), and synaptic impairment (Fadzil et al., 2023).

Honey, as a naturally complex substance rich in flavonoids, phenolic acids, and bioactive enzymes, has emerged as a promising candidate with neuroprotective potential. Through its diverse composition, honey may modulate multiple molecular pathways involved in neuronal damage, offering a multifaceted approach to neuroprotection in age-related cognitive decline.

Although increasing evidence suggests honey's neuroprotective potential, most available data derive from preclinical studies, including in vitro experiments and animal models. Clinical interventions involving human subjects remain extremely limited, making it difficult to draw definitive conclusions regarding efficacy and safety.

A significant challenge lies in the high variability of honey, influenced by its botanical and geographical origin, polyphenolic content, and processing methods—all of which can markedly affect its biological activity. Furthermore, there is currently no standardization of dosages, treatment durations, or evaluation parameters across studies, including oxidative stress markers, cognitive assessments, and neuropathological indicators.

Therefore, rigorously designed, randomized clinical trials are critically needed to confirm honey's therapeutic potential in neurological dis-

orders, to establish its safety profile, and to define appropriate therapeutic applications.

Effect of adulterated honey consumption on health

The increasing global demand for honey has led to widespread adulteration. Adulterated honey refers to honey that is mixed with cheap sugar syrups (such as glucose, fructose, or rice syrup) or subjected to processes that remove or diminish its natural components. In some cases, products labelled as "honey" are entirely artificial, produced without the use of bees. Most directly relevant to the clinical context, honey diluted with sugar syrups, subjected to excessive heat, or ultrafiltered will have dramatically reduced or absent biological activity. Patients or research subjects receiving such honey in a clinical trial are effectively receiving a sugary placebo. This may, at least in part, explain the inconsistent results seen in honey clinical trials that do not verify the bioactivity of the product used.

The presence of chemical contaminants poses a significant barrier; for instance, chloramphenicol, even at trace levels, carries a risk of aplastic anaemia — a potentially fatal suppression of bone marrow function — in susceptible individuals (Mohamadi et al., 2026). There is no established safe threshold for chloramphenicol. Nitrofuran metabolites (metabolic by-products of nitrofuran antibiotics) are similarly carcinogenic. The presence of pesticide residues — particularly neonicotinoids at concentrations that may not trigger food safety limits — raises concern in immunocompromised patients and children, who are disproportionately represented in clinical honey trials.

Adulterated honey may contain undeclared proteins from pollen of allergenic plants that were not present in the stated botanical source, or proteins introduced through non-bee-derived processing aids. In individuals with hypersensitivity to specific pollen, cross-reactive proteins in mislabelled honey can trigger IgE-mediated allergic reactions. Honey should never be administered to infants under 12 months of age due to the risk of infant botulism from Clostridium botulinum spores — a risk that applies regardless of adulteration status but is compounded by unverified sourcing (Kumar et al, 2011).

Fake or adulterated honey lacks natural enzymes (invertase, diastase, glucose oxidase), antioxidants, and micronutrients that are central to honey's therapeutic properties. Consumers may believe they are taking a natural, healthy product, but in reality, they are only consuming concentrated sugars. Adulterated honey behaves metabolically like refined sugar. Excessive intake can contribute to obesity, metabolic syndrome, diabetes, and cardiovascular disease. Recently, a systematic review analysed clinical studies on high-fructose corn syrup (HFCS), a sweetener often used in honey adulteration. This systematic review highlights that higher HFCS intake was associated with significantly increased hepatic lipid accumulation. Moreover, it provides experimental evidence that even moderate consumption of HFCS-sweetened beverages can produce rapid, adverse metabolic effects in healthy adults (Yu et al, 2025).

Unlike natural honey, which has a balanced composition that moderates sugar absorption, adulterated honey immediately strains glucose metabolism. Beyond direct health effects, adulteration erodes trust in honey as a natural medicine. This threatens beekeepers, health practitioners, and consumers who depend on authentic honey for both livelihood and wellness.

Conclusions and recommendations

The therapeutic potential of honey is real, biochemically grounded, and increasingly supported by mechanistic data — but it is being undermined by an analytical framework that was never designed to capture it. Current quality standards ensure a safe, authentic food product, but they are silent on the biological properties most relevant to clinical outcomes.

Clinical researchers have a responsibility to characterise the honey they use with the same rigour applied to any other therapeutic agent. A panel of bioactivity assays — encompassing antimicrobial (MIC, MBIC, GOX, defensin-1), antioxidant (TPC, DPPH, ABTS, polyphenol HPLC), and anti-inflammatory (NF-kB, cytokine profiles) par-

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ameters, complemented by protein characterisation (MRJP1) and safety screening (pesticides, antibiotics, heavy metals) — is scientifically feasible, not prohibitively expensive at laboratory scale, and would transform the reproducibility and interpretability of clinical honey research.

For beekeepers who wish to position their product in therapeutic or nutraceutical markets, the message is clear: documentation of biological activity is becoming a market differentiator and, in some regulatory contexts, a requirement. Partnerships with university laboratories or accredited testing providers to obtain bioactivity data offer both scientific credibility and commercial protection against fraudulent competitors whose adulterated products may undermine market prices and harm consumers.

The problem of honey adulteration is not merely a regulatory nuisance — in clinical settings, it constitutes a patient safety issue. Real honey is a unique natural product that cannot be replaced by artificial substitutes or imitations without sacrificing safety and health benefits. Choosing authentic honey is not only about taste and tradition—it is about protecting health. Supporting trustworthy beekeepers and demanding stronger regulations are essential steps in ensuring that the honey we consume is as pure and beneficial as nature intended.

Honey products destined for therapeutic use must be sourced from verifiable, traceable supply chains, tested for residues, and characterised for bioactivity before any clinical study commences. Anything less compromises both the science and the safety of the patients who stand to benefit.

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WINTER SURVIVAL OF INDIVIDUAL HONEY BEES AND HONEY BEE COLONIES DEPENDS ON LEVEL OF VARROA DESTRUCTOR INFESTATION

Abstract

Background: Recent elevated winter loss of honey bee colonies is a major concern. The presence of the mite Varroa destructor in colonies places an important pressure on bee health. V. destructor shortens the lifespan of individual bees, while long lifespan during winter is a primary requirement to survive until the next spring. We investigated in two subsequent years the effects of different levels of V. destructor infestation during the transition from short-lived summer bees to long-lived winter bees on the lifespan of individual bees and the survival of bee colonies during winter. Colonies treated earlier in the season to reduce V. destructor infestation during the development of winter bees were expected to have longer bee lifespan and higher colony survival after winter.

Methodology/Principal Findings: Mite infestation was reduced using acaricide treatments during different months (July, August, September, or not treated). We found that the number of capped brood cells decreased drastically between August and November, while at the same time, the lifespan of the bees (marked cohorts) increased indicating the transition to winter bees. Low V. destructor infestation levels before and during the transition to winter bees resulted in an increase in lifespan of bees and higher colony survival compared to colonies that were not treated and that had higher infestation levels. A variety of stress-related factors could have contributed to the variation in longevity and winter survival that we found between years.

Conclusions/Significance: This study contributes to theory about the multiple causes for the recent elevated colony losses in honey bees. Our study shows the correlation between long lifespan of winter bees and colony loss in spring. Moreover, we show that colonies treated earlier in the season had reduced V. destructor infestation during the development of winter bees resulting in longer bee lifespan and higher colony survival after winter.

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Competing Interests: The authors have declared that no competing interests exist.

Introduction

The parasitic mite Varroa destructor is considered to be one of the main causes for colony losses in honey bees (Apis mellifera L.) [1–4]. For example, the total number of honey producing colonies in the U.S. was reduced by 1.560.7% (mean 6 s.e.) per year since the introduction of V. destructor, while the decrease per year used to be on average 0.0660.5% [1]. This decline reflects the loss of colonies as well as the decline in number of beekeepers due to increased expenses and efforts needed to combat mite infestations [1,5]. Although there is a general agreement that there is no single explanation for the extensive colony losses, and that interactions between different stresses are likely to be involved, the presence of V. destructor in colonies places an important pressure on bee health [2]. V. destructor reduces the body weight and protein content of individual bees, which is found to shorten their lifespan [6–8]. This is especially important during winter in temperate regions when long lifespans are a primary requirement to survive until the next spring and to nurse the first brood [7,8]. In the temperate regions, the main colony losses due to V. destructor occur during winter [8].

Nowadays, winter losses are often up to 20% or more in many areas [1,3], while twenty years ago, 5 to 10% colony losses during winter were common [2].

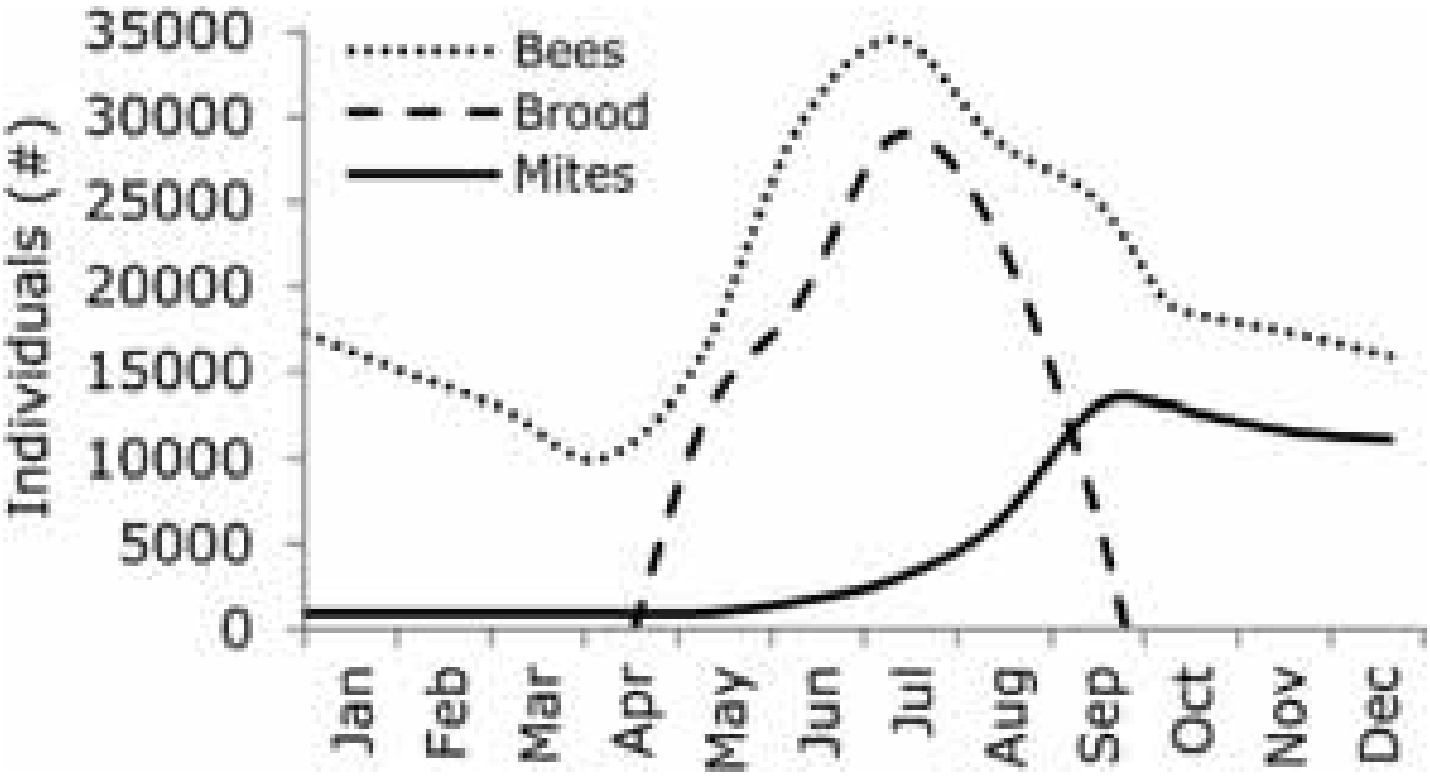

Figure 1. Colony development for adult bees, worker brood, and Varroa destructor mites. The daily number of individual adult bees (dotted line) and worker brood (striped line) was modelled over one year. The number of mites (solid line) was modelled as being the second year of mite infestation with a starting population of 100 mites in the first year. Figure was redrawn from Martin [9]. doi:10.1371/journal.pone.0036285.g001

In temperate regions, the number of bees and brood in a colony increase between April and July and decrease between August and October [9]. However, the main peak of the number of bees and brood occur earlier in the season than the peak of mite abundance [10,11]. Hence, mite infestation strongly increases during the period in which the number of bees and brood decrease [9] (Figure 1), resulting in an increasing number of brood cells infested with V. destructor over time. It is exactly during these months of reduction in the number of brood and rapid increase in mite infestation, that bees hatching from this highly infested brood will become winter bees [9,12].

Adult bees, which are infested by V. destructor as pupae, do not fully develop physiological features typical of long-lived winter bees compared with non-infested workers [6–8], making it unlikely for them to survive until spring and contribute to the build-up of the colony in early spring [2]. To date, however, the relation between the lifespan of individual bees and colony losses for different levels of V. destructor infestation has not been tested.

When the European honey bee (Apis mellifera) was moved to areas where the Asian honey bee (A. ceranae) was endemic, V. destructor switched to A. mellifera and spread nearly worldwide [2,4]. During the first years after its introduction in Europe and North America, V. destructor could be easily controlled and be kept below damaging infestation levels by one to two acaricide treatments per year. However, colony losses have recently started to increase drastically, despite the development of more intensive acaricide treatments [1,2]. Absence, poor timing and poor application of acaricide treatment have been reported to be important causes for honey bee colony loss [13,14]. Especially when honey is harvested at the end of the bee season in temperate regions, acaricide treatments are often postponed until after the harvest to avoid residues in honey. However, the mite population has often already reached injurious levels at this time, namely the time that winter bees are produced (Figure 1). Consequently, timing of acaricide treatment in the second half of the summer season (July to September) may thus affect winter survival of the colony.

In this study, the effect of different levels of V. destructor infestation during the transition from short-lived summer bees to long-lived winter bees on the lifespan of individual bees and the survival of bee colonies during winter was investigated. We manipulated the level of V. destructor infestation by reducing the number of mites using acaricide treatments at different times (during July, August, September, or not treated), resulting in increased mite fall directly during acaricide treatment and in reduced V. destructor infestation level in the months after this treatment (Figure 2 gives the expected infestation levels for different treatment moments). We expected a longer lifespan of bees in colonies treated earlier in the season, as low infestation levels during the development of winter bees should benefit the lifespan of these bees compared to colonies treated

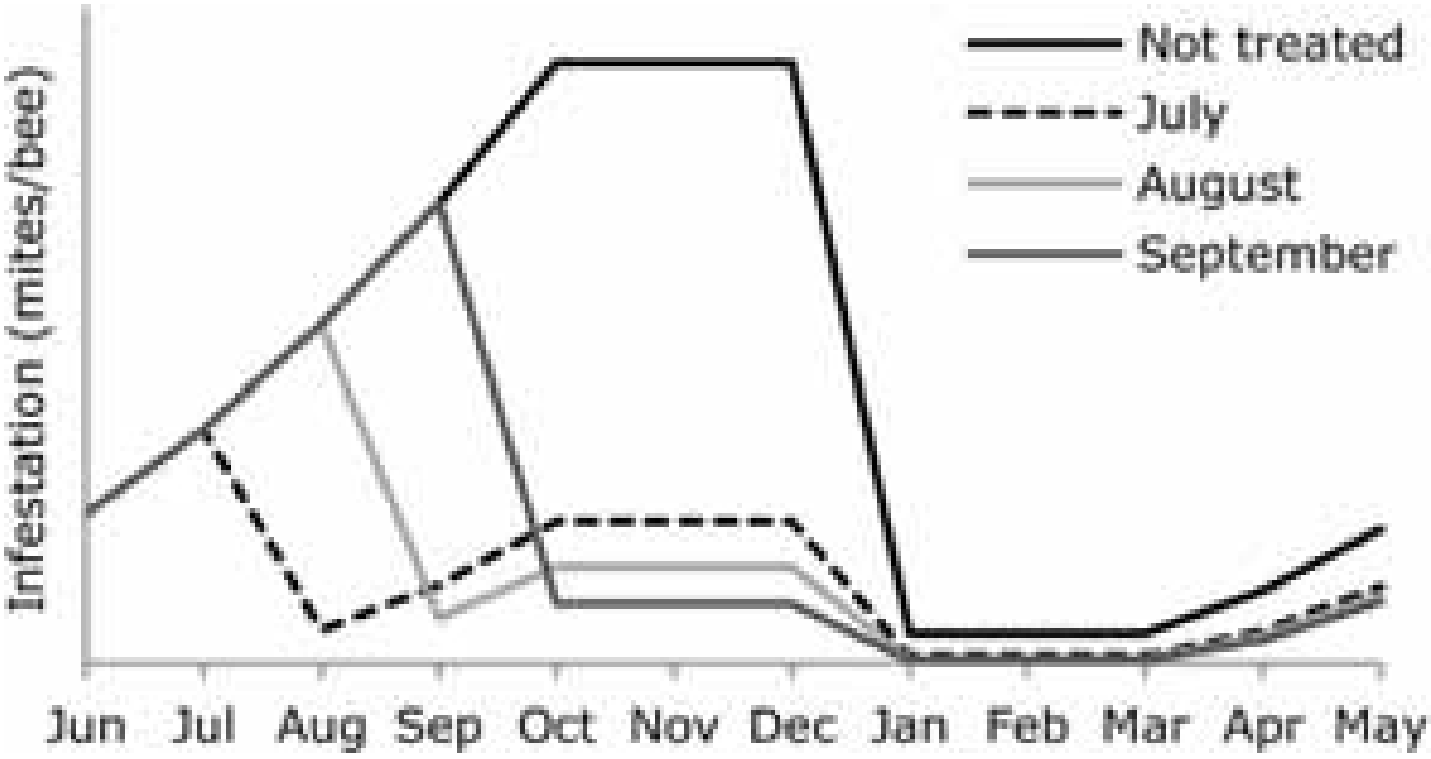

Figure 2. Expected infestation levels of Varroa destructor manipulated using acaricide treatment. Infestation levels of V. destructor (mites/bee) were manipulated using acaricide treatment applied at different moments (July, August, September or not treated at all). For the expected mite infestation, we used a simplified curve from mite infestation in Figure 1, with an exponential increase in mite infestation until October, after which the infestation remained equal. Efficacy of the acaricide Thymovar (July, August, September) was assumed to be 90%, while efficacy of oxalic acid (December) was assumed to be 95%. doi:10.1371/journal.pone.0036285.g002

later in the year or not at all. Consequently, colonies with relatively low V. destructor infestation during the development of winter bees are expected to have higher colony survival during or after winter. The experiment was performed in two consecutive years as environmental conditions such as weather or food resources are expected to also affect winter bee development and colony survival.

Materials and Methods

Experiment

The fieldwork took place in 2005/2006 and 2006/2007 at an apiary of Wageningen UR, The Netherlands (51u59932.350N, 5u39946.810E). Colonies (N = 24) were kept in one-story wooden hives with 10 frames and contained brood in all developmental phases. In the first year (2005/2006), mite fall was monitored in the colonies for one week in July. The colonies with the lowest daily mite fall (2.960.78, N = 6) were used to represent the low V. destructor infestation from July onwards. The remaining colonies were randomly allocated to 3 groups: treated in August, treated in September, or not treated at all. The mean daily mite fall in these groups did not differ from each other (overall mean daily mite fall 18.863.5, N = 18), but were all higher compared to the colonies with low infestation from July onwards (daily mite fall was Log10- transformed, Anova, F3,20= 9.31, P,0.001, Sidak post hoc test). In the second year (2006/2007), colonies were randomly allocated to 4 groups: treated in July, treated in August, treated in September, or not treated at all. Colonies were treated with the acaricide ThymovarH during three weeks in the allocated month. The experiment in the second

year was performed with new colonies. Colonies that became queenless or swarmed were removed from the study.

Daily mite fall in debris was monitored to give an indicative efficacy of the ThymovarH treatment during and after the treatment periods, starting in August. Outside these periods, mite fall was counted once a week (trapping period of 4 days with a bottom board) to get an indication of the infestation level. In winter (November/December), when there was no more brood, all colonies were treated with an oxalic acid solution (trickling, 37 gr oxalic acid dihydrate in 1 L sugar water, 1:1 weight ratio for sucrose: water). Mite fall was counted after trapping for one week continuously following the oxalic acid treatment. Thereafter, mite fall was monitored every two weeks (trapping period of 2 days).

Counting mite fall has been shown to be effective to estimate the population of mites [15,16].

In half of the colonies of each experimental group, the number of capped brood cells was estimated by superimposing a grid with 2.562.5 cm squares over the brood area. Solid squares were counted directly and partial squares estimated. The number of brood cells was then calculated from the number of grids multiplied by 25 brood cells (we counted 400 cells in one dm2). Brood was measured every two weeks from mid-August until midNovember. During 2006/2007, due to the

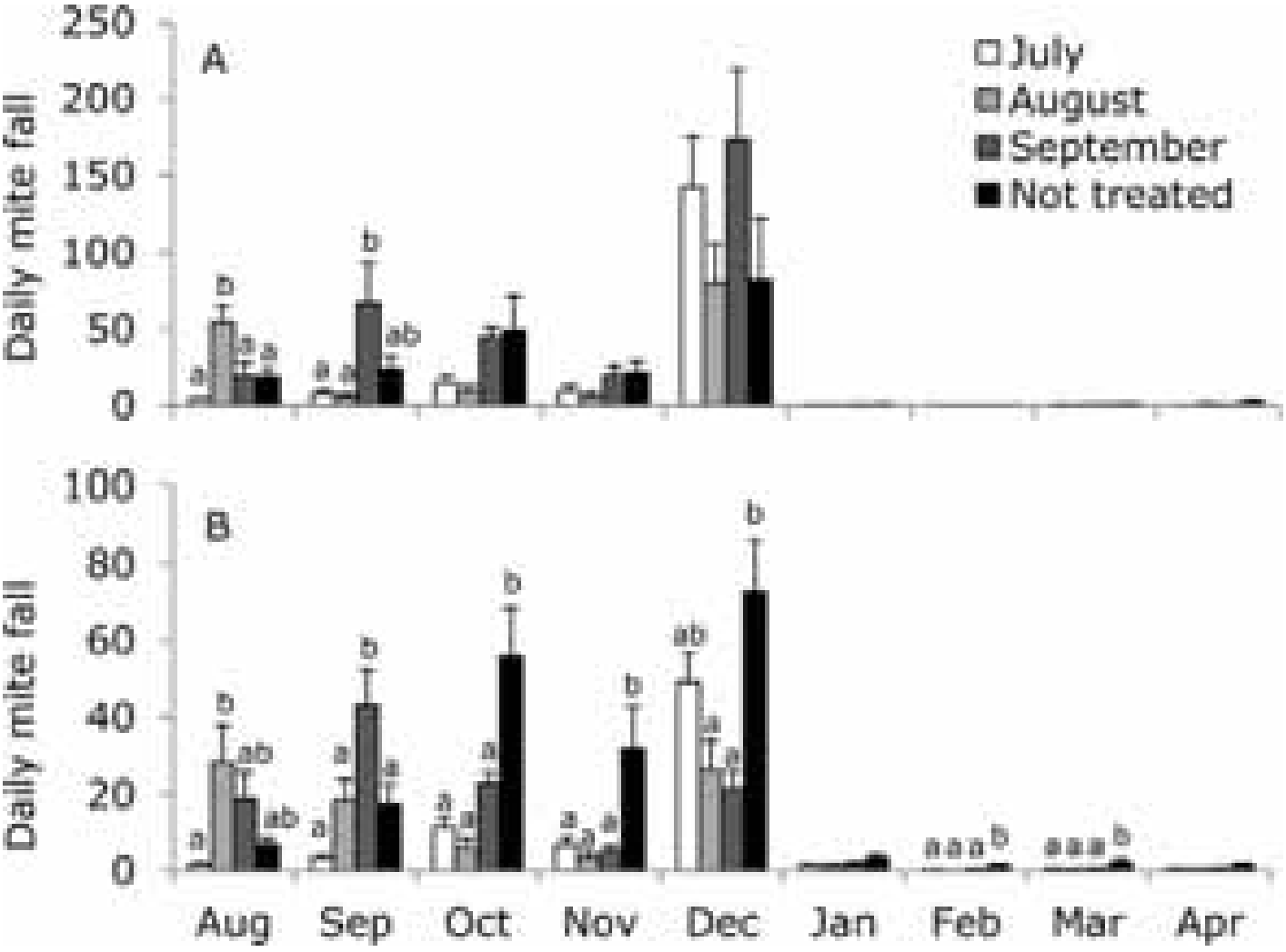

Figure 3. Mean daily mite fall in 2005/2006 (A) and 2006/2007 (B). Colonies were treated with ThymovarH in July (white bars), August (grey bars), September (dark grey bars), or not treated at all (black bars). All colonies were treated in December using oxalic acid (3%). Letters denote significant differences between treatments within each month. No letters mean no significant differences between treatments were found. Differences between months were not given. doi:10.1371/journal.pone.0036285.g003

high winter temperatures, brood measurements were continued every month until mid-April.

Every fortnight, cohorts of approximately 100 newly emerged bees were marked with a unique colour (colour marker Posca) and returned to their original colony. In 2005 marking cohorts started in July, resulting in eight cohorts in four (out of six) colonies per treatment. In 2006 marking started in August, resulting in seven cohorts in four (out of six) colonies per treatment. Marking cohorts was stopped at the beginning of November in both years. At equal intervals, the presence of bees from previously marked cohorts was recorded. Based on the unique colour the age of the bees could be determined. Recording cohort survival continued until mid-April the following year or until no more marked bees were observed. If colonies could not be examined during winter, it was assumed that worker mortality was constant.

After winter in April, the size of the colony was estimated by counting the number of frames with bees. Non-surviving colonies had zero frames with bees.

Statistics

To test whether the weather differed between the two years, the differences in ambient temperature were tested with a paired t-test (paired for month) for the period July–November and the period December–April separately in 2005/2006 and 2006/2007.

Mean daily mite fall per colony was calculated per month. Repeated measures ANOVAs were used to test mite fall for 2005/ 2006 and 2006/2007 separately, as mean daily mite fall in one month was assumed to be correlated to mean daily mite fall in the previous month. Sidak posthoc tests were used for pair wise comparison of differences between means. In 2005/2006, one colony from the group treated in September was excluded from the analysis due to missing data on mite fall for several months. One colony (treated in September) missed data on mite fall only in August. We interpolated this missing data in August using data from another colony, which was selected based on similar mite fall in September. Two colonies of the group that was not treated lacked data in March and April due to mortality of these colonies. To be able to use the Repeated measures ANOVA, we estimated the mite fall in these colonies to be similar to the highest mite fall found in the months March and April for all treatments. Slight changes in the estimated mite fall (approx. 10%) did not qualitatively change the results. Final number of colonies used in the Repeated measures ANOVA for mite fall in 2005/2006 were 6 (treated in July), 7 (treated in August), 5 (treated in September), and 5 (not treated).

In 2006/2007, in total 11 colonies were excluded from the analysis for mite fall due to missing data on mite fall for several months: two colonies in the group treated in July, two in the group treated in August, one in the group treated in September, and eight in the group that was not treated. All these excluded colonies were lost between October and November 2006, possibly due to high V. destructor infestation. To test whether excluded colonies showed higher mite fall until October than the remaining colonies, we used the Repeated measures ANOVA for mite fall in August to October, for excluded colonies (N = 11) and colonies still in the experiment (N = 24). Final number of experimental colonies used in the Repeated measures ANOVA for mite fall in 2006/2007 was 7 (treated in July), 6 (August), 6 (September), and 5 (not treated).

We calculated the survival rate for each cohort of bees marked in a colony, using survival analysis with Cox Proportional Hazards Models for treatment (timing of acaricide application), for the number of days since the cohorts were marked (is equal to the day the bees in that cohort were born), and for 2005/2006 and 2006/2007 separately. In addition to testing the differences between treatments and the differences over time, the Cox Proportional Hazards Model was used to predict the fraction of bees in a cohort that is still alive (in statistical terms this is called the predicted survival probability) at a certain age of the cohort, from here onwards called ‘bee survival’. To compare treatments over time, we calculated bee survival at 100 days (fraction of bees still alive at the age of 100 days). As summer bees only live for about 35 days, while winter bees live for about 135 days [12] or 150 days [17], we assume that bees that are alive after 100 days are winter bees. Low bee survival

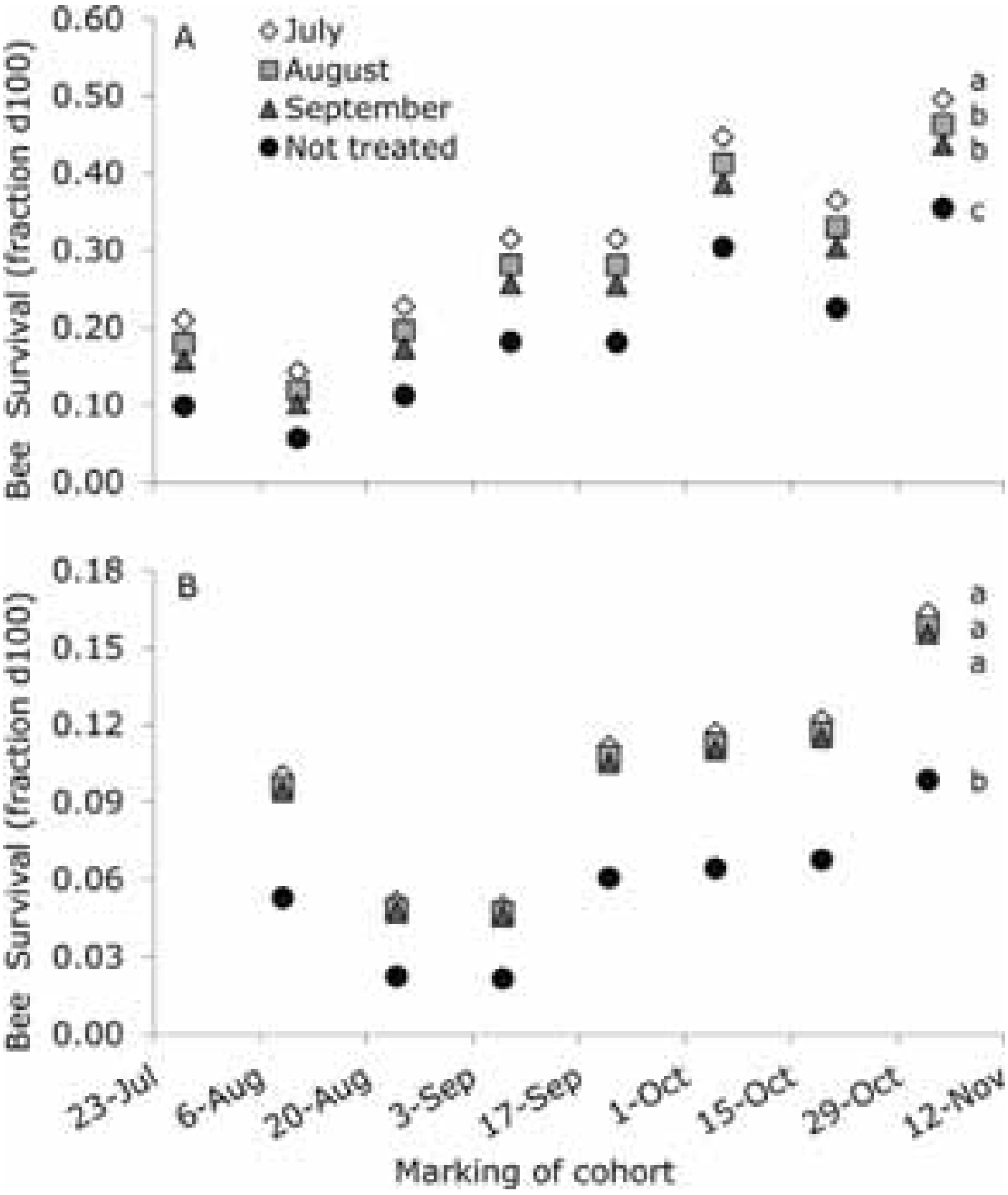

Figure 4. Bee survival as a function of time and treatment in 2005/2006 (A) and 2006/2007 (B). Bee survival (fraction d100) was the predicted fraction of bees that was still alive at the age of 100 days, and calculated using a Cox Proportional Hazards Model. Time was the marking date of the cohort (scatterplot). Different months of acaricide application show the treatments, where letters denote significant differences (over all marking dates). doi:10.1371/journal.pone.0036285.g004

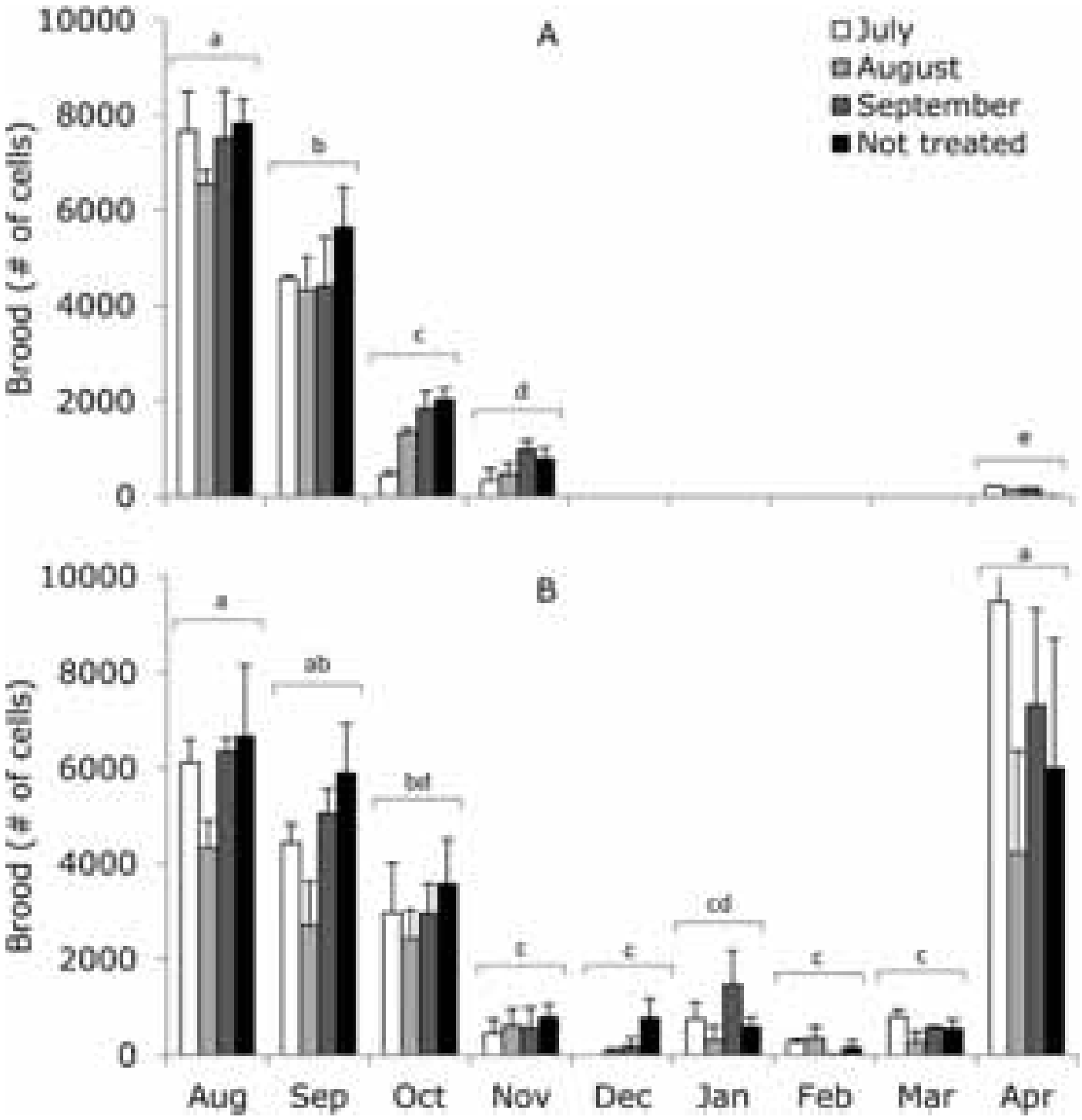

Figure 5. Mean number of capped brood cells in 2005/2006 (A) and 2006/2007 (B). Colonies were treated with ThymovarH in July (white bars), August (grey bars), September (dark grey bars), or not treated at all (black bars). Number of capped brood cells between December 2005 and March 2006 were not measured due to cold winter temperatures. Letters show significant differences between months. doi:10.1371/journal.pone.0036285.g005

at 100 days means that the mean lifespan of the bees in the cohort is short. Consequently this means for winter bees that fewer bees will survive until spring and be able to contribute to spring development of the colony. To test whether bee survival at 100 days differed between 2005/2006 and 2006/2007, Repeated measures ANOVA was used. As the days the cohorts were marked did not coincide perfectly between the years, we paired the days most similar for both years (maximum difference was 2 days) and excluded the cohorts marked in July 2005 (no co-

horts were marked in July 2006). Additionally, as we had only one mean value per day of marking per treatment, the treatments were pooled (N = 4 per day of marking).

Repeated measures ANOVAs were used to analyse the change in the number of capped brood cells over time in 2005/2006 and 2006/2007 separately. When colonies were lost during the experiment, brood measurements of other colonies within the experiment were used to continue the brood measurements. In 2005/2006, capped brood cells were counted from August to November and in April. Between November 2005 and April 2006, actual counts of capped brood cells were suspended due to cold temperatures and dense clustering of bees. The final number of colonies for counting capped brood cells was 3 for colonies treated in July, 3 for colonies treated in August, 2 for colonies treated in September, and 3 for colonies that were not treated. In 2006/ 2007, brood cells were counted continuously from August to April. The final number of colonies for counting capped brood cells was 4 for colonies treated in July, 3 for colonies treated in August, 3 for colonies treated in September, and 3 for colonies that were not treated.

To test whether the fraction of winter bees in a cohort increased during the decrease of brood in autumn we used a General Linear Model. Mean bee survival at 100 days of the different treatments (timing of acaricide application, fixed factor) was tested as a function of the number of brood cells (as covariate) for 2005/2006 and 2006/2007 separately. Possible interactions between treat ments in relation to the decrease in brood were added to show differences in the rate of change in bee survival. Sidak posthoc tests for pair wise comparison were used to test for differences between treatments.

To test the differences in colony size in April between the treatments, we calculated the mean fraction of frames that was occupied with bees in April using a Generalized Linear Model. If a colony had died before April, the number of frames occupied by bees was zero. The mean fraction of frames was estimated with the number of occupied frames in April as dependent variable and the 10 frames that were available in each hive as fixed number of trials (binomial distribution and logit link function). Sidak posthoc tests for pair wise comparison were used to test differences in the mean fraction of frames between treatments. A Pearson correlation was used to test if there was a correlation between bee survival at 100 days for the cohort that was marked (born) in November and the fraction of frames occupied with bees in April.

Results

Ambient temperature

The mean ambient temperature during summer and autumn (July–November) in The Netherlands did not differ between 2005 (14.061.9uC) and 2006 (15.962.2uC; paired t-test: t4= 22.38, P = 0.08). Mean temperature between December 2005 to April 2006 was however lower (4.361.3uC) than between December 2006 and April 2007 (8.161.3uC; paired t-test: t4= 27.35, P,0.01).

Acaricide treatment effectiveness (mite fall)

In 2005/2006, mean daily mite fall differed between the treatments per month (Repeated measures ANOVA: treatment F3,19= 2.76, P = 0.07; month F8,152= 32.87, P,0.001; treatment6 month F24,152= 2,39, P = 0.001; Figure 3A). As can be expected, mean daily mite fall in August was highest for colonies treated in August, and highest in September for colonies treated in September. In 2006/2007, mean daily mite fall also differed between the treatments per month (Repeated measures ANOVA: treatment F3,20= 7.63, P = 0.001; month F8,160= 41.38, P,0.001; treatment6month F24,152= 8.17, P,0.001; Figure 3B). Again, daily mite fall in August was highest for colonies treated in August, and highest in September for colonies treated in September. Daily mite fall for colonies that were not treated remained high during the year. In 2006, colonies that were lost between October and November and excluded from the analysis above indeed showed higher daily mite fall (overall 38.764.9) than colonies included in the analysis (overall

18.663.3), where the daily mite fall increased with time (month), but more for the colonies excluded than for colonies included in the analysis (Repeated measures ANOVA: in/ excluded $F_{1,33}$= 11.33, P = 0.002; month $F_{1,33}$= 13.82, P = 0.001; in/excluded6month $F_{1,33}$= 5.59, P = 0.02).

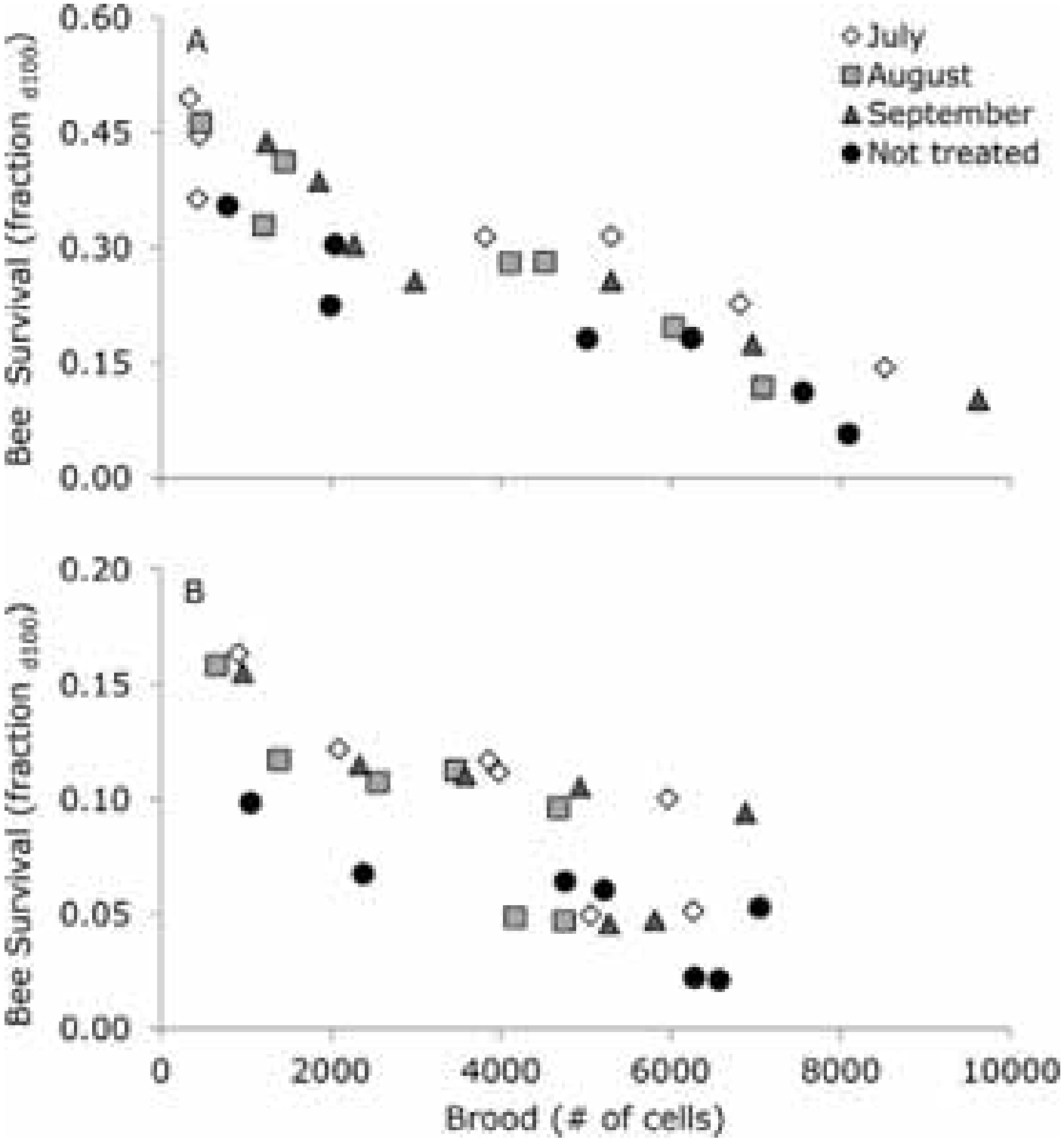

Figure 6. Bee survival as a function of brood in 2005/2006 (A) and 2006/2007 (B). Bee survival (fraction d100), the predicted fraction of bees that was still alive at the age of 100 days, as function of the number of capped brood cells for the different months of acaricide application. Symbols show means per marking day.
doi:10.1371/journal.pone.0036285.g006

Bee survival

Mean survivorship curves for marked cohorts of bees are shown in Figure S1. For the survival analysis, the Cox Proportional Hazards Models used 6398 uncensored cases and 353 censored cases for 2005/2006, and 8458 uncensored cases and 600 censored cases for 2006/2007. The cumulative survival curves for the different treatments over time clearly showed a lower bee survival in colonies that were not treated compared to all other treatments in both 2005/2006 (Wald = 123.2, df = 3, P,0.001) and 2006/2007 (Wald = 87.2, df = 3, P,0.001; Figure S2). We found that the cumulative survival increased with time in both 2005/2006 (Wald = 435.1, df = 6, P,0.001) and 2006/2007 (Wald = 200.4, df = 6, P,0.001; Figure S2), suggesting an increasing fraction of winter bees in the cohorts. Bee survival at day 100 (fraction of bees still alive at the age of 100 days) was predicted by the model as a function of time and treatment in 2005/2006 and 2006/2007 (Figure 4). For both 2005/2006 and 2006/2007, using day 50, 75 or 120 did not qualitatively change the results. When marked in 2005, bee survival at 100 days was higher than in 2006 from August 24th onwards (2006, coinciding with August 25th for 2005), and this difference became larger towards the end (Repeated measures ANOVA: year F1,21= 805.70, P,0.001; marking day F6,21= 13.83, P,0.001; year6marking day F6,21= 29.31, P,0.001). For example, from bees that emerged on November 4th 2005 4463% was still alive at an age of 100 days, while from bees that emerged on November 2 nd 2006 only 1461% was still alive at an age of 100 days.

Colony development (brood)

In 2005/2006, the number of capped brood cells decreased between August and November (Repeated measures ANOVA: treatment F3,7= 1.59, P = 0.28; month F4,28= 223.65, P,0.001; treatment6month F12,28= 1.20, P = 0.33; Figure 5A). Brood rearing had not yet shown the expected spring increase in April 2006 for any of the treatments. In 2006/2007, the number of capped brood cells also decreased between August and November (Repeated measures ANOVA: treatment F3,9= 3.89, P = 0.05; month F8,72= 38.25, P,0.001; treatment6month F24,72= 1.20, P = 0.38; Figure 5B). Brood rearing continued at a low rate during winter and was much increased in April 2007 for all treatments. Although the Repeated measures ANOVA showed a borderline significant effect of treatment for 2006/2007, the Sidak posthoc test did not show differences between treatments (the number of capped brood cells for colonies treated in July was almost higher than brood for colonies treated in August, Sidak P = 0.08).

Bee survival in relation to number of capped brood cells

In 2005/2006, bee survival increased with a decrease in number of capped brood cells (General Linear Model: treatment F3,23= 6.52, P,0.01; brood F1,23= 162.39, P,0.001; Figure 6A; if the interaction was included, then both the interaction between treatment6brood and the main effect treatment were not significant). In relation to brood, there was a lower bee survival for colonies that were not treated than for colonies treated in July or September, but not lower than colonies treated in August. In 2006/2007, bee survival also increased with a decrease in number of capped brood cells (General Linear Model: treatment F3,23= 3.60, P,0.05; brood F1,23= 38.59, P,0.001; Figure 6B; if the interaction was included, then both the interaction between treatment6brood and the main effect treatment were not significant). There was a lower bee survival for colonies that were not treated than for colonies treated in July, but not compared to colonies treated in August or September.

Winter survival

Between November 2005 and April 2006, four colonies were lost in the group not treated with acaricide, while no winter colony loss occurred in the other groups. The fraction of frames (out of 10) that were occupied with bees in April 2006 was the lowest for colonies that were not treated in 2005 (Generalized Linear Model: Wald Chi-Square = 38.1, df = 3, P,0.001; Figure 7A insert), and increased with an increase in bee sur-

vival (Pearson correlation: r = 0.98, n = 4, P = 0.02; Figure 7A). During the winter of 2006/ 2007, no colonies were lost. The fraction of frames (out of 10) that was occupied with bees in April 2007 was highest for the colonies that were treated with acaricide in July 2006 (Generalized Linear

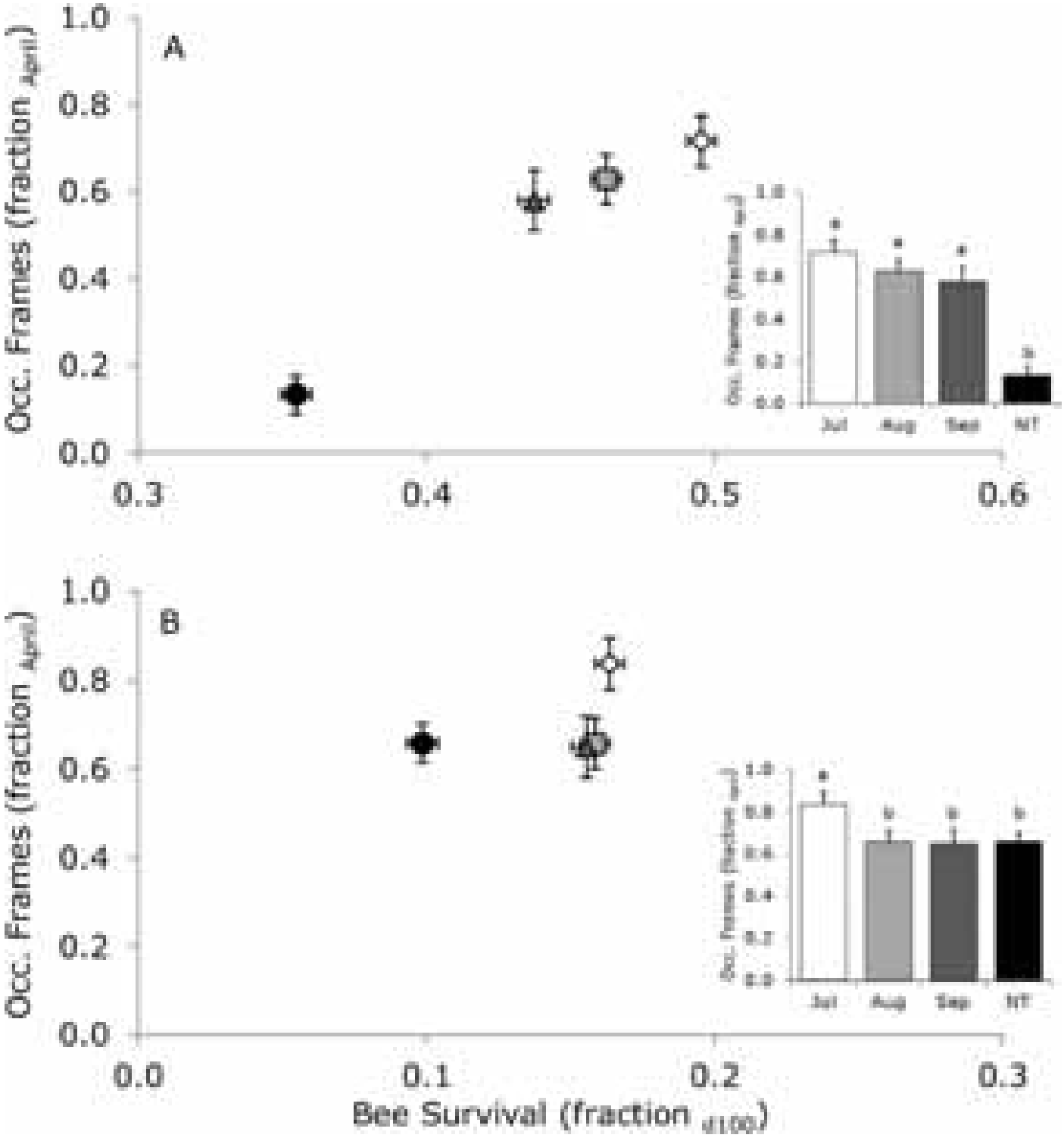

Figure 7. Winter survival as a function of bee survival in November 2005 (B) and 2006 (B). Fraction of frames occupied with bees in a colony in April in relation to bee survival at 100 days for the cohorts marked in November 2005 (A) and November 2006 (B). We used the data for November as an example, the relationship is similar for all days of marking, the trend only showed lower bee survival for cohorts marked earlier. Inserts show the differences in the fraction of frames occupied between for the different treatments (timing of acaricide application, NT = not treated). Letters indicate significant differences. doi:10.1371/journal.pone.0036285.g007

Model: Wald Chi-Square = 9.2, df = 3, P = 0.027; Figure 7B insert), but did not relate to bee survival (Pearson correlation: r = 0.42, n = 4, P = 0.58; Figure 7B). For the relation between the fraction of frames that were occupied with bees in April and bee survival, data from November was used as an example: the relationships were similar for all days the cohorts were marked, the trend only showed lower bee survival for cohorts marked earlier.

Discussion

In this study, we found that low V. destructor infestation levels during the development of winter bees resulted in an increase in lifespan of bees compared to colonies that were not treated and that had higher infestation levels. Acaricide treatment before the expected transition period from summer to winter bees resulted in the highest lifespan of bees. Colonies with low infestation levels had fewer losses in number of bees and higher survival during and after winter. A large number of bees in the bee colony at the start of the growing season in temperate regions has indeed shown to increase survival and production of bee colonies [18]. Several studies reported the decrease in lifespan of individual bees due to V. destructor infestation [6,7,19] or the altered physiology in bees suggesting a decrease in lifespan [8]. Here, we link the decreased lifespan of individual bees due to V. destructor infestation to colonies losses in at least some circumstances.

Mattila et al. [12] showed an increase in bee longevity between August and the beginning of November, which fully agrees with our findings: the number of capped brood cells decreased drastically between August and November, while at the same time, the lifespan of the bees increased indicating the transition of short-lived to long-lived winter populations [20]. When low infestation of V. destructor occurred earlier in the period of winter bee transition, lifespan of the bees increased and consequently the winter survival of the colonies increased, which supports previous findings by Delaplane and Hood [13] and Currie and Gatien [14].

In our study, however, mean lifespan (estimated by bee survival at 100 days) was longer during the winter in 2005/2006, compared to the winter of 2006/2007. A variety of stress-related factors such as winter temperatures or foraging conditions in autumn, could have contributed to the variation in lifespan between years. The much shorter lifespan for bees during the winter 2006/2007 at least suggests that bees were more active during this winter. Possibly due to the observed rearing of brood, as long lifespan is inhibited by brood pheromones [21] and reduced by brood rearing activities depleting body reserves [20,22]. This shorter lifespan, however, may have been less problematic due to the earlier start of spring [8] illustrated by the high number of brood cells in April 2007 compared to the year before.

Although winter temperature was not included as a replicated treatment, we observed that mean lifespan (estimated by bee survival at 100 days) was longer during the colder winter in 2005/ 2006, compared to the relatively mild winter of 2006/2007. Mean longevity in the study of Mattila et al. [12] was longer than in our study, for comparison: on October 6th longevity ranged between 125–150 days in the study of Mattila et al. [12], while in our study on this date mean longevity was 62 days for 2006/2007 and 93 for 2005/2006 (calculated using the method described in Matilla et al. [12]). Mattila et al. [12] performed their experiments in the south of Manitoba, Canada, which has approximately the same latitude as The Netherlands, but has a continental climate characterized by large annual amplitudes in temperature instead of an oceanic climate as in our site with narrow annual temperature amplitudes. The even lower winter temperatures in Canada compared to the Netherlands can maybe explain the longer lifespan of the Canadian bees. We therefore hypothesize that the negative effect of V. destructor (i.e., shortened lifespan of winter bees and possible colony loss) is larger under colder winter conditions.

Colony survival, measured by the number of frames with bees occupied in April, was highest with treatment against V. destructor applied in July, due to the longest lifespan of the bees (bee survival at 100 days) in autumn for these colonies. Delaplane and Hood [13] also studied the effects of timing of acaricide treatment (with Apistan) on honeybee colonies parasitized by V. de-

structor, where type of one-story hives, colony sizes and amounts of brood were comparable to our experiment. They found that colony survival and colony size, measured in December, was higher by acaricide treatment in August (in contrast to treatment in June or October). In their study, colonies treated in October resulted in unacceptably high bee mortality in December. Mite fall before treatment of these colonies was 145630 mites per 1865 h, which was much higher than mite fall in November in our study (max. 32611 mites per 24 h; mite fall in December in our study was not representative for 'natural' mite fall due to the acaricide treatment in this month). In our study, however, at this relatively low level of mite fall, colony loss already occurred. Our late treatment (September) did not show an increase in colony size (in April), and nor did theirs (October, resulted in a 45% decline in colony size in December). Acaricide treatments to kill V. destructor in late autumn may thus fail to prevent losses of colonies because many of the adult bees are no longer able to survive until spring [8].

We manipulated the level of V. destructor infestation by using acaricide treatments at different moments. This acaricide treatment with ThymovarH was effective because mitefall was indeed increased during the month the acaricide treatment was applied. The pattern of mite fall directly after the acaricide treatment for the different moments (Figure 3) confirms with the expected infestation level after the month of treatment (Figure 2). The efficacy of ThymovarH as an acaricide has been shown before: 72% for one-story and 94% for two-story colonies [23], or 97% for one-story colonies with low amount of brood [24]. Although mite fall was reduced after the acaricide treatment in July, August or September, it was not as much reduced as after the treatment using oxalic acid in December. Oxalic acid however only affects mites in the phoretic phase, which is the predominant phase during winter when brood rearing has stopped or is reduced [25,26].

This is supported by the slightly higher mite fall during winter 2006/2007 compared to 2005/2006, and the most likely higher amount of reared brood (assumed during winter 2005/2006, not measured).

Previous studies showed that V. destructor infestation reduces the body weight and protein content of individual bees, which shortens their lifespan [6–8]. Our study supports these findings and shows the relation between decreased lifespan of individual bees and increased colony losses. Additionally, colonies treated earlier in the season had reduced V. destructor infestation before the development of winter bees resulting in longer bee lifespan and higher colony survival after winter (Figure 7). This study contributes to theory about the multiple causes for the recent elevated colony losses in honey bees. Our study shows that high V. destructor infestation during the transition to winter bees can cause these colonies losses due to decreased lifespan of winter bees. We can expect that other environmental stresses, such as pesticides, other pathogens, decreased food availability, or reduced diversity of this food [1,3,27], in combination with V. destructor will further reduce lifespan of bees and increase colony losses during and after winter.

Supporting Information

Figure S1 Mean survivorship curves for cohorts of bees marked in 2005/2006 (left) and 2006/2007 (right). Cohorts of bees were marked at 14-day intervals for each acaricide treatment: July (open diamonds), August (grey squares), September (dark grey triangles), and not treated at all (black circles). Each line shows the mean survival of 1 to 4 cohorts. During the winter of 2005/2006, actual counts of marked bees were suspended due to cold temperatures; mortality was assumed to be constant for that period.

Figure S2 Cumulative survival curves for 2005/2006 (top) and 2006/2007 (bottom), per acaricide treatment (left), and for the marking date of the cohorts (right).

Cumulative survival curves were calculated from the Cox Proportional Hazards Models for cohorts of bees marked. For the survival analysis, we had 6398 uncensored cases and 346 censored cases for 2005/2006, and 8458 uncensored cases and 547 censored cases for 2006/2007. During the winter of 2005/ 2006, actual counts of marked bees were suspended due to cold temperatures; mortality was assumed to be constant for that period.

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APITHERAPY CAMP

Cooperation with the Local Community

CONTENTS

WHAT IS AN APITHERAPY CAMP?

The Apitherapy Camp is organized by the Institute for the Development of Empathy and Creativity Eneja in cooperation with beekeeping associations and other partners.

The Apitherapy Camp is one of the typical programs of Apipedagogy®, characterized by a pedagogical–apitherapeutic approach. In practice, it includes apipedagogical workshops, Safety and Responsibility at the Apiary, Rules of Good Behavior Near Bees, A Child-Friendly Apiary, the apipedagogical segment of apitherapy, Bee Lessons, and the apipedagogical program Together We Are Stronger.

Since 2025, the program also includes Bee Lessons, focusing on strengthening democratic values through the API School program.

The Apitherapy Camp takes place under the professional guidance of a certified apitherapist licensed in Apipedagogy, in cooperation with bee-

keepers, herbalists, educational professionals, tourism professionals, and local communities.

How does it differ from traditional beekeeping camps?

The Apitherapy Camp is not a holiday course in beekeeping or handling bees. Instead, it focuses on children's health, bee products in the context of apitherapy. It incorporates a specific methodology and a pedagogical–apitherapeutic approach under the Apipedagogika® brand.

BACKGROUND

Since its first announcement in 2020, the Apitherapy Camp has included a special program called Etiquette in the Vicinity of Bees, aimed at developing empathy through role-play, where children metaphorically "put on different shoes" each day.

During the program, children:

- became apitherapists and created an apitherapeutic product while learning about intangible cultural heritage through experiential learning;
- experienced the role of visitors of the Ljubljana Bee Path, guided in the first edition by beekeeping tourism guide Dominika Koritnik Trepel;
- acted as scientists, experimenting with bee products;
- received apitherapy services (Honey massage for children, aerosol apitherapy, and apitherapeutic api-culinary experiences);
- swam in the river while exploring the interconnection between matter, herbs, and pollinators;
- participated in the Open Day at the Honey Educational Garden at Grba, which was an integral part of the program.

The Apitherapy Camp program is a protected concept within Apipedagogy, characterized by its pedagogical–apitherapeutic approach. It is implemented in various forms and locations.

For the past four years, it has also been an important element in obtaining the Best API Kindergarten award, granted annually by the Municipality of Ljubljana.

The program has also been implemented in cooperation with the City of Ljubljana and the Mala Ulica Public Institute, where it took place three times as a five-day program at the Grba Urban Garden Area (without overnight stay). When conducted in Slovenian kindergartens, pedagogues learn to perform within colaboration between Eneja Institure and Ministry of Education of the Repuclic of Slovenia.

The Honey Educational Garden at Grba, together with API workshops (Apipedagogy®) and therapy with the therapy dog Lilu, represented key didactic elements.

WHAT IS THE PURPOSE OF THE APITHERAPY CAMP?

The purpose of the Apitherapy Camp project is to promote understanding of the importance of bees, intangible cultural heritage, apitherapy, herbalism, and nature as the foundations of sustainable development within the local community.

The project connects the fields of Apipedagogy (a.k.a. Apipedagogika®), apitherapy, herbalism, and sustainable tourism, with the aim of creating a unique space for learning, relaxation, and connection between young people, the wider public, nature, and one another.

Figure 2: Bee Democracy and Constutitional Democracy

KEY PROJECT OBJECTIVES:

- Increasing the visibility of the municipality or local community as an innovative and green municipality on the national and international map
- Promoting beekeeping and apitherapy as important economic, environmental, educational, and cultural activities
- Encouraging sustainable urban development and responsible use of natural resources
- Promoting apitherapy as a natural complementary method for strengthening health and a healthy lifestyle
- Involving the local community, beekeeping and herbal associations, apipedagogical experts, tourism providers, schools, and families
- Cooperating with holders of intangible cultural heritage, especially beekeepers, tourist guides, and herbalists
- Implementing educational and experiential programs for children, youth, families, and visitors of all generations

The program builds a bridge between heritage and modernity, strengthening the identity of the municipality or local community as a place where nature, knowledge, and health intersect.

HOW DOES COOPERATION IN APIPEDAGOGIKA® WORK?

The program is implemented under the Apipedagogika® brand.

It is in the interest of participating partners that the program operates under an established and professionally protected name.

Why?

- Because it demonstrates professional quality
- Because it reduces risk (the program is developed, tested, and systematic)
- Because it ensures recognition and trust among parents, schools, kindergartens, and residents

A municipality or local community is a governing authority, not a commercial entity, and therefore does not compete on the market. For this reason, it is in its interest to implement projects under an established brand.

Within the framework of licensing cooperation, the competent body Eneja Institute:

- grants the right to use the Apipedagogy® trademark
- provides professional training, expert guidelines, educational materials, and permission to implement the program under licensing conditions
- provides promotional and mentoring support
- provides professional materials and necessary documentation

PROGRAM FORMATS

The vision of the Apitherapy Camp is the gradual establishment of permanent apipedagogical and tourism destinations, recognized both in Slovenia and internationally.

The program can take place as:

- a 1-day,
- 3-day, or
- 5-day Apitherapy Camp for children, families, or adults.

In all formats, the program focuses on learning about:

- bees
- natural hive products
- therapeutic effects of bee products
- herbs
- the importance of self-sufficiency.

It combines educational, experiential, and health-beneficial content and involves experts from different fields:

- beekeeping
- Apipedagogy®
- herbalism
- art

Through this, a local community implementing the Apipedagogical Apitherapy Camp positions itself on the global map of apipedagogical, herbal, and apitherapeutic centers, where re-

spect for bees intertwines with medicinal plants, intangible cultural heritage, healthy lifestyles, learning, and community connection.

Figure 3: photo Matic Šuc

4-DAY REWARD APITHERAPY CAMP FOR THE WINNING TEAM OF THE INTERNATIONAL YOUNG BEEKEEPERS COMPETITION

What do you think about the idea that the winning team of the International Young Beekeepers Competition would receive a special experience – a 4-day Apitherapy Camp?

Apitherapy is an interesting field that connects beekeeping, health, and well-being. For young beekeepers, such a camp could represent an opportunity to explore the broader world of bee products, beyond competitive knowledge.

They could experience the safe apitherapeutic uses of honey, propolis, pollen, and modern pedagogical-apitherapeutic approaches of Apipedagogika® in person.

A 4-day Apitherapy Camp could become an attractive reward for competition winners – and above all an additional motivation for young beekeepers to explore new dimensions of their knowledge and future opportunities.

Would such a concept be, in your opinion, an interesting addition to the International Young Beekeepers Competition?

I first presented this proposal in 2024 within a smaller beekeeping community in Slovenia. While discussions are ongoing, I would be very pleased to hear the opinions of beekeepers from the European beekeeping community.

Nina Ilič
Graduate in Public Administration
and licensed apitherapist
Author of Apipedagogika® and lecturer
at IFA (https://api-terra.org/nina-ilic-slovenia/)

zavod.eneja@gmail.com

LETTER OF SUPPORT TO SERBIAN APITHERAPY SOCIETY

The European Beekeeping Association (EBA) has submitted an initiative to the Ministry of Health of the Republic of Serbia, calling for an expert review of the status of apitherapy within the national healthcare system.

The proposal focuses on exploring its potential role within complementary medicine, while ensuring clear regulatory frameworks, professional standards, and patient safety

. The initiative also emphasizes the importance of developing structured medical education and scientific activities in cooperation with key national institutions, including the Serbian Medical Society and the Health Council of Serbia.

The proposal has been supported by the EBA Scientific Committee for Apitherapy, highlighting the growing need for a coordinated, evidence-based and professionally supervised approach to apitherapy in Serbia.

Subject: Submission for Consideration Apitherapy within Complementary Medicine and Professional Medical Education Frameworks in Serbia

Dear Minister,

On behalf of the European Beekeeping Association, which represents more than 420 thousand european beekeepers from 32 countries, I am honored to address you as the respected Minister of Health of the Republic of Serbia.

Apitherapy the professional use of bee products such as honey, propolis, royal jelly, bee hive air and bee venom has developed internationally as a part of traditional, complementary and integrative medicine, and is increasingly discussed in connection with regulation, education, research, and patient safety The World Health Organization continues to emphasize the importance of evidence, regulation, and responsible integration of traditional and complementary practices within national health systems.

In this context, I respectfully submit for the Ministry's consideration an initiative to facilitate an expert review of the status of apitherapy within Serbia's professional and regulatory frameworks, particularly in relation to:

1. Professional organization and medical education: enabling apitherapy-related scientific activities and continuing medical education pathways in cooperation with the Serbian Medical Society (Srpsko lekarsko društvo – SLD) and its Section for Traditional Medicine (Sekcija za tradicionalnu medicinu), and The Health Council of Serbia, wich is responsible for the Continuing Education of health workers (Zdravstveni savet Srbije) sld.in.rs

2. Regulatory clarity under the Ministry's framework for complementary medicine: considering whether, and under what professional criteria, apitherapy may be appropriately addressed within the scope of the Ministry's rulebook governing the performance of methods and procedures of complementary medicine, with a clear emphasis on safety, defined indications, competency-based training, and ethical standards.

As far as we know, apitherapy-related professional activities have become more difficult to accredit within certain professional frameworks in recent years, which may unintentionally limit structured education, the organization of scientific meetings, and the establishment of uniform safety standards. At the same time, Serbian health professionals remain active contributors to European and international scientific events in this field.

With full respect the EBA would be grateful if the Ministry would consider initiating or supporting an appropriate expert consultation to clarify how apitherapy may be addressed—if deemed appropriate—within Serbia's complementary medicine and Continuing Professional Education systems.

Respectfully,

MD PhD MPH apitherapist. Zorica Plavšić, EBA Scientific Committee for Apitherapy

With the full support of:

President Boštjan Noč – President of European Beekeeping Association

Dr. Nik Luple –Head of EBA Scientific Committees

EBA Scientific Committee for Apitherapy

LET ALL OF EUROPE JOIN IN!

Five Years of Connecting for Pollinators: Planting the Future Together – Let Every Slovenian Plant at Least One Melliferous Plant.

For the fifth consecutive year, the Slovenian Beekeepers' Association (ČZS) is connecting people through the "Day of planting Melliferous (Honey) Plants " project with a shared mission – to preserve pollinators and co-create a greener, more blossoming future.

As part of the project this year, 84 municipalities took over a total of 3,999 melliferous tree saplings, which were distributed across 13 collection locations nationwide. The project takes place under the auspices of the ČZS and with the support of the Ministry of Agriculture, Forestry and Food, which promotes measures for nature protection and sustainable environmental development. In many municipalities, the initiative has been further enhanced—on this occasion, parents of newborns are gifted melliferous tree saplings, which symbolically grow alongside the child while providing food and shelter for bees and other pollinators.

This year, beekeeping societies (ČD) again have the opportunity to apply for a co-financing tender for melliferous saplings, through which they can obtain up to €1,000 for planting species that provide bees and other pollinators with pollen, nectar, and honeydew. The tender is an opportunity for societies, together with the local community, to create new flowering areas, improve bee forage, and contribute to greater biodiversity. We invite beekeeping societies to take advantage of this possibility and apply—more information on the conditions is available on the tender's website or from the advisors of the public beekeeping advisory service at the ČZS.

Every individual can make a significant contribution to the preservation of pollinators. Melliferous plants can be planted almost anywhere—in gardens, near apiaries, in orchards, in fields, or even on balconies and terraces. Numerous plants represent an important food source for bees: from early spring messengers like hazel,

crocuses, and willows, to summer and autumn plants such as chestnut, sunflowers, buckwheat, clover, or phacelia. Even herbs like lavender, sage, and thyme can create a rich source of nectar and pollen on smaller surfaces. We therefore invite you to look at the selection of melliferous plants and consider where in your environment you can create a new flowering corner—every plant is a step closer to a more diverse environment for pollinators.

Day of planting Melliferous Plants reminds us every year that small actions can achieve big changes. We therefore invite you to join us on Saturday, March 21, 2026, and plant a melliferous plant according to your means—whether it be a flower, a shrub, or a honey tree. With every plant sown or planted, we co-create a blooming environment, richer biodiversity, and more stable living conditions for pollinators and future generations.

TO THE EBA WITHOUT MEMBERSHIP FEE

At the meeting of the EBA Executive Board, on the proposal of the EBA President Mr. Boštjan Noč, an important decision was made regarding membership in the EBA in the upcoming period: "**Membership in the EBA is free for the duration of the mandate of the EBA President Mr. Boštjan Noč**."

Decision of the EBA Executive Board is another confirmation that the EBA continues to work only in the interest of bees, bee-keepers and consumers in Europe.

SPONSORSHIP REQUEST

AND METHOD OF ADVERTISING IN THE MAGAZINE

On behalf of the European Beekeeping Association (EBA),I am writing to seek your support in the form of sponsorship to help ensure the smooth and effective operation of our Association.

The EBA is dedicated to promoting and supporting beekeeping across Europe. The Association was founded out of necessity, as bees and beekeepers are essential for our ecosystem and society. Without beekeepers there are no bees, and whithout bees there is no pollination, leading to a lack of food on planet Earth.

EBA works for bees, beekeepers and consumers.

Our mission is to:

1. Fight against counterfeit honey that flooded the European market;
2. Introduction of incentives per beehive as agro-ecological programme;
3. Fight against the improper use of chemicals that are harmful to bees;

In return for your generous support, we offer various sponsorship benefits. We believe that this partnership would be mutually beneficial and would significantly contribute to the advancement of the european beekeeping sector.

ADVERTISING IN THE MAGAZINE:

1. Through sponsorship packages;
2. It is possible to pay for an ad only for 1/4 page (100 euros), for a larger area by agreement. The entire page cannot be obtained, it belongs only to the General Sponsor.

IT CONTINUES

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12 advertisements in the EBA monthly e-magazine in half A4 page size

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EBA SUPPORTER - 1.000 euros:
Advertisement on the EBA website
12 advertisements in the EBA monthly e-magazine in the size of 1/8 A4 page

These are basic packages, but we are open to different forms of cooperation, which we agree on individually. We would be delighted to discuss this opportunity further and explore how we can align our goals with your organization's values.

Thank you for considering our request. We look forward to the possibility of working together.

Yours sincerely,

Boštjan Noč
President of the European Beekeeping Association

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