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NO BEES LIFE

EBA MAGAZINE

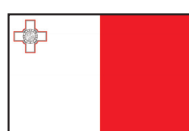
30 COUNTRIES

FROM WHICH EBA HAS MEMBERS

(55 beekeeping organizations)

In order of confirmation of the Statute of EBA

414.349 beekeepers



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Bulgaria
Greece
Romania
Malta
Germany
Hungary
Ukraine
Montenegro
Lithuania
Bosnia and Herzegovina
Sweden
Croatia
Czech Republic
Poland
United Kingdom
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**BEES
LIFE**

Dedication >

< Apathy

A YEAR OF DEDICATION

THE FIRST ANNIVERSARY OF EBA SCIENTIFIC COMMITTEES

As we mark the first anniversary of the establishment of the first Scientific Committee within the European Beekeeping Association, we take this opportunity to reflect on a year of important progress. The Scientific Committee on the Safety and Quality of Bee Products held its inaugural meeting in July 2024. Since then, its members have produced a significant body of work, particularly in shaping the EBA's positions for the Honey Platform meetings. Following this first committee, four additional Scientific Committees have been created, each contributing their expertise to advance our shared goals. The commitment, knowledge, and tireless efforts of all our committee members have been invaluable in supporting the EBA's mission to advocate for sustainable beekeeping across Europe. Their voluntary dedication of time and insight has strengthened our voice in key discussions and in

addressing the challenges faced by the beekeeping sector. We extend our sincere thanks to every member for their service. Together, we will continue to work towards a thriving future for bees, beekeepers, and biodiversity.



Dr. Urška Ratajc

Head of the Scientific Committees of the EBA

LETTER

TO THE EUROPEAN COMMISSION REGARDING THE HONEY PLATFORM

The EBA is honoured to participate in the Honey Platform meetings.

We welcome the creation of this working group as a positive and necessary step toward tackling the long-standing legislative issues affecting the honey sector. In this spirit of constructive dialogue, we have decided to send a letter to the European Commission, offering suggestions to help make the meetings more effective and meaningful for all stakeholders.

We are publishing a part of this letter below. Our Position Paper on pollen content, enzymatic activity and traceability will also be attached to the letter.

»The EBA represents 55 beekeeping organizations from 30 countries, collectively representing 414,349 beekeepers. EBA actively collaborates with and supports the work of all European beekeeping associations that strive to combat fraud and adulteration in honey.

Its work is firmly grounded in the experiences of its beekeeper members and a large network of scientists specializing in honey characteristics, properties, quality, analytical methods, fraud de-

tection, and the legislative framework governing honey and other hive products.

The accumulated knowledge and expertise of EBA's beekeepers and scientists have, over the 24 years since the adoption of Directive 2001/110/EC and the 11 years since its amendment by Directive 2014/63/EU, identified several legislative gaps that facilitate honey fraud and adulteration, specifically:

- The Commission's failure to issue implementing acts concerning methods for verifying compliance of honey with the quality criteria set out in Directives 2001/110/EC and 2014/63/EU.
- The absence of regulated methods for detecting the removal of HMF from overheated honey using resin filters, or the addition of artificial enzymes such as diastase or invertase.
- The Commission's inability to issue an implementing act defining the term "mainly" in relation to monofloral honeys (Directive 2014/63/EU, Article 4(2a)).
- The Commission's failure to issue an implementing act defining the minimum pollen count in filtered honey (Directive 2014/63/EU, Article 4(2b)).

- The unjustified classification of filtered honeys under the definition of "baker's honey" (Directive 2024/1438).

- The lack of specific limits for foreign organic and inorganic substances in the composition of honey, despite the vague phrase "Honey must, as far as possible, be free from organic or inorganic matters foreign to its composition" (Annex II of Directive 2001/110/EC).

- The concealment of harvest countries behind generic terms such as "blend," in contradiction to Regulation 1169/2011, which grants consumers the right to know the geographical origin of all foods they consume.

- While the amended Directive 2024/1438 mandates the indication of all countries of origin involved in a honey blend with the percentage that each of those countries of origin represents, there is no existing laboratory method to verify

this. Yet, the Honey Platform has not prioritized solving this critical issue.

- In Annex I of Directive 2001/110/EC, the heading "The main types of honey are as follows" implies that additional types may exist beyond those listed, thereby allowing misleading terms such as "raw honey," "unprocessed honey," "cream honey," "virgin honey," or even "vegan honey" to be marketed within the EU.

Beyond these legislative gaps, current EU regulations contain provisions that unfairly penalize honest beekeepers.

Notably, the correlation of diastase activity with HMF content in naturally low enzyme honeys, and the natural deviations of monofloral honeys in various parameters—none of which are currently exempted—pose significant issues.«



POSITION PAPER

EBA'S PROPOSAL ON ENZYMATIC ACTIVITY, POLLEN CONTENT AND TRACEABILITY

At the 2nd meeting of the Honey Platform, the European Beekeeping Association (EBA) stated that the current use of HMF content and diastase activity as indicators for detecting honey overheating must be revised and supplemented with additional provisions.

To ensure that honey quality standards reflect scientific evidence and modern fraud detecting techniques, the EBA recommends:

- amending current HMF and diastase criteria to account for honeys with naturally low enzymatic activity;

- providing an official EU-wide list of monofloral honeys with documented low diastase levels.
- clarifying the legal interpretation of the phrase “after processing and blending” to protect producers from post-processing degradation penalties;
- legislating detection methods for enzyme adulteration and HMF removal;
- considering invertase as an alternative quality parameter only after thorough standardization and validation through a structured pilot phase.

This article aims to further explain and support the EBA’s position, helping the chair and the committee to better understand our concerns and recommendations.

A. THE HMF AND DIASTASE CRITERIA SHOULD BE AMENDED

The current criteria must be revised in the following three areas:

a) Reconsidering the Correlation Between Enzyme Activity and HMF in Honeys with Naturally Low Enzymatic Activity

Both Codex Alimentarius and the European Honey Directive acknowledge that some types of honey naturally have low enzymatic activity. The Directive cites citrus honey as an example, permitting a diastase activity as low as 3 DN, provided that HMF does not exceed 15 mg/kg.

However, this provision is problematic and not in accordance with the latest scientific evidence. In honeys with naturally low-enzymatic activity, fresh and unprocessed samples may already contain 12–13 mg/kg of HMF. Minor processing or blending can easily push the HMF level beyond 15 mg/kg. Additionally, the use of oxalic acid to control Varroa mites—a common practice among European beekeepers—can also elevate HMF beyond the legal threshold.

Figure 1 illustrates HMF and diastase enzymatic activity values, expressed as DN values, in 61 citrus honey samples collected directly from colonies and analyzed fresh and unprocessed. While the first 15 samples show zero HMF with

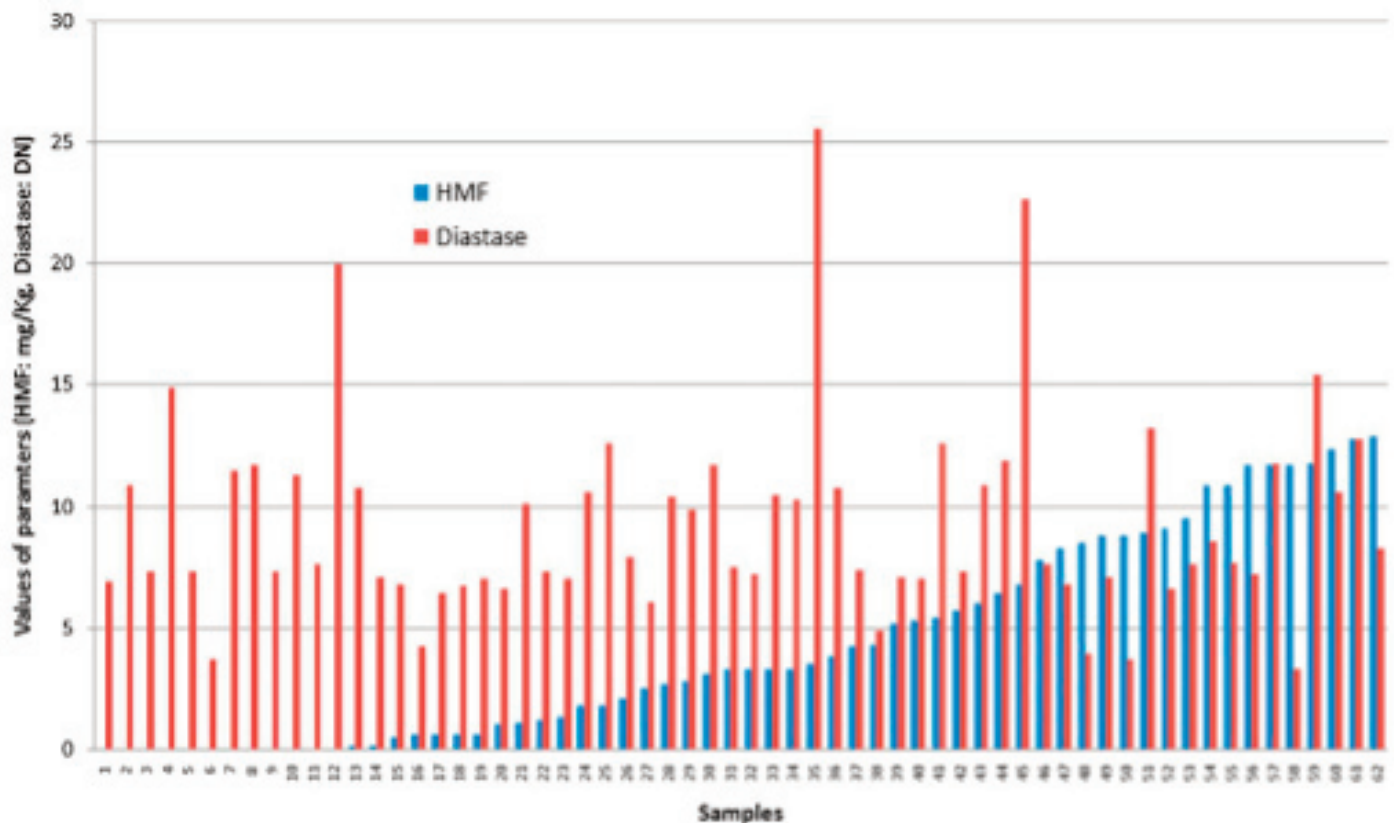


Figure 1. HMF and diastase activity of fresh unprocessed samples of citrus honey (Thrasylvoulou et al., 2018).

low diastase activity (thus fully marketable), the last 7 samples (No. 54–61) have HMF levels above 10 mg/kg. Minor processing could easily bring them above the legal 15 mg/kg limit, resulting in 11.5% of authentic, unprocessed citrus honey being ineligible for market placement.

Unlike the Directive, Codex does not tie diastase levels to HMF concentrations, nor does it single out citrus honey. This is reasonable, as there are many other honeys with naturally low enzymatic activity levels, like manuka (*Leptospermum* spp.), black locust (*Robinia pseudoacacia* L.), rosemary (*Rosmarinus officinalis* L.), heather (*Erica* spp.), dandelion (*Taraxacum* spp.), strawberry tree (*Arbutus* spp.), and pine honey, which should be acknowledged by control authorities.

Countries such as Brazil, Canada, Russia, Turkey, and Serbia accept any honey with diastase levels above 3 DN, provided that HMF is below 15 mg/kg.

EBA recommends disconnecting the diastase activity requirement from HMF content for honeys with naturally low enzymatic activity levels. These honeys should be recognized as such, without being subject to additional quality constraints. This approach aligns with the principles of Codex Alimentarius.

b) Including a List of Honeys with Naturally Low Enzymatic activity in the Directive

Control authorities are often not specialists in honey and may not know which types naturally exhibit low enzyme activity. Any honey that does not originate from citrus and shows diastase ac-

tivity below 8 DN is often deemed non-compliant, removed from the market, and subject to fines—regardless of authenticity.

EBA recommends that each Member State compile and provide an official list of monofloral honeys that are naturally low in diastase activity. This list should be incorporated into the Directive, similar to existing exceptions for sucrose and water content, to prevent unjust penalties against producers and packers.

A harmonized template for such national lists could include: botanical source, typical diastase activity range (DN), geographical zones of occurrence, and citation of published data or national studies. This list should be dynamically updated based on emerging research and monitored jointly by national food authorities and apicultural experts.

c) Clarifying the Meaning of “After” in “Determined After Processing and Blending”

Diastase activity and HMF content are critical criteria used to evaluate honey quality, heat treatment, and potential adulteration. These “freshness” parameters are sensitive to both heating and storage conditions.

Annex II, paragraph 6 of the European Directive states that diastase activity and HMF content must be “determined after processing and blending.” However, this phrasing is ambiguous and can be interpreted in two ways:

- Interpretation 1: The producer analyzes the honey immediately after processing and labeling in an accredited laboratory and keeps the results linked to the batch number. Official



inspections rely on these original test results. In this case, the producer is not liable for quality changes due to prolonged storage or inappropriate storage conditions on the market. If HMF exceeds 40 mg/kg or diastase falls below the legal threshold later, the producer simply replaces the product without penalties.

- Interpretation 2: The control authority may analyze honey at any time post-processing, even after prolonged shelf storage. In this case, the producer is held responsible for any degradation in quality—even if it occurred naturally during storage.

EBA recommends that the phrase “after processing and blending” be clarified in legislation to avoid misinterpretation and unfair sanctions. Legislative language must be unambiguous and consistent. EBA proposes that the phrase “after processing and blending” be replaced with:

“Immediately following processing and prior to retail packaging, as documented by a traceable batch analysis conducted in an accredited laboratory. Test results from this phase shall serve as the definitive reference for product conformity, and legally compliant storage thereafter shall not be grounds for penalization.”

B. THE HMF AND DIASTASE CRITERIA SHOULD BE SUPPLEMENTED

a) Legislate a Method for Detecting Added Fungal Diastase

Overheated honey can be fraudulently “re-stored” by adding fungal enzymes to artificially increase the diastase number. Commercial alpha- and beta-amylases—primarily derived from *Aspergillus oryzae* or *Rhizopus* spp.—can be mixed into honey under mild heating to raise the enzyme level just above the legal threshold.

Detection of exogenous enzymes is possible using advanced techniques such as Isoenzyme profiling (e.g., isoelectric focusing, electrophoresis), Enzyme activity ratio (diastase/invertase), Mass spectrometry (MS), Immunodetection (e.g., ELISA for fungal proteins) and other methods.

These methods must be officially legislated for them to be admissible in legal proceedings.

b) Legislate a Method for Detecting HMF Removal via Resin Filters

HMF is a key indicator of honey overheating. However, adulterators can now remove excess HMF using resin filtration systems, which are advertised online by certain suppliers (especially in China) (Fig 2). These filters also remove antibiotics, chemical residues, and pollen.

The removal of pollen impairs the ability to trace geographical origin. Even small additions of local honey to ultra-filtered blends can create the

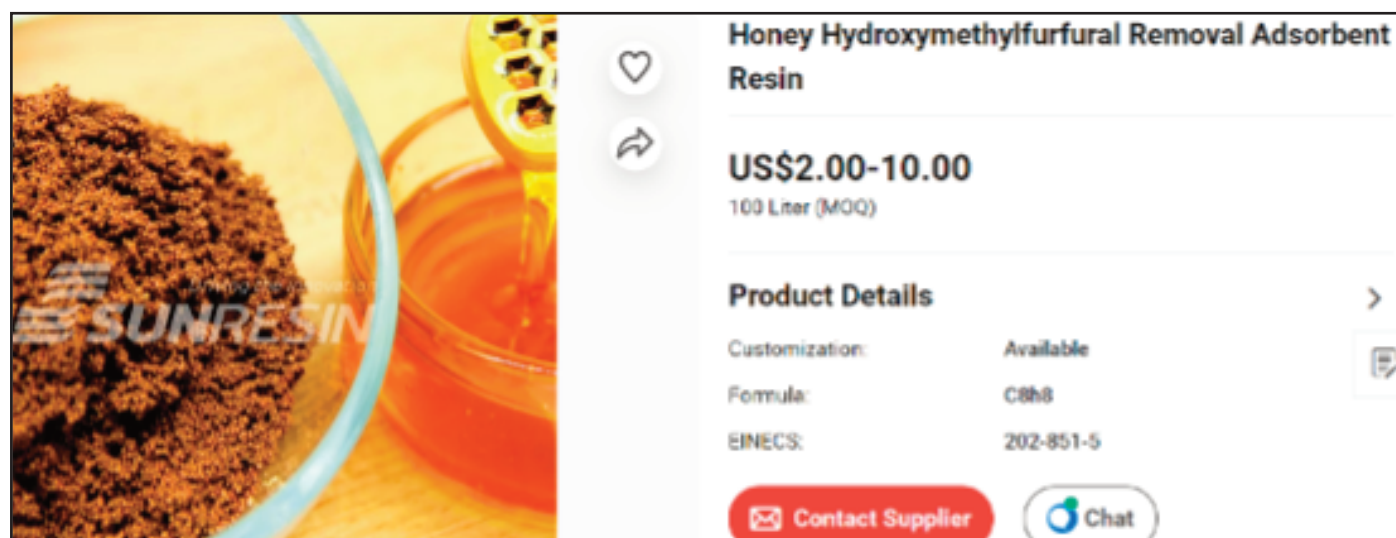


Figure 2. The removal of HMF from honey is now widespread and much advertised.

illusion of “local origin.” For instance, mixing just 20 kg of local honey into a 1-ton blend can produce 1,000 pollen grains per 10 g of honey—technically enough to appear authentic under current EU guidelines, which set no minimum threshold for pollen content. While filtered honeys are no longer permitted in the EU, such products are now often labeled as “baker’s honey,” which can be used in similar ways.

Detecting artificial HMF removal is challenging, but not impossible. Potential methods include Isotope Ratio Mass Spectrometry (IRMS), HPLC/GC-MS, FTIR/NIR with Principal Component Analysis (PCA), Nuclear Magnetic Resonance (NMR), Detection of resin residues (leachables) and other methods

EBA believes that unless methods to detect both enzyme addition and HMF removal are legislated, the integrity of honey overheating controls cannot be guaranteed.

c) Replacing HMF and Diastase with Invertase?

If the European Commission decides not to amend the HMF and diastase criteria or introduce supporting legislation to detect adulteration, EBA is open to considering invertase as a replacement—but only under specific conditions.

Invertase could replace HMF and diastase as a quality control criterion if:

- Member States are given time to analyze a large number of monofloral honeys to determine natural enzyme variability;
- Honeys with naturally low enzymatic activity are listed and exempted from threshold limits, similar to our recommendations for diastase;
- Enzymatic activity is measured immediately after processing. Packers should not be penalized for post-processing degradation;
- A validated method is legislated to differentiate between natural (bee-derived) and industrial (added) invertase.

EBA proposes a structured pilot phase for invertase adoption. During this phase, Member States would analyze a representative number of monofloral honeys ($n \geq 100$ per country) to define baseline invertase levels. Only after cross-comparison and standardization could invertase be

considered a robust replacement for HMF and diastase. Until then, its use should be restricted to research and supportive documentation.

The addition of prerequisites for the acceptance of invertase as a criterion for identifying overheated honey, comes from the following considerations:

- Natural invertase levels in monofloral honeys are not well established;
- Invertase levels vary significantly within the same honey type, depending on factors like bee health, climate, nectar flow, season, and hive conditions;
- Some honeys have low invertase, others moderate, and some very high—making standard thresholds unreliable;
- Invertase is highly sensitive to storage. Its activity declines rapidly over time, limiting shelf life;
- Industrial invertase, such as β -fructofuranosidase used in bee feeding syrups, can contaminate honey. There is also a risk of direct addition of non-bee invertase—paralleling concerns about added diastase.

Conclusion

The EBA strongly recommends that the criteria for HMF content and diastase activity be amended, clarified, and supplemented with enforceable legislation to detect fraudulent practices. If invertase is to be considered as an alternative criterion, a structured approach is necessary and essential to ensure its effective, fair, and scientifically sound implementation.

EBA’S PROPOSAL ON TRACEABILITY AND HONEY POLLEN CONTENT

We welcome the amendment to the Honey Directive requiring labelling of origin and percentages in honey blends. For transparency, an effective traceability system must support this. Current rules on pollen content and food tracea-

bility do not sufficiently ensure geographic origin or trace honey from producer/importer to consumer. A robust regulatory framework is urgently needed to protect authenticity, traceability, and safety in the EU honey market.

A. HONEY POLLEN CONTENT

The gold standard for pollen analysis is a melissopalynology analysis using light microscopy. AI-assisted methods and DNA barcoding are promising but require validated reference libraries of pollen from 100% authentic honeys—available only from beekeepers, not processors.

The Directive permits only coarse filtration, not ultrafiltration, which requires pressure and heat, damaging the honey. Revised definitions under Directive 2024/1438 now allow extensively filtered products under "baker's honey"—a concern since pollen is the primary natural indicator of geographic and botanical origin. Removing it eliminates the forensic traceability of the product. We urge the EU to clarify "filtration" and "foreign matter" definitions, suggesting the latter include only large visible particles (e.g., bee parts, wax lumps, plant fibers).

a) Minimum pollen content

Minimum pollen levels must be sufficient to enable determination of geographic and botanical origin. As pollen content varies by botanical origin, processing methods, climate, soil, and beekeeping practices, exceptions should exist for monofloral honeys with naturally low pollen content.

b) Minimal mesh size of filters

Pollen grains in honey vary in size depending on their botanical origin, typically ranging from 5 μm to 150 μm in diameter. Pollen grains larger than 100 μm are relatively rare but can be good indicators of the tropical or subtropical origin of honey.

Coarse filtration/straining with mesh size $>200 \mu\text{m}$ preserves the honey pollen spectra. Baker's honey could be filtered using a mesh size $>100 \mu\text{m}$, allowing the removal of only the largest pollen grains.

We summarise our proposals for definitions of filtration and categorization of the honey after filtration in the table below.



Filtration and mesh size	Name of the product
Ultrafiltration, <10 μm	Should NOT be called “honey”!
Fine filtration, 10-99 μm	Should NOT be called “honey”!
Filtration, 100-199 μm	“Baker’s honey”
Coarse filtration / straining, >200 μm	“Honey”

EBA proposes that melissopalynology experts from each country define thresholds for monofloral honeys and list monofloral honeys with naturally low pollen content to be treated as exceptions. EBA recommends minimal mesh size 200 μm and banning filtration using filters with mesh size <100 μm , as it changes the pollen spectrum to a level where determination of botanical and geographical origin is not possible anymore. Such products should not use the name “honey”. Filters with mesh size between 100 μm and 199 μm could be permitted only for baker’s honey.

B. TRACEABILITY

A comprehensive system should combine stricter border controls, digital platforms, and administrative oversight.

a) Stricter Border Controls

All honey imports must pass through approved Border Control Posts (BCPs), as per Regulation (EU) 2017/625. These should be equipped with labs and trained personnel. With

honey among the most adulterated foods globally, limiting entry to certified BCPs is justified. We support heightened checks—especially for high-risk countries—detaining consignments pending results and conducting secondary sampling at delivery sites.

b) Digital Traceability Systems

Paper systems are inadequate for complex global supply chains, especially when honey is blended post-import. We propose a mandatory



EU-wide digital traceability framework. Each member state should maintain a national Honey Inventory Balance, recording inflows/outflows of honey at every stage of storage and distribution. These should integrate with BCPs, national beekeeper registries (with annual hive declarations), and the TRACES system.

Though TRACES certifies imported honey, its references are not currently tracked through the supply chain. We recommend mandating honey batch-level linkage of TRACES certificates





throughout processing, blending, analysing, packaging, and distribution, ensuring immediate backward traceability to the importer. Each country should appoint a national reference laboratory to maintain a database of imported honey samples and support a pollen atlas. Labs should collaborate EU-wide, sharing data and conducting interlaboratory comparisons. Mandatory tests should include pollen analysis and testing for adulteration with exogenous sugars and enzymes.

Traceability gaps persist within the EU. Once honey enters the single market, repackaging, blending, or re-export often lacks transparency. A registry of bottlers/traders—covering both domestic and imported honey—is essential. Bottlers should declare origin percentages and total volumes per batch, enabling better stock tracking and post-mixing traceability. Sampling and testing of intra-EU shipments should be routine, with data submitted to national reference laboratories and the pollen atlas. Member states should issue interim national regulations, as done in Germany, France, and Greece.

We recommend blockchain technology for traceability, assigning each batch a unique code (QR, barcode, or RFID) linked to full origin and processing history. With a blockchain-based system the entire journey of honey can be tracked and verified—from the apiary to distribution centres, and finally, to store shelves. Each entry is immutable, meaning it cannot be altered or deleted once added to the blockchain. Blockchain's immutability ensures data integrity, transparency, and accountability. Moreover, a part of the database could be made public for consumers to scan

the identifier on the honey label and easily reach relevant data, e.g. its origin and relevant laboratory test results. This would significantly boost consumer confidence and traceability assurance.

c) Strict Administrative Controls

Full documentation (invoices, certificates, transport records) must accompany all intra-EU shipments. TRACES references should be retained for at least five years. Controls must verify that supplier invoices match declared stock records and batch quantities.

EBA recommends integrating current regulatory tools (TRACES, digital beekeepers registries) with modern digital systems. In summary, our proposal includes:

- establishment of Honey Inventory Balance system;
- integration of TRACES data;
- integration with national digital beekeeper registries;
- enforcement of Regulation (EU) 2017/625;
- designation of reference laboratories, responsible for database and pollen atlas of imported honey;
- traceability system also for honey traded within Europe;
- declaration of mixing percentages and batch quantities;
- adoption of digital traceability systems across EU.

To implement traceability requirements effectively and affordably, we propose a blockchain-based traceability system and unique

identification for each batch. Prior to mandatory implementation, the EU should explore regulatory sandboxes to test, refine and standardize these tools.

*Members of the EBA's Scientific Committee
on Safety and Quality of Bee Products*

References

Andreas Thrasyvoulou, Chrysoula Tananaki, Georgios Goras, Emmanuel Karazafiris, Maria Dimou, Vasilis Liolios, Dimitris Kanelis & Sofia Gounari (2018) Legislation of honey criteria and standards, J. Apic. Res. 57:1, 88-96, DOI: 10.1080/00218839.2017.141118



DECISION ON THE ELECTION OF A NEW MEMBER OF THE EBA EXECUTIVE BOARD UNTIL THE END OF THE MANDATE PERIOD OF THE PREVIOUS MEMBER

At the written meeting of the EBA Executive Board held on June 8, 2025., a Decision was made on the election of a new member of the EBA Executive Board until the end of the mandate period of the previous member: Dr. Michael Hardt, veterinarian and bee specialist, member of the Presidium of the German Beekeepers Association.

Since the current member of the Executive Board, Mr. Stefan Spiegl from Germany, has withdrawn, the German Beekeepers' Association has proposed a new candidate,

In accordance with Article 26.4. of the EBA Statute "The Executive Board has the right to make decisions within the

jurisdiction of the assembly between the sessions of two assemblies if circumstances and dictate, all except decisions related to changes to the Statute".

We congratulate the new member of the EBA Executive Board and wish him all the best in his future work.



THE SCIENTIFIC YOUTH COMMITTEE OF THE EBA

The Scientific Youth Committee was founded as one of the EBA's working groups. Our aim is to improve the work with youth all over Europe. For this objective we have different approaches which will show in our future work. But first we want to introduce ourselves.



Jiří Píza lives in Prague, Czechia, and works in the food industry. He has been a beekeeper since childhood, member of the Czech Beekeepers' Associations (ČSV) for over 30 years, worked in the ČSV in various positions from the local to the national level and for 20 years as a member of the commission for work with beekeeping youth. He is also a beekeeping teacher and lecturer.

Jiří is the founder and the president of the International Centre for Young Beekeepers (ICYB),

a non-profit organization, which established and is coordinating the International Meeting of Young Beekeepers (IMYB), which, since 2010, has brought together more than 1,000 teenage beekeepers from 48 countries. IMYB is the world's largest gathering of young beekeepers and serves as a unique platform for the best young beekeepers in the world to meet and compete.

Jiří would like young beekeepers to apply the experience gained at IMYB in their own countries, to set up beekeeping clubs and to excite young people about beekeeping.



Mart Kullamaa is a civil engineer from Estonia who got addicted to bees. He has been a beekeeper for 25 years now and still counting. This also is his main occupation.

His motivation is fired by the feeling of being still young and the realization that there are

younger generations we have to take care of. For this reason, he believes having to give forward our knowledge to help them obtaining a better world.

Kristina Dolinar Paulič is a veterinarian from Pohorje where she lives on an organic farm and is keeping her bees. In her profession as a veterinarian, she is teaching at the Biotechnical School in Maribor. Her subjects are part of the professional veterinarian programme.

In addition to that she is leading the elective subject of beekeeping and a beekeeping club, as well as being responsible for the bee hives of three different schools. Therefore she works with different frame and hive types as there are LR, 2/3 L, Kirar and the traditional Slovenian AŽ hive.

With her students she attends different beekeeping events like Altermed, ApiSlovenije and Agra and represent beekeeping, apitherapy and their bee products there.

There's another main part of her work with students and youth beekeepers as she is leading different ERASMUS+ programmes around the importance of bees and beekeeping, for example in 2022 "Bees give us Food and Health".

But it doesn't end with high school students but she's organizing workshops for primary school students and kindergarten children.

Kristina was also part of the organizing team of the 44th National Competition of Slovenia in Maribor as well as the 12th IMYB in Stična.

»Working with bees is a true passion, and I find great joy in sharing my knowledge and enthusiasm with the younger generation.«



Meral Kekeçoğlu has a PhD degree in biology and is a professor at the University of Düzce in the field of biology. She started beekeeping in 2004 whilst and because of starting the studies for her PhD thesis.

Her experience in working with children and youth beekeepers is based on many different workshops for preschool and high school students held by herself. In addition to that she is part of the organizing team of a beekeeping camp for youth beekeepers. Therefore her favourite part is seeing the excitement and curiosity of the children when looking into a beehive and onto the frames with them.

Her wish and vision is to fascinate children and youth for bees in all their appearances and the world of the bees.

And make them aware of the importance of (honey) bees for sustainable agriculture and the whole environment.





Slobodan Dolasević is a professional beekeeper, working in large scales for over 10 years now, from Belgrade, the capital city of Serbia. He is working at the Institute of Animal Husbandry, and he also owns his own company “Golden Bee doo” which is specialised in queen bee rearing and breeding.

He is having different classes at kindergartens and schools where he works with children from all different stages of age. In addition to that he provides a project about solitary bees that includes young people, too.

Slobodan takes his motivation from seeing the energy children and youth invest in those projects and likes to push their interest. “Youth is stronger and more powerful than the old generation!”

For the future he wishes to realise tours for young beekeepers at his Institute and apiary.

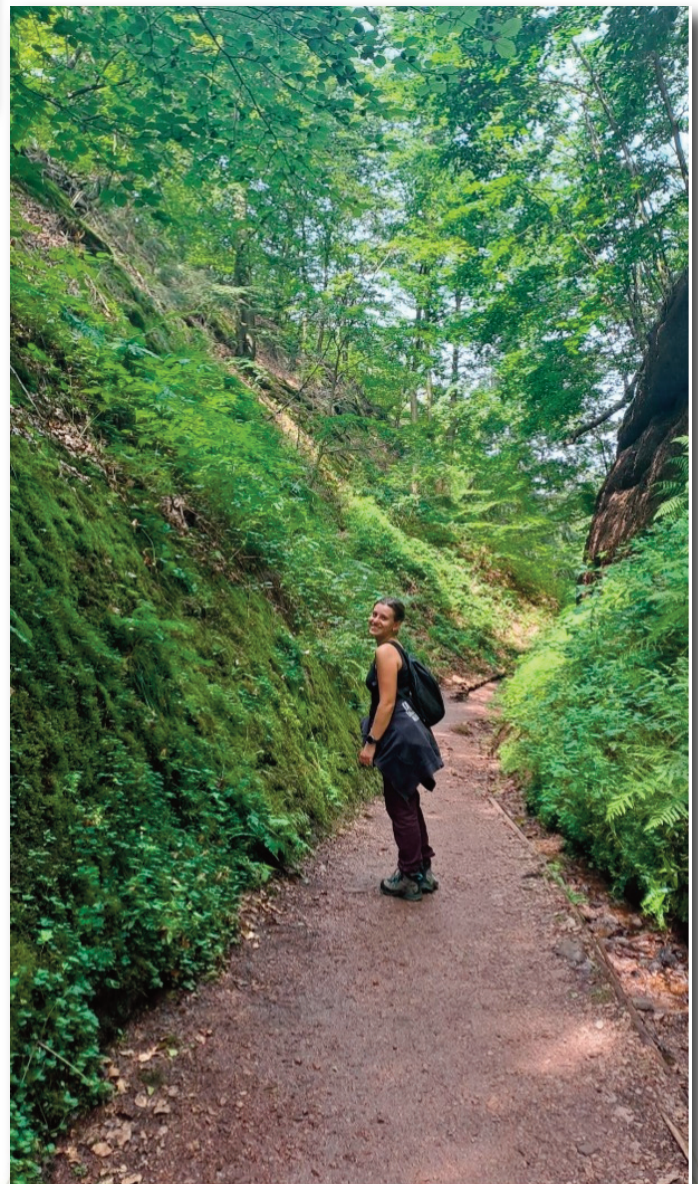
Juliane Kreuzhuber is a student from Passau in Lower Bavaria, Germany. She is studying to become a high school teacher where her subjects are biology and chemistry.

She started beekeeping at 10 years at her high school’s beekeeping club. During this time, she came in contact with different types of bee-

keeping and teaching these to the younger ones which has also sparked the flame for her teaching profession. As a student she competed in the IMYB and later participated as a facilitator. In preparation for this she took part in educational programmes for facilitators.

During her school time she already helped leading the beekeeping club and is now a member of the ICYB where she is part of the competition crew. In this beekeeping club she holds different lessons for children from different ages about common and special topics around the honey bees and their solitary relatives.

“I love to see the spark jump over and the kids losing their fear while drones on their bare hands. Also their fascination as they realise there’s an order behind this chaos is great motivation to move on”.



WHEN THE HIVE IS INNOCENT

THE LEGAL TRAP OF DRUG RESIDUES IN HONEY

Introduction

Regulatory gaps in the EU extend beyond honey legislation to several other areas related to beekeeping. One such area of concern is the contamination of hive products by residues from plant protection products (pesticides, herbicides, fungicides) and veterinary drugs. However, there is a critical legal distinction between these two types of substances.

For plant protection products, European legislation sets Maximum Residue Limits (MRLs), which provide a safeguard for producers in cases of unintentional contamination. In contrast, for veterinary drug residues, no MRLs are established for honey. Any detectable concentration is considered unacceptable and presumed hazardous to human health, regardless of how low it is.

This article presents a real case of a Greek beekeeper whose honey was found to contain trace amounts of a sulfonamide antibiotic, even though he had never used veterinary drugs in his hives. He found himself in a desperate position, unable to convince authorities of his innocence, and risked severe reputational and economic damage.

The purpose of this article is twofold: first, to shed light on this unjust situation and support

producers who may find themselves in similar circumstances; and second, to highlight the urgent need for more nuanced and scientifically based European legislation that protects beekeepers from being unfairly penalized when they are not at fault.

Unacceptable Sulfonamide Residues in Honey

Unlike other animal-derived food products, no MRLs have been established for antibiotics in honey (Table 1). The reason is economic: honey represents a small market for pharmaceutical companies, which therefore have little incentive to fund the studies needed to submit MRL dossiers to the European Medicines Agency (EMA).

Table 1:

MRLs for antibiotics in animal products ($\mu\text{g/kg}$), per Reg. 37/2010

A Case Study

In this case, honey tested by a Veterinary Control Laboratory was found to contain $11.30 \mu\text{g/kg}$ of sulfonamide residues, exceeding the laboratory's decision limit (CC α) of $3.40 \mu\text{g/kg}$.

Animal Products	Sulphonamides ^c	Streptomycin	Tetracycline
Milk	100	200	100
Meat-Fish*	100	500-1000	100-600
Egg	-	-	200
Honey	-	-	-

Table 1: MRLs in animal products ($\mu\text{g/kg}$) according to Reg. 37/20010

The method was officially accredited and validated.

As per Regulation (EC) No 396/2005, when no specific MRL is established (for either plant or animal products), a default limit of $10 \mu\text{g/kg}$ applies—but only for pesticides, not for veterinary drugs, where zero tolerance is the rule. The Polish National Monitoring Program acknowledges this legislative gap and applies a more reasonable quantification threshold of $50 \mu\text{g/kg}$ for honey (Szczeńska et al. 2009).

Furthermore, DG SANTE (European Commission's Directorate-General for Health and

Food Safety) has clarified that laboratories accredited under ISO/IEC 17025 must include measurement uncertainty (U) when reporting results—especially in borderline cases (SANTE/11312/2021). A result should be expressed as $X \pm U$, where U is typically 50% of the measured value.

So, for a residue of $11.30 \mu\text{g/kg}$, the result becomes $11.30-5.65 \mu\text{g/kg}$, and under pesticide rules of Reg. No 396/2005, it could be interpreted as within acceptable limits ($<10 \mu\text{g/kg}$). Yet, for veterinary residues, uncertainty is not considered, and any detection above CC α results in

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the product being declared unsafe, destroyed, and flagged as dangerous to human health.

Risk Assessment of the Residue

The Veterinary Service concluded that the honey was harmful to health. But is this scientifically justified? Exceeding MRLs in food is an indication of improper or illegal treatment or environmental contamination but this does not necessarily mean the food poses a risk to public health.

According to Regulation (EC) No 470/2009, Article 6.1, the risk assessment of residues must consider the metabolism and depletion of the substance, the types and quantities of residues, the acceptable daily intake (ADI) over a lifetime. Similarly, Regulation (EC) No 178/2002, Article 14.4, requires consideration of immediate, short-term, long-term, and cumulative effects on human health.

The European Medicines Agency (EMA) and the FAO/WHO scientific committees have set an ADI of 0–50 $\mu\text{g/kg}$ body weight/day for total sulfonamides. This is based on the No Observed Effect Level (NOEL) of 5 mg/kg body weight.

For example, an adult weighing 60 kg could safely consume $60 \times 50 = 3000 \mu\text{g}$ of sulfona-

mides per day. According to Regulation (EU) 2018/782, the assumed daily intake for honey is 20 g. Therefore, a person consuming 20 g of honey with 11.3 $\mu\text{g/kg}$ sulfonamide would ingest only 0.23 $\mu\text{g/day}$. This represents 0.0077% of the ADI and 0.000046% of the NOEL.

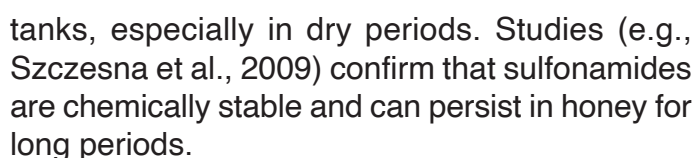
These are negligible amounts, especially compared to milk or meat, which are consumed in far greater quantities and legally tolerate up to 100 $\mu\text{g/kg}$.

Possible Sources of Contamination

Regulation (EC) No 178/2002 also requires that the source of contamination be identified during food safety assessments. The official report attributed the residue to illegal veterinary drug use. However, the beekeeper consistently denied such use, and the following scientifically supported scenarios point to secondary environmental contamination:

a) **Contamination from livestock farms:** Sulfonamides are used legally in sheep and goat farming for diseases like enteritis and respiratory infections. These drugs are commonly administered in drinking water or feed. Bees foraging near such farms may collect contaminated water or feed particles. They also access open water





b) **Contamination from herbicides:** A study by Bogdanov and Edder (2005) detected sulfonamide residues in honey from hives located 1 km away from areas treated with Asulam, a herbicide. Similarly, Kaufmann & Kaenzig (2004) confirmed contamination from herbicides.

In Greece, the herbicide Florasulam is approved. Its chemical name includes the sulfonamide functional group and degrades into sulfonamide metabolites, which are environmentally stable and may be absorbed by bee plants, ultimately ending up in honey.

c) **Low concentrations inconsistent with direct hive treatment:** Illegal use of antibiotics typically results in much higher residue levels, often in the mg/kg range (Dluhosova et al., 2018; Szczesna et al., 2009). A level of 11.3 $\mu\text{g/kg}$ strongly suggests environmental exposure, not hive application.

Exceeding a laboratory limit does not imply a health risk. The concentration of sulfonamides (11.30 µg/kg) detected in the honey, although exceeding the decision limit of 3.40 set by the accredited laboratory, is significantly lower than the

MRLs applicable to other animal products (100 µg/kg) and well below Acceptable Daily Intake for humans. According to current European and national legislation, health risk assessment is based on toxicological evaluation (e.g., NOEL, ADI) and not merely on exceeding a laboratory threshold. Therefore, this particular batch of honey cannot be considered hazardous to consumer health.

The presence does not necessarily indicate illegal use by the beekeeper. The producer's claim that no antibiotic treatment was administered to the bees is supported by the scientifically documented possibility of secondary contamination, primarily from bees accessing contaminated water or feed near livestock farms, which were abundant in the area.

Need to revise European legislation. This case highlights the need to revise European



legislation on residue assessment in honey. The separate regulatory framework that sets zero tolerance for veterinary drugs but allows flexible limits for pesticides—at concentrations that pose no risk to human health—leads to unfair treatment of producers and the destruction of safe food products.

A suitable risk assessment framework, as described in Regulation (EC) 470/2009 and the guidelines of the EMA, EFSA, and FAO/WHO, should be applied. Additionally, the principles of Regulation (EC) 396/2005, which allow a default level of 10 µg/kg for non-regulated pesticide residues, should also apply to veterinary drugs. Strict adherence to the laboratory decision without assessing risk leads to the arbitrary rejection of honey that is completely safe.

Determining the source of honey contamination. The competent control authority should investigate whether the presence of residues in honey constitutes evidence of illegal treatment or an accidental and unintentional source of contamination. In cases of low concentrations, the control authority should examine whether there is substantiated evidence of fraud or intent, in accordance with EU Regulation 625/2017. The absence of such evidence, combined with proven environmental sources of contamination, should lead to the exoneration of the beekeeper and the issuance of a simple non-compliance notice, not the assignment of blame.

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Legislation

- Regulation (EC) No 178/2002: Lays down the general principles and requirements of food law, establishes the European Food Safety Authority, and sets procedures in matters of food safety.
- Regulation (EU) 2017/625: Relates to official controls to ensure the application of food and feed law, and rules on animal health and welfare, plant health, and plant protection products.
- Regulation (EU) 2018/782: Establishes the methodological principles for risk assessment and recommendations for risk management under Regulation (EC) No 470/2009.
- Regulation (EC) No 396/2005: Concerns maximum residue levels of pesticides in or on food and feed of plant and animal origin, and amends Council Directive 91/414/EEC.
- Regulation (EC) No 470/2009: Establishes Community procedures for setting maximum residue limits of pharmacologically active substances in foodstuffs of animal origin.
- Law 4235/11-02-2014 (G.G. A' 32/11-02-2014): Pertains to administrative measures, procedures, and sanctions for the implementation of EU and national legislation on food, feed, and animal health and welfare, under the jurisdiction of the Ministry of Rural Development and Food.
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TEMPORAL INCREASE OF VARROA MITES IN TRAP FRAMES USED FOR DRONE BROOD REMOVAL DURING THE HONEY BEE SEASON



Abstract

Varroa mites are highly attracted to drone brood of honey bees (*Apis mellifera*), as it increases their chance of successful reproduction. Therefore, drone brood removal with trap frames is common practice among beekeepers in Europe and part of sustainable varroa control. However, it is considered labour-intensive, and there are doubts about the effectiveness of this measure. At present, it is mostly unknown how many mites a drone frame can carry at different times of the season, and how many mites can be removed on average if this measure is performed frequently. Therefore, we sampled a total of 262 drone frames with varying proportion of capped cells (5–100%) from 18 different apiaries. Mites were washed out from brood collected from mid-April to mid-July based on a standard method to obtain comparable results. We found that a drone frame carried a median of 71.5 mites, and with the removal of four trap frames, about 286 mites can be removed per colony and season. In addition, mite counts were significantly higher in June and July than in April and May (Tukey-HSD, $P < 0.05$). The number of mites and the proportion of capped cells, however, were not correlated ($R^2 < 0.01$, $P < 0.05$). Our results suggest that drone brood removal is effective in reducing Varroa destructor numbers in colonies, supporting the findings of previous studies on the efficacy of this measure. Although mite counts varied, we believe that increasing sample size over different seasons and locations could elucidate infestation patterns in drone brood and ultimately improve drone brood removal as an integrated pest management tool for a wider audience of beekeepers.

Varroa destructor

More than 70% of Varroa destructor mites are found in capped cells of bee brood when brood is present in *Apis mellifera* colonies (Frey & Rosenkranz, 2014). Drone brood is 6–11 times more likely to be infested with mites than worker brood for probably several reasons (Beetsma et al., 1999; Fuchs, 1990); (i) drone development takes 2 days longer, giving mites more time to reproduce (Boot et al., 1995); (ii) drone brood is two

to three times more likely to be frequented by nurse bees that may carry phoretic mites (Calderone & Kuenen, 2003); (iii) the pre-capping period during which drone brood is attractive to mites is two to three times longer than for worker brood (Boot et al., 1992); and (iiii) longer and increased production of kairomones by drone larvae, which make them attractive to mites (Trouiller et al., 1992).

Considering all the reasons above makes drone brood removal (DBR) an effective tool for controlling varroa mites when integrated as a pest management measure (Evans et al., 2016; Whitehead, 2017). Good results can be achieved when 4 to 5 fully capped trap frames are removed per season (Charrière et al., 2003). It is worth noting that DBR is mainly used by small-scale beekeepers in Europe and is considered labour-intensive or not effective enough as a single treatment elsewhere (Evans et al., 2016; Whitehead, 2017). There is also a risk of rapid varroa spread if trap frames are not harvested in time (Jack & Ellis, 2021).

When done properly, the effectiveness of DBR is demonstrated by the fact that the number of mites during colony development in spring and early summer was significantly lower than in untreated colonies (Wantuch & Tarpy, 2009). Final infestation rates of colonies after late summer treatments were also substantially lower than in colonies where DBR was not performed (Calderone, 2005; Charrière et al., 2003). However, to date, there are few data on how many mites a single drone frame can actually carry. Furthermore, it is unknown whether there is a difference in infestation levels over time and to what extent the proportion of capping (i.e. the number of capped drone cells in relation to all drone cells) may influence DBR success. The latter could play a role in practice, since beekeepers may simply have removed the trap frame too early if they do not find the method sufficiently effective. There is also general doubt among beekeepers if this method removes mites at all (Whitehead, 2017).

The aim of this study was, therefore, to determine the number of mites in individual drone frames over the course of a bee season. In addition, we assessed whether there was a correlation between the number of mites and the proportion of capped cells.

2 MATERIALS AND METHODS

2.1 Experimental field sites and colonies

The field sites with apiaries ($n = 18$) were all located in the state of Baden- Württemberg in southern Germany. Apiaries were sampled unevenly due to logistical reasons (1– 3 times). Some drone frames were collected only once, others multiple times from these locations. The total number of honey bee colonies (*A. m. carnica*) sampled was $n = 63$. These colonies belonged to the stock of the Apicultural State Institute and were kept according to good bee-keeping practice. This included varroa treatment with 85% formic acid twice in the previous season (August and September) and winter treatment with 3.5% oxalic acid in November/December, the last treatment before drone frames were sampled. Colonies were housed in Hohenheim standard hives with 10 Zander frames per box. A hive consisted of two boxes for brood and up to two boxes for honey, separated by the use of a queen excluder. One empty frame without foundation was placed next to the brood nest, either as frame no. 2 or 9 in the upper brood box. Bees and brood showed no clinical signs of disease upon inspection throughout the sampling period.

2.2 Data collection

Whole drone frames ($n = 262$) were collected from mid- April (18 Apr) to mid- July (15 Jul) of the 2011 season. We applied a brood washing method similar to that of Dietemann et al. (2013), chapter 3.1.4.2.2. In brief, the entire brood was uncapped with a sharp knife, and the comb parts were rinsed through a first sieve (5 mm mesh) with a hand shower until all the cell contents were removed. Subsequently, empty comb parts were washed again, and cell caps that were removed and washed separately, as mites can hide under them. All mites were then collected in a second sieve (0.5 mm mesh) and dried on tissue paper. They were counted with the help of a counting grid and a hand counter. Prior to washing, the area of capped cells of each drone frame was

measured in 10×10 cm squares, which were then converted to percentage using the Liebefeld method (Imdorf et al., 1987). One Zander frame fits exactly 8.1 dm² or eight Liebefeld units per side and thus a total of 8×230 (1840) drone cells (Aumeier, 2017; Imdorf & Gerig, 1999).

2.3 Statistical analysis

We fitted a negative- binomial mixed model (estimated using ML and nlminb optimizer) to predict mites with month and location (formula: mites ~ month + location). The model included the proportion of the frame with capped cells as a random effect (formula: ~1|capped_perc). The model's explanatory power related to the fixed effects alone (marginal R²) was 0.65. To compare groups pairwise, estimated marginal means were calculated and adjusted by the Tukey- HSD method for multiple comparisons for the response variable month (= adjusted means). In addition, linear regression was performed to identify whether the number of mites per frame, and the proportion of capped cells were correlated (formula: mites ~ capped_perc).

All analyses were performed in R v.4.1.2 (R Core Team, 2021). A significance level of $\alpha = 0.05$ was used for all tests, respectively.

3 RESULTS

3.1 Varroa mite count

The model's intercept was at 3.94 (95% CI [3.07, 4.81], $P < 0.001$). To illustrate the effect size, the estimated marginal means ($\pm$ CL) are shown in Figure 1. The number of mites per drone frame increased each month, as indicated by the higher mean values.

The increases from April to June, April to July, May to Jun and May to July were significant (Figure 1, Tukey- HSD, $P < 0.05$). Across all samples, a single frame carried a median of 71.5 mites (Mean = 208.49, SD = 344.21, Skewness = 3.31, Figure S2).

The number of mites per frame across all 18 apiaries was significantly different (Tukey- HSD, $P < 0.05$), as was the number of drone frames removed (Figure S1). Overall, there were only six samples with 0 mites (2.3%) and 40 samples with



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<10 mites (15.3%) (Figure S2). Note that all data points above 200 are shown in Figure S2 only.

3.2 Proportion of capped cells

For linear regression, 12 data points were excluded from the analysis because their capping status was not recorded. Therefore, only $n = 250$ data points were analysed. With $R^2 < 0.01$, no correlation was found between the number of mites and the proportion of capped cells (Figure 2). On average, the proportion of capped cells was 63% across all samples, with the majority above 50% ($n = 210$ samples or 84%, Figure S3).

4 DISCUSSION

It is known that drone brood attracts varroa mites on average eight times more than worker

brood and is, therefore, an effective means of controlling this pest when removed (Charrière et al., 2003). Due to limited data, it is currently unclear how many mites are removed by a single frame and at what status drone cells were cut. Understanding how a temporal progression can alter drone brood infestation could provide insight into the effectiveness of this measure and further improve it. In this study, therefore, we evaluated drone frames taken from 18 apiaries over an entire season to determine mite counts and infestation patterns that have not been reported anywhere before. We found a significant increase in mites over time, consistent with mite development in the entire colony (Wantuch & Tarpy, 2009). Less than 3% of our samples contained no mites at all and only ~15% contained <10 mites, demonstrating the effectiveness of this method. Assuming that DBR was performed four times per season and colony, an average of 834

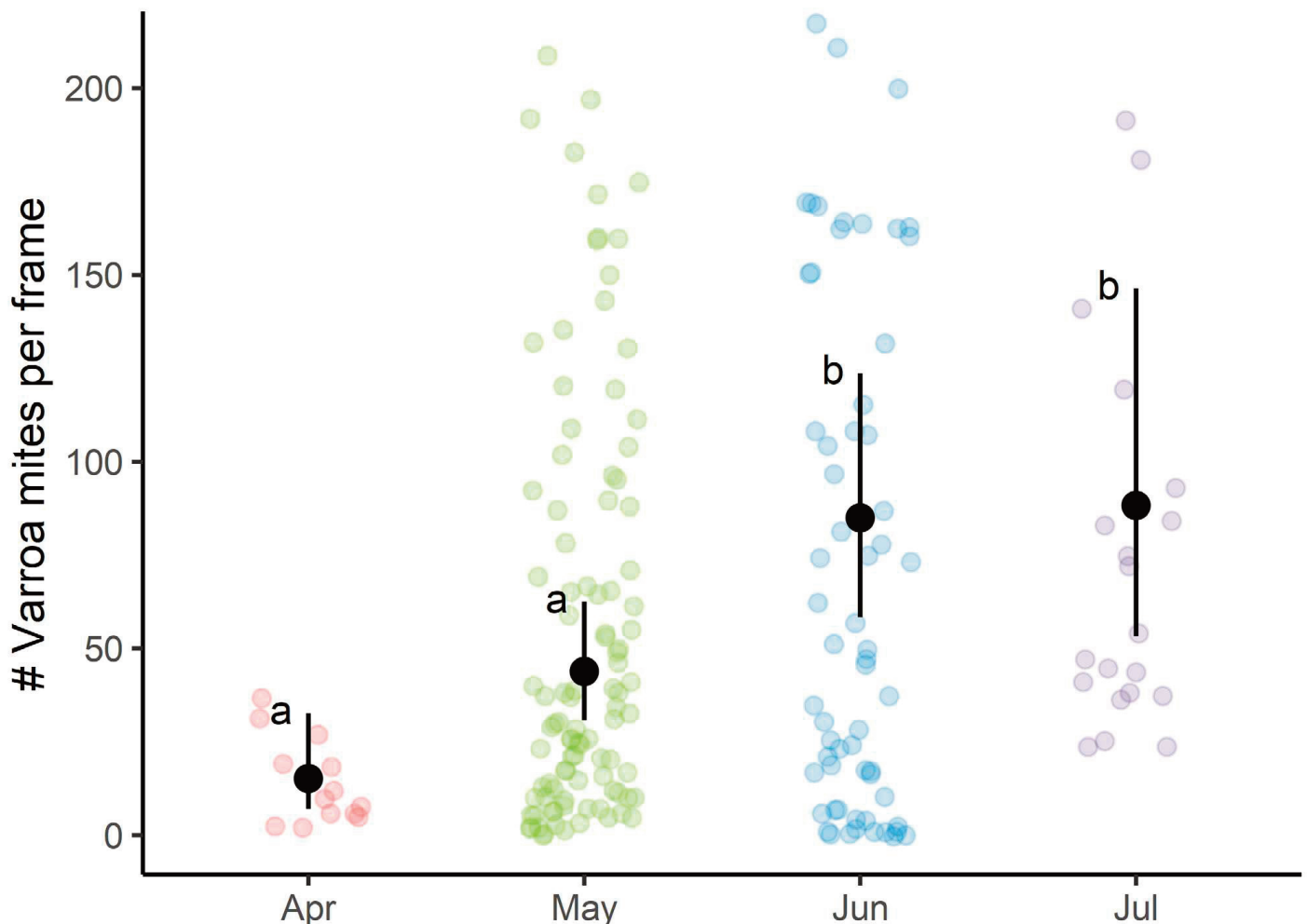


FIGURE 1: Number of varroa mites per drone frame. Black dots and error bars indicate the adjusted means ($\pm$ CL) of mites per drone frame. Means that follow a common letter are not significantly different (Tukey- HSD, $P > 0.05$). Note that all values above 200 mites are not shown in this graph but are available in Figure S2

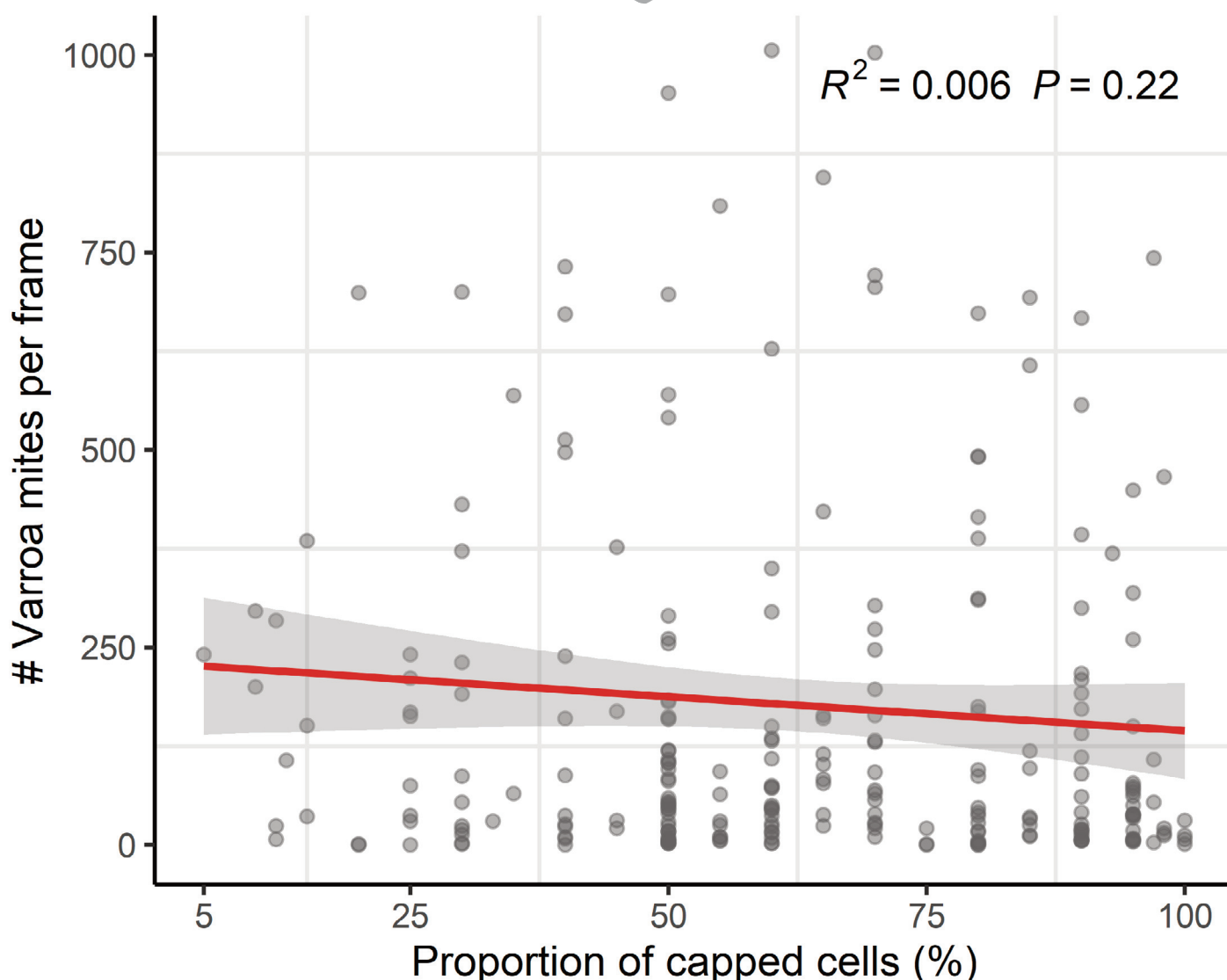


FIGURE 2: Scatterplot of capped cell proportion (x- axis) versus varroa mite number per frame (y- axis) including 250 valid data points. Linear regression for mite count and proportion of capped cells was not significant ($P = 0.22$)

mites could be removed (mean). This agrees with the results of Charrière et al. (2003), who removed 788 mites under similar conditions. It is important to note that our data are left- skewed, which requires a cautious interpretation of mean values. A more reasonable interpretation, in this case, is provided by the median of 71.5 mites per drone frame (von Hippel, 2005). Removing four trap frames during the season, therefore, yields a more realistic estimate of 286 mites removed (median).

Furthermore, the proportion of capped cells of the drone frame did not affect the mite count. When the frames were evaluated, an average of 63% of the cells were capped. This indicates that all open cells containing larvae were in an appro-

priate condition to be infested (i.e. <60 h before capping) (Calderone & Kuenen, 2003; Frey et al., 2013). In practical terms, this means that DBR does not require fully capped frames to be effective. Thus, frames could be removed earlier to minimize removal intervals and maximize removal frequency to extract more mites. Likewise, Licek et al. (2004) suggest overwintering colonies with drawn trap frames to promote drone rearing in the early season and extend the removal period. Some beekeeping magazines also recommend using two trap frames and collecting them in alternating order to maximize mite extraction (Bienen & Natur, 2022).

Since we have only presented a small data set on this subject, a better insight into the infes-

tation pattern of drone brood and ultimately an increase in the effectiveness of DBR could be the result if studied in more detail. This is why we encourage data collection from different countries to enable future region- specific recommendations for DBR as an integrated pest management measure in beekeeping.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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MEDICAL-GRADE HONEY

ITS DEFINITION

AND REFINED STANDARDS

Abstract

The surge in the use of honey in modern medicine, driven by concerns over escalating antibiotic resistance, places an unprecedented emphasis on the need for medically safe and effective honey. In response, the term ‘medical-grade honey’ (MGH) emerged, accompanied by stringent criteria. However, the evolving landscape of honey authenticity challenges and new medical device regulations demand a comprehensive revision of MGH criteria and a refined definition. This article provides a clear definition of MGH and refines its standards. MGH must be: organically produced; undergo gamma sterilisation; adhere to clinical safety benchmarks; meet production standards; and meet specific physico-chemical criteria, affirming its suitability for medical use. Furthermore, the authors advocate for proven biological activity in MGH, including antimicrobial and antioxidant properties, vital for medical efficacy. This paper also sheds light on significant regulatory shifts introduced by the European Union’s Medical Device Regulation, enhancing device safety while demanding increased investment in terms of cost and effort. In summary, the presented refined guidelines ensure secure, effective honey use in medical contexts, reaffirming MGH’s role in modern healthcare. Declaration of interest: LJFP and NAJC are employed by Triticum Exploitatie bv,

the Netherlands, the manufacturer of L-Mesitran (a MGH-based wound care product). Other authors state no conflict of interest. JM is partially supported by the Slovak Research and Development Agency (under Contract No. APVV-21-0262) and the Scientific Grant Agency of the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences (VEGA 2/0022/22). FADTGW is supported in part by grants from the Swiss Osteology Foundation (19-054), and Dr Vaillant Foundation. FO is partially supported by the ‘From Learning to Leading: Cultivating the Next Generation of Diverse Food and Agriculture Professionals Program’ (NextGen) program of the U.S. Department of Agriculture, National Institute of Food and Agriculture (Award No 2023-70440-40142).

Honey

Honey has been considered a traditional medicine for a wide range of indications because of its healing properties, such as antimicrobial, antioxidant and anti-inflammatory activities.¹ With the discovery and development of antibiotics, the use of honey for medical purposes declined; however, with the emergence of antimicrobial resistance (AMR) to some antibiotics, the use of honey has seen a resurgence.² AMR is currently a growing problem worldwide; the World Health Organization (WHO) declared AMR as one of the



top¹⁰ global public health threats facing humanity.³ The absence of recorded AMR to honey has propelled its adoption in modern healthcare. While honey has gained renown primarily for its efficacy in wound care, its potential extends to a diverse array of medical disciplines. These encompass: upper respiratory tract infections; dental diseases; mucositis; ophthalmology; gastrointestinal diseases; diabetes management; alleviation of the side-effects of cancer treatments; and various other non-conventional applications.^{4–8}

Over the past three decades, there has been a steady increase in the number of scientific publications about the use of honey in the medical field. A publication in the *Lancet* from 1993 by Postmes et al.⁹ was the first to propose higher quality standards for honey intended for medical use. The authors proposed that honey intended for medical purposes should be sterile because it may contain dangerous endospores that could lead to wound botulism or gangrene.⁹ In addition, it was highlighted that the variability within batches of honey may be an important factor influencing the results of clinical trials.⁹ Since 1993,

there have been multiple cases in which honey has caused botulism and other complications.^{10,11} In a case report where so-called ‘medicated honey’ was used, it was suspected to have caused wound botulism in an infant.¹² For this reason, it is important to ensure the safety of honey for medical applications.

In addition, the biological activity of honey used for clinical purposes is important.¹³ Differences between clinical studies—for example, as experienced in trials investigating mucositis and upper respiratory tract infections^{4,6}—may be explained by differences in the type of honey used. Due to the variability of honey among different types and geographical origins, and the impact of these variabilities on the outcomes of trials, standardisation of honey can contribute to more effective products. A plethora of wound care studies tested natural pure honey as an alternative wound treatment, with limited or no qualitative characteristics and unknown antibacterial, anti-biofilm, or anti-inflammatory potential.¹⁴ In the absence of essential information about the honey used in clinical trials, it is difficult to draw a conclusion about its clinical efficacy. Therefore, only



demand worldwide.¹⁹ In 2021, the European Commission (EC) organised the ‘From the Hives’ initiative to test whether honey on the market would comply with the standards set in its Directive 110/2001.¹⁹ A striking 46% of imported honey was found to contain sugar syrup which was added to lower the cost.²⁰ This finding underlines the need for careful selection of honey and the setting of strict criteria for what can be termed MGH. Furthermore, the European Union (EU) medical device regulations²¹ have been updated, which has consequences for existing and new wound care products using MGH in their formulations. Therefore, there is a pressing need to update the definition of the MGH and the criteria with which it needs to comply. In this article, the new criteria and regulations of the EU are described, as well as MGH wound care products currently on the market and the problem of honey fraud.

Defining medical-grade honey

The Food and Agriculture Organization of the United Nations (FAO) and WHO provided the following definition of honey in the Codex Alimentarius (adopted in 1981; revised in 1987 and 2001; amended in 2019):

Honey is the natural sweet substance produced by honey bees from the nectar of plants or from secretions of living parts of plants or excretions of plant-sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in the honeycomb to ripen and mature.¹⁹

In the natural production of honey, honeybees play a vital role in transforming nectar or honeydew into honey. This intricate process involves several key steps. Honeybees add enzymes and organic acids—often originating from various *Lactobacilli* species within their crops—to the nectar or honeydew. This enzymatic action effectively converts the sucrose present in the source material into glucose and fructose. The transformation of nectar into honey is a communal effort among the honeybees. As many as 200 bees participate in this process through a remarkable practice known as trophallaxis. They pass the nectar among themselves,

‘medical-grade honey’ (MGH), or fully characterised and sterile natural honey should be used in clinical studies.

Furthermore, using honey directly from beekeepers or supermarkets is not advised, as these types of honey may not be extensively tested for safety and efficacy. Honey from a beekeeper may potentially be contaminated with environmental pollutants and harmful plant derivatives, while honey in the supermarket may be processed with heat and filtration, thus having lower biological activity potential.^{15–17} Standardised criteria should be met to ensure the quality, safety, efficacy and therapeutic potential of honey. These criteria, along with the term MGH, have been defined by Hermanns et al. in 2019.¹⁸

The growing research focus and general public interest in using MGH and its enhanced variants in wound care and other medical fields highlights the need for an updated definition of MGH; this requires careful consideration of the quality and biological potential of the source of MGH. Increasingly, honey is being adulterated to keep the costs lower and satisfy a high consumer

continuing the enzymatic conversion. After several rounds of trophallaxis, the bees deposit the partially converted nectar into comb cells within the hive. To further concentrate the nectar and reduce its moisture content, the bees engage in wing fanning, which accelerates the evaporation of water from the nectar. This crucial step con-

tinues until the moisture level drops to approximately 16–18%. Once the desired moisture content is achieved, the bees seal the comb cell with wax, effectively preserving the honey until it is ready for consumption. The culmination of these intricate processes results in the creation of natural honey characterised by its thick consistency, low moisture content and high sugar-to-water ratio, making it a delectable and enduring food source for bees, some animals and humans.²²

Honey contains carbohydrates, enzymes, amino acids, vitamins, organic acids, minerals, phytochemicals, and trace elements from the environment.²³ Its composition is intrinsically linked to the geographical region and the type of plants from which bees collect nectar. This variability gives rise to a rich tapestry of honey types, including acacia, eucalyptus, pine, thyme, clover, manuka and buckwheat, among others. Each honey variety possesses a unique profile, potentially harbouring distinct antibacterial, antioxidant and therapeutic properties.^{7,13} However, it is essential to recognise that the safety and efficacy of these honey types can fluctuate. Therefore, the existing knowledge surrounding honey's diverse healing attributes, as well as the identification and characterisation of the specific honey components responsible for these effects, should collectively inform the development of a refined definition for MGH.

To qualify as MGH, strict adherence to rigorous honey collection and production standards is paramount. Fig 1 illustrates the indispensable prerequisites for MGH certification. Furthermore, alignment with medical device standards is of utmost importance. While Hermanns et al.¹⁸ comprehensively outlined the criteria that MGH must meet, a definitive definition of MGH itself remained somewhat elusive. Building upon the established criteria and drawing insights from publications referencing MGH, an enhanced and unequivocal definition of MGH emerges as follows:

'Medical-grade honey serves as an assurance of honey's excellence, as well as its effectiveness and safety when intended for medical applications. Medical-grade honey is a carefully selected, organic honey that undergoes gamma-irradiation to ensure it is free from contaminants and harmful microorganisms. It meets strict production and storage standards, complies with

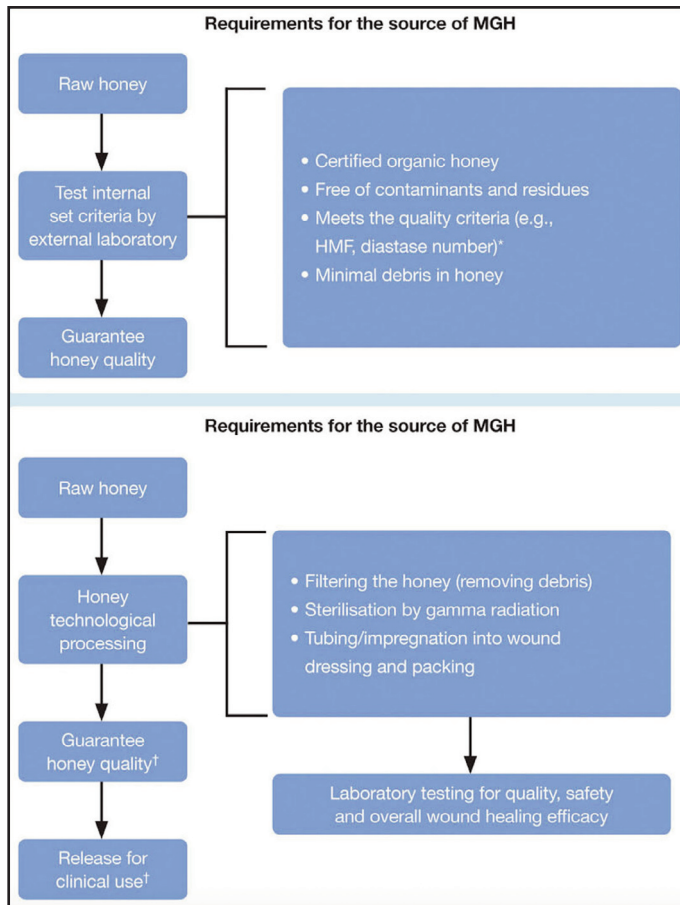


Fig 1. Flow diagram summarising the criteria to which medical-grade honey (MGH) selection and production needs to comply. Both the honey itself and the production of MGH need to adhere to specific criteria to ensure safety and efficacy. External parties should perform inspections to reduce the risks of integrity issues.

*Following quality parameters for honey according to European Union (EU) Honey Directive (110/2001), Codex Alimentarius (CODEX STAN 12-1981), and organic standards (regulations 834/2007 and 2021/1165);

†Following quality regulations, e.g., ISO13485 (production), ISO11137 (sterilization), ISO14971 (risk assessment), Medical Device Regulations (2017/745/EU, 2017/746/EU), Conformité Européenne (CE), US Food and Drug Administration; HMF—5-hydroxymethyl furfuraldehyde

legal and safety regulations, and is compliant with physicochemical criteria. Furthermore, it showcases a noteworthy degree of biological activity, significantly surpassing the typical sugar content's activity.'

When choosing honey for MGH production, prioritising authenticity is critical to guaranteeing its effectiveness in medical applications. Of increasing concern in honey production and processing is the violation of the Codex Standard of 1981 and Directive 110/2001.^{19,24} While honey fraud has a long history, it has now become more prevalent, largely due to current circumstances. These include: a demand which is higher than supply of the pure product; the potential for high profits through fraudulent practices; the emergence of various new methods of honey adulteration; the complex nature of honey testing; and the inadequacy of current detection methods for adulterated honey, i.e., EA-IRMS (AOAC 998.12), which is not able to detect adulteration with C3-type sugars.²⁵

APIMONDIA is the International Federation of Beekeepers' Associations and facilitates information exchange and discussion on matters such as honey fraud. In 2020, APIMONDIA highlighted practices during both honey production and processing that may violate the Codex Standard of 1981 and Directive 110/2001.²⁵ The product that comes from these malpractices is not allowed to be named as 'honey'. All malpractices are summarised in Fig 2.

Different methods are applied to speed up the natural process of honey production by the honeybees (Fig 2, 'Production'). Adulteration of

these processes could occur mainly in two ways, i.e., the harvest of immature honey and the artificial feeding of honey bees. When honey is harvested prematurely, the bees will not have sufficient time to add certain substances of their own, such as diastase or organic acids, to the honey. This will result in honey that is partially produced by the bees while being matured by artificial dehydration. Furthermore, bee colonies are artificially fed using dough-like sugar patties or syrups to further speed up the production of honey.²⁶ However, honey should only be sourced from the nectar of plants, the secretions of the living parts of plants, or the excretions of plant sucking insects on plants.

During honey processing, multiple fraudulent practices can be performed (Fig 2, 'Processing'). As mentioned earlier, honey is commonly adulterated through dilution with various sugar syrups to reduce production costs. In addition, pollen is also being added to the exported honey to disguise the origin of the honey. No additives or substances, whether naturally occurring in honey or not, are allowed. Only raw honey itself is allowed to be blended with honey according to the Codex Standard of 1981 and Directive 110/2001.²⁵ Moreover, the moisture reduction of immature honey with technical devices is also considered a malpractice. The dehydration of honey should exclusively be done by the honeybees and is an integral part of the honey maturation process. Furthermore, the processing of honey that results in a change of composition or quality is considered malpractice. For example, ion-exchange resins are used to remove offensive aromas, residues, and components important for

quality control, such as 5-hydroxymethyl furfuraldehyde (HMF, abnormal levels of HMF may indicate adulteration of the honey, excessive heating or prolonged storage), as well as to lighten the colour of the product. The final practice that occurs in honey fraud is the mislabelling or masking of the origin of the honey. It may only be labelled as coming from a certain geographical area if the honey was exclusively produced within that area, which is officially known as Protected Designation of Origin (PDO). Honey can only be designated to a cer-



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tain geobotanical origin if it mainly comes from that floral source and has specific physicochemical properties that correspond with that floral origin.²⁷

The adulteration of honey resulted in a decline in honey prices, discouraged traditional honey-producing nations from producing and exporting pure honey, and paved the way for new exporting countries to (re-)export counterfeit honey products.²⁵ These repercussions significantly affect beekeepers and tarnish the reputation of the honey industry. The low prices paid to beekeepers are not sustainable, and many might either quit apiculture or reduce their current bee colony counts.²⁵ Furthermore, the reputation of honey as a natural product and its attractiveness to customers may be at risk, ultimately harming honest beekeeping. APIMONDIA has provided recommendations for safeguarding the authenticity of honey.²⁵ These include, but are not limited to, implementing third-party audits during the production season and creating awareness of honey fraud among beekeepers and consumers.²⁵

Honey and production standards

The criteria for MGH encompass several standards, summarised in Fig 3.18 By applying these criteria, safety and efficacy should be ensured.

Criterion 1: Organic and free of contaminants

First and foremost, MGH must be organic, and free of contaminants and toxic substances. Honey harvest and production practices must adhere to strict guidelines to ensure the absence of pollutants and maintain organic integrity. Such practices include limiting the foraging area of bee colonies exclusively to geographical areas that are at least 10 km away from polluted environments and minimising antibiotic treatment of the honeybees to prevent trace amounts contributing to antibiotic resistance.^{28,29} In addition, international food standards, including the CODEX STAN 12-1981, provide guidelines for honey quality.²⁴ Organic standards, such as EC regu-

lations 834/2007 and 2021/1165 in Europe, impose additional requirements to promote ecological balance and conserve biodiversity.³⁰

Systematic laboratory testing is essential to verify MGH's organic origin and confirm its compliance with safety regulations. Specific testing protocols and accredited laboratory certifications ensure that MGH is free from herbicides, pesticides, antibiotics and toxic heavy metals. Moreover, the levels of iron and zinc should be within acceptable ranges.^{31,32} The testing parameters must comply with legal regulations, including EC 1881/2006, 396/2005, 470/2009, and 37/2010. By adhering to these rigorous standards and conducting comprehensive testing, the safety and quality of the MGH can be guaranteed.

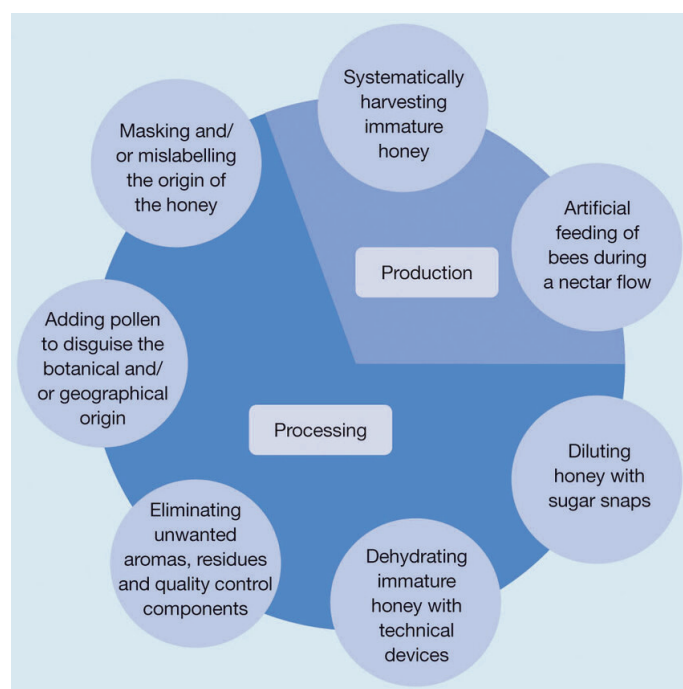


Fig 2. Ways of violating the Codex Standard of 1981 and Directive 110/2001. Adapted from APIMONDIA²⁵

Criterion 2: Sterilisation with gamma irradiation

The second criterion of MGH is the sterilisation of honey using gamma irradiation under standardised conditions to eliminate potentially dangerous microorganisms. Various bacteria, yeasts and fungi may be detected in honey, influencing its quality and safety.^{33,34} Clostridium botulinum, a bacterium found ubiquitously in

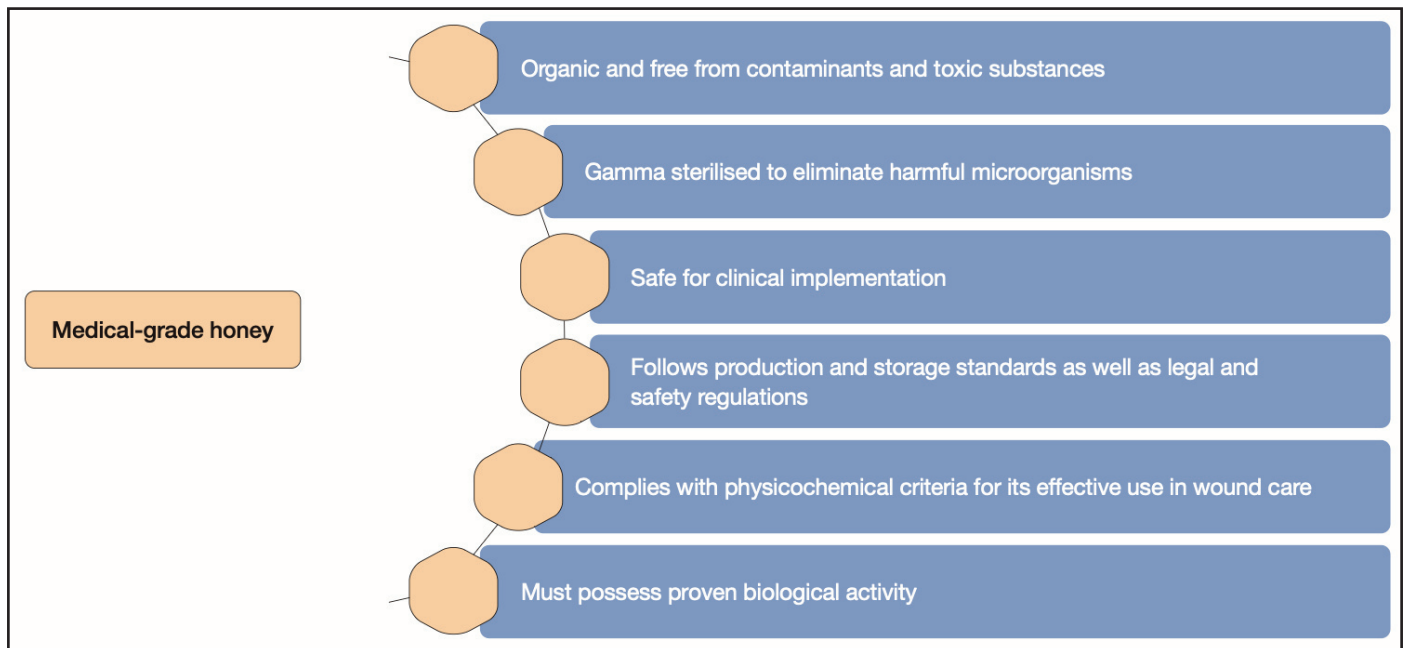


Fig 3. The criteria to which medical-grade honey must adhere

natural products, such as dust and soil, has also been detected in honey samples worldwide, its prevalence ranging from 5–64%.^{35–37} This percentage varies depending on geographical origin and beekeeper procedures (harvesting, processing, packing and storage), and there is a significant correlation with hygienedependent production factors.^{38,39} While harmless to healthy individuals, *Clostridium botulinum* can pose life threatening risks to immune-compromised individuals, particularly infants <12 months of age^{11,12,40–43}

To eliminate the unacceptable risk of botulism and other health issues, MGH must be sterile, and free from bacterial endospores of pathogens, such as *Clostridium botulinum* and *Clostridium tetani*. Sterilisation by heat or extensive heat processing, as applied to supermarket honey, inactivates enzymes and other heat-labile phytochemicals (e.g., flavonoids) that underlie honey's antibacterial effects. Gamma irradiation has been proven to eradicate endospores and all viable bacteria from the honey while preserving its antibacterial and healing properties.^{9,44–46} It is the standard sterilisation procedure for medical devices and food products. International Organization for Standardization (ISO) 11137 provides guidelines for gamma irradiation sterilisation.^{47,48} The irradiation level must be carefully controlled to eliminate endospores while preserving the beneficial properties of honey. Another sterilisa-

tion technique is ozonation, which neutralises bacterial residues and endospores.⁴⁹ However, ozonation has been shown to fail to eradicate all microorganisms and is therefore regarded inferior to gamma irradiation.⁵⁰

Criterion 3: Safe for clinical implementation

The third criterion of MGH is that it must be safe for clinical implementation. The term 'medical-grade honey' is commonly used in scientific publications; however, it is important to note that some studies may not specify the use of sterilised and standardised MGH, leading to confusion. It is crucial to distinguish between properly processed MGH and other forms of honey, especially when discussing adverse events due to the treatment in clinical cases, such as botulism in infants.¹² Once honey is irradiated, it becomes suitable for medical applications and can be referred to as MGH as long as it retains its bioactivity potential.^{45,47} The antibacterial activity of honey varies significantly, depending on the source of the honey, its processing, and storage.^{51,52} Therefore, different types of monofloral and polyfloral honeys are being studied for their wound healing and immunomodulatory properties. Phenolic components in honey, particularly in monofloral varieties, such as acacia, manuka and buck-

wheat, as well as polyfloral jungle honey, such as tualang honey, play a role in its antioxidant and anti-inflammatory activities.^{53–61} Some studies have also shown that acacia, tualang and buckwheat honey have greater effectiveness in terms of their antibacterial properties and wound healing compared to manuka honey.^{56,59,60,62–64}

Criterion 4: Strict production and safety standards

The fourth criterion to qualify as MGH are the strict production and storage standards, as well as the legal and safety regulations. Honey used for consumption must adhere to various food standards, such as the Global Standard for Food Safety and International Food Standard certifications.⁶⁵ However, honey used for medical purposes requires even higher quality standards and proven biological activities.⁹ Additional guidelines and restrictions, such as country-specific organic certifications/regulations may be needed, further ensuring its safety for medical use.⁵² For

example, exposure to extensive heat or light during harvesting, manufacturing, packaging or storage can diminish these beneficial properties. Compliance with standards, such as European Standard-International Organization for Standardisation (EN-ISO) 13485, Medical Device Directive (MDD) 93/42/EEC, 21CFR820, and EN-ISO 14971, is mandatory to classify MGH for wound care as a Class 2b medical device and obtain quality certifications.⁶⁶ Monitoring factors such as HMF concentration can help assess product decay during production, storage and handling. In Directive 110/2001,¹⁹ the EU sets a maximum HMF value of 40 mg/kg, except for Baker's honey and honey of tropical origin, which should not exceed 80mg/kg and may be less suitable for wound care products. It has been discussed elsewhere⁶⁷ whether HMF and diastase activity can be considered dependable indicators of heat exposure in certain honey varieties. For example, subjecting these honeys to rigorous heating conditions (80–120°C) did not lead to values surpassing the permissible levels for these parameters. On the other hand, such thermal conditions are detrimental to the antibacterial activity of honey.

Criterion 5: Compliance with physicochemical criteria

The fifth criterion of MGH is compliance with essential physicochemical criteria necessary for effective use in wound care. These physicochemical criteria encompass various factors including, but not limited to: moisture content; sugar composition; water-insoluble content; diastase activity; electrical conductivity; acidity and HMF content. Over the past two decades, compliance with physicochemical criteria has gained increasing importance as it is needed for issuing honey certificates. Honey is composed of various compounds, including sugars, enzymes, minerals, vitamins, phenolic compounds, and solid particles, such as pollen, that contribute to its antioxidant and antimicrobial properties.^{54–57} Ensuring a specific composition of honey will guarantee that it can deliver the desired antimicrobial, antioxidant and anti-inflammatory effects. Honey must meet specific composition criteria outlined by the EU's Directive 110/2001 (Table 1).¹⁹



Table 1. Composition criteria for honey

Component	General requirement	Exceptions
Fructose and glucose content	Blossom honey: $\geq 60\text{g}/100\text{g}$ Honeydew honey: $\leq 45\text{g}/100\text{g}$	
Sucrose content	$\leq 5\text{g}/100\text{g}$	False acacia, alfalfa, firewood banksia, French honeysuckle, red gum, leatherwood, citrus spp.: $\leq 10\text{g}/100\text{g}$ Lavender, borage: $\leq 15\text{g}/100\text{g}$
Moisture content	$\leq 18\%$	Calluna, erica ($\leq 23\%$)
Water-insoluble content	$\leq 0.1\text{g}/100\text{g}$	Pressed honey: $\leq 0.5\text{g}/100\text{g}$
Electrical conductivity	Blossom honey: $\leq 0.8\text{mS}/\text{cm}$ Honeydew honey: $\leq 0.8\text{mS}/\text{cm}$	Strawberry tree, bell heather, eucalyptus, lime tree, tea tree, ling heather, manuka or jelly bush
Free acid	≤ 50 milliequivalent acid/1000g	
Diastase activity	≥ 8 (Schade scale)	Honey with natural low enzyme (e.g., citrus honey) and HMF content $\leq 15\text{mg}/\text{kg}$: ≥ 3 (Schade scale)
HMF	$\leq 40\text{mg}/\text{kg}$	Fresh and unheated honey: $\leq 15\text{mg}/\text{kg}$ Honeys of tropical origin: $\leq 80\text{mg}/\text{kg}$
HMF—5-hydroxymethyl furfuraldehyde		

Criterion 6: Determination of biological activity

Finally, the biological activity of MGH should be determined to ensure that it exerts a minimum level of activity dependent on its indication of use. For example, the antibacterial activity of honey is currently not included in international honey standards, although necessary for different medical applications. A study by Bucekova et al.⁶⁸ revealed that $>40\%$ of honey bought in supermarkets exerted identical levels of antibacterial activity compared to artificial honey, consisting of sugars dissolved in water. The low antibacterial activity of these honeys could be due to several reasons, including authenticity and the manufacturing process of honey, such as heating and ultra-filtration. As previously mentioned, honeys often have sugar syrup added to lower their price, which also negatively affects their quality and antibacterial effects. The antibacterial activity of honey is usually associated with its osmotic activity and low pH, which inhibit bacterial growth and promote wound repair.^{69,70} Additionally, glucose is converted into gluconic acid via glucose oxidase during which process hydrogen peroxide is produced as a side-product. Hydrogen peroxide has antiseptic and oxygen-releasing prop-

erties.⁷¹ However, several studies showed no consistent correlation between the antibacterial activity and hydrogen peroxide, and demonstrated that other components within honey may also contribute to its antibacterial properties.^{68,72–74} It has been suggested that there are synergistic effects between hydrogen peroxide and certain honey polyphenolic compounds as honey with low hydrogen peroxide content can exhibit high antibacterial potential.⁷⁵ Therefore, measuring the hydrogen peroxide levels in honey would not be sufficient to determine its antibacterial activity. The antibacterial activity of manuka honey (a non-peroxide honey) is correlated with the concentration of methylglyoxal, which is reflected by the Unique Manuka Factor (UMF) grading system. However, the UMF grading system has limitations and may not accurately reflect antibacterial efficacy, as shown by contradicting data.^{69,76} Furthermore, methylglyoxal exerts antimicrobial effects but also reduces peroxide-dependent activity.^{77,78}

The scientific community is increasingly investigating diverse types of honey for their potential as wound healing products, aiming to discover new potential sources of MGH. Establishing criteria for biological activity, including antimicrobial properties, phenol content, and



antioxidative and anti inflammatory action, is crucial for ensuring honey's efficacy in wound healing. Dilution and batch testing may influence the assessment of honey's antimicrobial activity.¹⁸ When this biological activity is extensively tested for each MGH, it may offer new tailor-made therapeutic potential, in which the specific biological activity can be used for particular indications. For example, honey with a strong antimicrobial activity can be used for infected wounds, while honey with a strong regenerative, angiogenic, cytoprotective, antioxidative, and/or antiinflammatory activity can be used, dependent on the phase of wound healing. However, further studies into the molecular mechanisms are needed first.

Medical device regulations

MGH requires a Conformité Européenne (CE) label before it can be marketed in Europe as a medical device product, proving that the device meets the necessary performance and safety requirements. The Medical Devices Directives (MDDs) regulate the safety and marketing of medical devices in the EU. These included three regulations:^{79,80}

- Active Implantable Medical Devices Directive (AIMDD) 90/385/EEC
- MDD 93/42/EEC
- In vitro Diagnostic Medical Devices Directive (IVDMD) 98/79/EC. However, these directives were replaced by two new regulations, launched in 2017 and applied since April 2021:⁸¹
 - Medical Devices Regulation (MDR) 2017/745/EU
 - In vitro Diagnostic Medical Devices Regulation (IVDR) 2017/746/EU.⁸²

New medical devices must comply with the MDR and cannot be introduced to the market without extensive safety data, as mandated by this regulation. This entails a range of assessments, such as chemical characterisation of the product, strict evaluation of safety endpoints, and rigorous collection and scrutiny of extensive clinical data. The level of scrutiny and data requirements may vary depending on the device's classification.

The MDR imposes more stringent regulations compared to the AIMDD and MDD, with the aim of ensuring heightened safety and performance standards for medical devices. Among the notable revisions are the classification and con-

formity requirements, which have been enhanced to bolster the overall safety and efficacy of medical devices. The MDR classifies medical devices into four categories: class I; class IIa; class IIb and class III. The class of medical devices determines the conformity requirements. Devices with higher risk levels, such as class III (which is the highest), undergo more rigorous assessments.⁸² Animal-derived products typically fall into the highest classification category. However, honey is an exception, as it is not classified as an animal-derived product. Instead, the classification of honey depends on its intended application. In the context of wound care, for example, honey is categorised as a class IIb medical device. However, it is important to note that if an MGH product is supplemented with an animal-derived substance, such as collagen, its classification may change from class IIb to a class III medical device. This transition from a lower to a higher class has a substantial impact on the CE marking process, as it can necessitate a different and more rigorous conformity assessment procedure. Indeed, when a device undergoes a classification shift from class IIb to class III, it triggers a significant change in regulatory requirements. Clinical investigations, which were previously optional for class IIb, become mandatory, and the manufacturer's flexibility in selecting conformity assessment routes becomes more restricted. This transition can result in heightened costs and potential delays in (re)certification and may, in some cases, discourage manufacturers from continuing to market devices that do not align with the new and more stringent regulations.⁸²

MGH wound care products

Over the past two decades, there has been a notable increase in the availability of wound care products using MGH. These products vary in composition, with some being composed solely of MGH, while others incorporate supplementary components. Table 2 provides a comprehensive list of the various brands of MGH products available on the global market at the time of writing.

Notably, only four products on the list have received certifications from both the CE and U.S. Food and Drug Administration (FDA). It is worth noting that a majority of FDA-approved products

rely on the use of manuka honey, which has garnered significant attention in honey research. Nevertheless, it is important to recognise that other honey varieties exhibit comparable or even greater biological activity than manuka honey. This highlights the promising potential for exploring alternative honey varieties in various medical applications.^{52,83,84} The price of manuka honey has witnessed a substantial surge in recent years, primarily driven by soaring demand, coupled with adverse weather conditions that have affected honey production, leading to reduced availability. This price escalation is quite pronounced, with the bulk cost of manuka honey surging from a range of \$10.45–60.00 NZD/kg in 2013 to a more considerable range of \$5.00–160.00 NZD/kg in 2022. Notably, the most expensive Manuka honey variants are those boasting the highest UMF levels.⁸⁵ In contrast, for most other types of honey, the bulk price barely changed, e.g., light clover honey cost \$5.00–7.30 NZD/kg in 2013 and \$3.00–7.00 NZD/kg in 2022.⁸⁵

All the MGH wound care products mentioned in Table 2 have undergone gamma irradiation sterilisation, except for one that uses ozonation (Melloxy, SanoMed Manufacturing bv, the Netherlands). While both sterilisation methods effectively preserve the bioactivity of honey, gamma irradiation is widely regarded as the preferred industry standard. The preference for gamma irradiation is primarily due to the fact that ozonation, while effective in reducing the number of microorganisms, does not entirely eliminate them.⁵⁰ Surgihoney (Matoke Holdings, UK) undergoes sterilisation through heat treatment, followed by the addition of a known quantity of glucose oxidase to standardise hydrogen peroxide production. It is important to note that heat processing, while effective for sterilisation, has broader effects on honey. Heat not only inactivates glucose oxidase but also denatures other enzymes present in honey and impacts protein structures. Furthermore, heat processing can diminish the quality of honey by adversely affecting compounds such as HMF.

It is important to acknowledge that securing CE and FDA approvals is a financially demanding process. However, this rigorous regulatory journey provides essential assurance that the bene-

fits of MGH-based wound care products significantly outweigh the associated risks. These products should not only adhere to organic standards but also contain an ample amount of honey to ensure their efficacy. Additionally, some companies may incorporate supplementary ingredients that enhance ease of application and enhance antimicrobial and pro-healing activities. For example, certain products incorporate hypoallergenic medical grade lanolin (CAS 8006-54-0), propylene glycol (CAS 57-55-6), and polyethylene glycol (PEG) 4000 (CAS 25322-68-3) to enhance application properties and reduce temperature sensitivity. When selecting MGH products for wound healing, it is imperative to prioritise safety certifications and sterilisation procedures. The effectiveness of MGH depends on its antimicrobial and pro-healing activities, which vary based on the honey type and formulation composition. MGH formulations with lower honey content supplemented with other compounds, such as vitamins C and E, have been shown to exhibit stronger antibacterial activity and may exert im-

proved wound healing effects compared to non-supplemented MGH.^{7,86,87} However, further research is needed to test the antibiofilm activities of non-supplemented and supplemented MGH.

Honey as complementary therapy

Antibiotic resistance is an escalating global concern that, if left unchecked, is projected to become the primary cause of mortality worldwide by 2050.⁸⁸ Complementary and integrative medicines are frequently underappreciated and underutilised as viable treatment options. This issue was highlighted during the WHO Traditional Medicine Global Summit in 2023.⁸⁹

Complementary medicine could, however, provide a solution to the rise of multidrug-resistant microbial species. Honey stands as a time-honoured traditional medicine with a rich history of use, particularly in wound care, as extensively demonstrated throughout this article. Within this

Table 2. Medical-grade honey (MGH) wound care products available on the global market (at time of writing)

Product name	Manufacturer	Honey type	MGH content, %	Sterilisation method	Certification	Supplements
Activon	Advancis	Manuka	100	Gamma irradiation	FDA and CE	—
L-Mesitran	Triticum	Organic polyfloral	40 and 80	Gamma irradiation	FDA and CE	Vitamins C and E, zinc oxide, essential oils
Manuka FIII	Links Medical Products Inc.	Manuka	100	Gamma irradiation	FDA and CE	—
Manuka Health Wound Gel	Ectomed	Manuka	100	Gamma irradiation	CE	—
Medihoney	Derma Sciences	Manuka	80	Gamma irradiation	FDA and CE	—
Melectis	Melipharm	Mix of monoflorals	100	Gamma irradiation	CE	—
Melladerm Plus	SanoMed Manufacturing bv	Polyfloral	45	Ozonation	CE	Vitamins C and E, glucose oxidase
Melloxy	SanoMed Manufacturing bv	Polyfloral	40	Ozonation	CE	PEG4000, propylene glycol and ozonated olive oil
Principelle IF	Principelle	Dark buckwheat	n/a	Gamma irradiation	CE	Minerals, trace elements, oxides
Revamil	Bfactory Health Products bv	Polyfloral	100	Gamma irradiation	CE	—
Surgihoney	Matoke Holdings	Any honey	100	Heated	CE	Glucose oxidase
Therahoney	Medline	Manuka	100	Gamma irradiation	FDA	—
Vivamel	Tosama	Chestnut	100	Gamma irradiation	CE	—

CE—Conformité Européenne; FDA—U.S. Food and Drug Administration; n/a—not available

domain, honey has gained renown for its wound-healing properties and wide ranging antimicrobial effects. The efficacy of honey against antibiotic-resistant strains has been substantiated by a wealth of both clinical and in vitro studies, corroborated by several systematic reviews and meta-analyses.^{90–94} To date, there have been no reports of bacterial resistance developing against honey. This underscores the compelling rationale for considering honey as a complementary and integrative therapeutic option in various medical contexts.

Nevertheless, the authors emphasise that this use should be confined to MGH, as it represents the safest approach, ensuring optimal outcomes without jeopardising patient health. Establishing a clear definition of the term ‘MGH’ and outlining its specific criteria emerges as a vital first step in fostering awareness regarding the use of honey as a complementary and integrative therapy. Furthermore, the endorsement of MGH in the medical field can be significantly fortified by conducting large-scale clinical trials, further solidifying its significance as a credible and efficacious complementary and integrative medicine.

Conclusions

Previously, the standards and criteria for MGH were defined to ensure safety and efficacy for medical use.¹⁸ This present article revisited the established criteria for MGH and offered a comprehensive and precise definition of MGH. It is imperative that both honey harvest and production strictly adhere to specific standards, a

necessity accentuated by recent developments concerning honey authenticity. With the growing popularity of honey, there has been a corresponding rise in honey fraud, underscoring the critical importance of meticulous honey selection for medical purposes, and safeguarding honey authenticity through enhanced measures and awareness campaigns.

Furthermore, MGH should conform to a defined set of criteria. These encompass its: organic nature; gamma sterilisation; suitability for clinical implementation; adherence to production standards; and compliance with essential physico-chemical criteria. Within this framework, the authors have proposed that MGH should also demonstrate proven biological activity, a requisite that guarantees its efficacy as a medical device. By incorporating this criterion, MGH for medical purposes not only attains the necessary safety standards but also ensures that it functions as intended by the manufacturer.

In addition, the article examines the regulatory modifications pertaining to medical devices, particularly the changes introduced in the MDR, which serve to elevate the quality and safety of medical devices within the EU. While these alterations are indispensable, they have translated into increased costs, delayed (re)certifications, and a reduced availability of devices.

In summation, the certification of MGH must be conferred exclusively upon honey that meticulously complies with the specific standards and criteria delineated herein. This rigorous adherence guarantees that MGH stands as an effective and safe therapeutic option, suitable for use as a complementary and integrative therapy across an array of medical applications.



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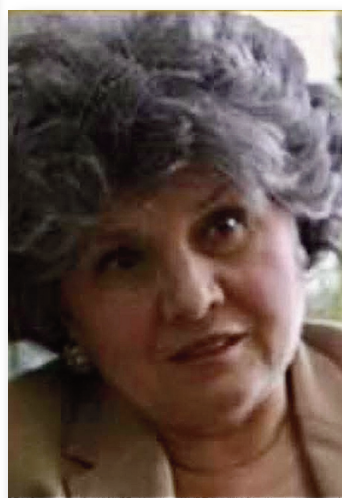
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THE BEEKEEPERS' MANIFESTO HONEY, OBESITY, AND THE HUNGRY BRAIN

Why Should Beekeepers Learn About Obesity?

Let's be honest — no one expects us beekeepers to become doctors. Our job is to care for the hive, not run hospitals. But here's the thing: if researchers don't tell the truth, and the media won't challenge the narrative, then who's left to speak up?

We are.

Because honey is our world. And if the scientific community continues to ignore its potential — not just as a sweetener, but as a metabolic ally — then it's up to us to educate, inform, and push the conversation forward.

Not because we want to be medics, but because this fight is personal.

The truth about honey isn't just buried — it's being actively ignored. And we're not okay with that.

Honey and Obesity – A Forgotten Connection

In our last article, we explored how refined sugar hijacks the brain's energy supply.

Now it's time to dig deeper into obesity — one of the most misunderstood and misdiagnosed conditions of modern life.

To understand fat gain, we must understand hunger.

And hunger, despite what your stomach tells you, begins in the brain.





The Starving Brain

When you eat refined sugar, it creates a neurochemical storm. The key enzyme responsible for pumping glucose into your brain — glutamine synthetase — gets damaged. As a result, the brain starves even when the bloodstream is full of sugar.

This starvation triggers more hunger hormones. You eat more. But your brain still isn't satisfied. The loop continues.

The Glutamate/Glutamine (GG) Cycle – Your Metabolic Gatekeeper

The GG cycle is ancient — 500 million years old. It regulates energy flow to the brain and protects against excitotoxic damage caused by excess glutamate. When it works, your neurons get fuel. When it's blocked (by refined sugar), you get fat. And forgetful. And inflamed.

This is where honey enters the scene — not just as a food, but as a metabolic protector.

Honey vs. Refined Sugar: A Neurochemical Showdown

Refined Sugar:

- Blocks glutamine synthetase
- Triggers brain energy starvation
- Leads to hyperglycaemia
- Converts unused glucose into fat
- Fuels chronic hunger and weight gain

Honey:

- Protects glutamine synthetase with flavonoids
- Maintains healthy GG cycle function
- Ensures glucose reaches the brain
- Stabilizes blood sugar levels
- Reduces fat storage and overeating

Scientific Silence or Scientific Cowardice?

A 2022 review in The Journal of Evidence-Based Integrative Medicine stated clearly:

"Honey and its components reduce blood sugar, improve insulin sensitivity, regulate lipid

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metabolism, and prevent weight gain”. How many citations has this study received?

Zero. Not one.

Meanwhile, global health institutions still refuse to publicly connect refined sugar with brain shrinkage, metabolic collapse, or the rise in childhood obesity.

Let’s be blunt — this isn’t ignorance. This is willful blindness.

A Crisis Decades in the Making

In the 1960s, only 13% of Americans were obese. Today, it’s over 40%. The shift didn’t come from more fat in the diet. It came from more sugar.

The McGovern Committee of the 1970s wrongly vilified fat and opened the floodgates for sugar-based “low-fat” foods. That mistake set off a domino effect: obesity, diabetes, Alzheimer’s.

This isn’t just history. It’s still happening. Every sugary drink sold to a child is a step closer to a brain that’s both starving and inflamed.

Are We Just Going to Sit Here?

Beekeepers — we are the custodians of nature’s most intelligent food. If we don’t speak up for honey, who will? No health minister. No talk show doctor. No policy committee.

Let them keep quiet.

We’ll keep telling the truth.

The Science Is Clear: Honey’s Flavonoids Work

Here are just a few examples of flavonoids found in honey and what the science says:

- Quercetin — Reduces inflammation and improves insulin sensitivity in obesity.
- Kaempferol — Prevents liver damage and supports gut microbiota in high-fat diets.
- Caffeic Acid — Fights oxidative stress, inflammation, and metabolic dysfunction.
- Gallic Acid — Decreases fat droplet formation and lowers triglycerides.



- Ferulic Acid – Lowers risk of metabolic syndrome and obesity.
- Syringic Acid – Reduces body fat and improves lipid balance.
- Luteolin – Boosts fat burning through thermogenesis.
- Apigenin – Protects gut health and stabilizes metabolism.

Still think honey is just sugar?

One Landmark Study You've Never Heard Of

BMJ, 2016

A 24-year study tracking over 124,000 adults showed that higher intake of dietary flavonoids correlated with better weight maintenance. The more flavonoids you eat, the less likely you are to gain fat over time.

Where do you find those flavonoids?
Right. In honey.

Final Thoughts: The Beekeeper's Role

We don't need to wear lab coats to know when something stinks. The scientific community has failed to protect public health from the sugar industry's long shadow.

But we still have time. We can be the first to say: Enough. Enough lies. Enough silence. Enough pretending that honey is just another sweetener.

It's not.

It's the original brain fuel.

It's the metabolic key.

It's nature's answer to obesity.

Let's stop waiting for permission to say so.

Let's lead.

Fabian Lindhe
Mike McInnes



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BEEES, CHILDREN AND HEALTH: Advancing Apitherapy Globally

The International Federation of Apitherapy (IFA) is actively transforming the landscape of apitherapy through its Permanent Commissions. These expert bodies are designed to legitimize, innovate, and expand apitherapy across diverse sectors—integrating science, medicine, sustainability, education, and entrepreneurship. By creating structured and collaborative platforms, the IFA is launching apitherapy into a new era of global recognition and health impact.

Each commission plays a specialized role in shaping the ethical and evidence-based growth of apitherapy. They are formed by experts, researchers, educators, and practitioners working collectively to align apitherapy with 21st-century healthcare and ecological education.

Apitherapy for Children's Education Commission (ACEC)

One of the most active and impactful commissions is the Apitherapy for Children's Education Commission, coordinated by apitherapist Nina Ilič from Slovenia. The commission recently adopted a Strategic Plan for 2025–2028, which outlines an ambitious, internationally coordinated roadmap to incorporate apitherapy into children's education.

Strategic Objectives (2025–2028):

1. Development of a comprehensive curriculum for apitherapy in children's education – incorporating the established Apipedagogy® framework along with innovative new programs (i.e. apitherapy clubs, etc.).
2. Preparation of specialized educational materials, including the authorship and publication of a dedicated Apitherapy for Children's Education manual.
3. Establishment of international certification standards to ensure quality and consistency in educational programs involving apitherapy for children.
4. Creation of Regional Training Centers to facilitate hands-on education, teacher training,





and community engagement across different parts of the world.

5. Organization of international conferences and workshops, aiming to share best practices, scientific research, and applied knowledge.

6. Public awareness and outreach activities to foster a broader understanding of apitherapy's potential role in child development, well-being, and nature-based education.

A highlight of the commission's work is its collaboration with the APIS RETIS Network of API Kindergartens and Schools, an international consortium. This network is active in Slovenia and abroad, with support from the City of Ljubljana and the Slovenian Ministry of Education. Their integrated approach reflects a broader movement to embed honeybee-related practices in early childhood education, emphasizing empathy, sustainability, and eco-literacy.

Leadership & Vision

Dr. Stefan Stângaciu, President of the IFA, has been instrumental in shaping this direction. His vision and commitment to evidence-based, globally inclusive apitherapy has positioned the IFA as a key driver in bridging health, education, and ecological consciousness.



Summary

Through its Permanent Commissions, the IFA is:

- Promoting high-quality, ethical apitherapy practices worldwide.
- Embedding honeybee-based healing and learning into mainstream education.
- Empowering educators, therapists, and institutions to foster a healthier, more nature-connected generation.

I feel widely honored to be a part of this inspiring story.

Nina Ilić

Coordinator of the Apitherapy for Children's Education Commission

YOUNG BEEKEEPER NATIONAL COMPETITION IN SLOVAKIA



Jozef Dekret Matejovie Secondary vocational school of forestry and woodworking in Lip-tovský hrádok (North Slovakia) hosted our Young Beekeeper National Competition (súťaž Mladý včelár) organized by the Slovak Beekeepers' Association (SZV – Slovenský zväz včelárov) on 6th-7th June 2025. More than 100 children from all Slovakia, divided into two age groups – younger students (up to 12 years old) and older students (12 to 18 years old), took part in this competition. Most of them were very keen to show their knowledge and practical skills needed to be chosen as the best young beekeepers in Slovakia. The main motivation for older students was the opportunity to qualify for the next IMYB event.

All participants and their mentors arrived on Friday afternoon and checked in into their rooms. After a short guided tour around the premises of the school we had a ceremonial line up followed by dinner. After dinner the older students stayed in the canteen and started to do the theory test. It contained 30 challenging questions which allowed them to get up to 30 points for the final score. Only 2 older students got all answers correctly. As soon as all of them finished writing the test, the younger students came in and did their

version of the test as well. The mentors brought a lot of different types of honey so the children could taste them and gain some necessary information needed for the next day's recognition of different sorts of honey.

Later in the evening, they were in their rooms, many of them studying anatomy for the next day or just having fun with their peers.

The next day, on Saturday, the practical part of the competition started at 9 a.m. Altogether, there were 11 disciplines (or stations) where they could receive from 5 to 30 points.

The children in both categories were divided into groups of three and visited every station as a team. Three examiners were present at most stations, so each child had their own task and an individual examiner.

This way we were able to assess both individual young beekeepers as well as teams at the same time.

Microscopy (15 points)

The children arriving at this station were given three microscope slides.

They were supposed to place them into the microscope, adjust until the slide was in sharpest



possible focus, identify the slide and provide the examiner with some extra information about the slide. For example, anterior leg - it has a brush that is used as an antenna cleaner, the leg is attached to the thorax, etc. There were more than 10 different slides including 2 parasites.

Work with bees (30 points)

Unfortunately, this year's conditions did not allow us to let the children work with living bees.

The examiners had to promptly come up with some solution, so they decided to use a set of photographs of honeycombs where the children were supposed to demonstrate their knowledge of practical work with the bees.

They were asked to describe what they see in those photographs, followed by a few questions about the work with the bees.

Marking drones (5 points)

Children arriving at this station were supposed to catch a drone from a box that was previously filled with drones and then mark them with the right colour.

This is a very popular activity, more than half of the children were given the maximum of 5 points.

Recognition of beekeeper's tools (10 points)

There is a plethora of beekeeping equipment and tools so to make it smooth and time effective the examiners decided to prepare this station in a different way than in previous years.

Every item was labeled with a number (there were more than 30 items), every child had to draw ten pieces of paper where the names of tools were written and match them to the items labeled with a number. Most kids did very well here too.

Recognition of different sorts of honey (10 points)

It might seem simple, but this is the only discipline where none of the older students was good enough to get the maximum of 10 points.

The task was to taste and identify the type of honey (acacia, linden, sunflower, honeydew

conservation efforts and sustainable practices in beekeeping.

The participating children at the Anatomy station were supposed to demonstrate their knowledge of the external and internal structure of a honeybee's body. Teams of three children arrived, but each child had their own task and an individual examiner.

Younger students looked at a picture of a worker bee—and were asked to name the basic parts of its body. Apart from a few minor hesitations, everyone performed excellently.

Older students faced a more challenging task—they were given a detailed diagram of a bee's body and its internal organs, which highlighted 50 points to be named. Each student randomly selected 15 labels from a set of cards with names of body parts or organs and then had to match those to the correct points on the bee's body diagram.

Honeybee anatomy (15 points)

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Here, considerable differences in preparedness among the children became evident—some were able to accurately identify nearly all the parts they chose. However, there were children who, especially with internal organs, struggled more.

Based on the results, it can be concluded that the anatomy station was more challenging for the older students compared to previous years' competitions. Despite this, the children handled it with dignity, and it might motivate them to further study the missing or less familiar details.

Rudolf Kotrusz

leader of the Anatomy station

Recognition of bee forage plants (20 points)

This station was beautifully situated in the green zone of the school, surrounded by greenery, trees, and natural wooden elements. The space was divided across three tables, each offering a different type of challenge for the participants. One table displayed living plants, another showcased photographs, and the third featured interactive riddles - a brand-new addition this year that caught the children by surprise and made the task both more engaging and more challenging.

The plant selection was thoughtfully curated to include species that children might recognize from home gardens, urban parks, or common flowering shrubs known for their significance in supporting bee populations. This approach not only tested their knowledge but also helped them connect their learning to the world around them.



Introducing riddles this year was a deliberate step in raising the bar for the competition. It encouraged critical thinking and deeper engagement, adding an extra layer of difficulty and fun to the experience. A big thank you goes to Martina and Jozef for their creativity and support in designing this station. We sincerely hope the children found it both enjoyable and educational!

Juraj Sestrienka

leader of the Recognition of bee forage plants station

Honeybee diseases (15 points)

Motivated by IMYB UAE 2024 event we decided to extend our competition by two new disciplines – diseases and English. Being knowledgeable in honeybee diseases is a vital part of beekeeping. Unfortunately, even experienced adult beekeepers often lack a lot of knowledge regarding diseases of honeybees. Every beekeeper, including a young one, is supposed to be well informed and able to recognize diseases and pests of various types. At this station, the children were supposed to do a test where they had to recognize the symptoms of AFB vs. EFB and answer a few additional questions. The second task was to match pictures of different diseases and pests with their names written on small pieces of paper. Surprisingly, most of the

children scored over 80% in this discipline, which is very satisfying to know that our mentors spent some time preparing the children for this discipline and taught them about such issues.

Karol Kliment

leader of the whole event



English (15 points)

As IMYB became a real international event with participants from all around the world, being fluent in English is a very important skill for future participants to be successful and to enjoy the



time spent with other young beekeepers. The English station consisted of a 10-question quiz on Quizizz.com platform where the children were able to get up to 10 points, and additional up to 5 points were given to the children for their speaking skills. The test for the younger beekeepers was prepared by Margaréta Hockicková. We both tried to be as spontaneous as possible and asked children to answer everyday questions as well as questions about beekeeping. The words most of them did not know were continuously written on board to teach them as well as to test them. Even an event like a competition can be a good ground to learn something new.

Ladislav Pongrácz
examiner at the English station
and the theory test

The winners

Older student

(qualified for the next IMYB event):

1. place Bázsó Richard
2. place Kuzmová Zoe
3. place Oriščik Tobiáš

Younger students:

1. place Brádziková Zuzana
2. place Galánek Jakub
3. place Lovíšek Peter



YOUNG BEEKEEPERS' NATIONAL CHAMPIONSHIP IN AUSTRIA (SALZBURG)

Austria's Young Talents Show Impressive Skills

From May 30th to June 1st, the Tamsweg Agricultural College hosted the Young Beekeepers' National Championship. The state of the event changes every year, and this year it was Salzburg that hosted it. 25 young people from all over the country traveled to demonstrate their extensive knowledge and practical skills – at the highest level.

Right at the beginning, the participants had to demonstrate their knowledge of beekeeping in a challenging theory test. Here, they had to answer 50 tricky questions and thus earn the important 50 points towards the final score.

The exciting practical day followed on Saturday. A total of 13 stations awaited the young beekeepers. Among other things, they had to identify forage plants, name bee products, draw drones, identify honey varieties, classify microscope images, and explain beekeeping tools.

Practical work with bee colonies was also required, as was the recognition and prevention of diseases and the proper preparation and execution of bee transport. 10 points could be achieved at each of the 13 stations. As a sporting activity, archery was offered in the afternoon, where many participants were able to demonstrate their accuracy. The day concluded with a cozy barbecue, before the highlight of the weekend took place in the evening: the awards ceremony.



Two first-place finishers and a strong field

This year's national championship brought a special surprise: two participants claimed first place. Kilian Steer (Styria) and Fabio Rieder (Vorarlberg) achieved exactly the same number of points (172.5 out of a possible 180) and thus deservedly shared the title of national champion.

Third place was also shared by two: Elija Raab (Lower Austria) and Matthias Schaidreiter (Salzburg) also achieved exactly the same number of points.

Overall, all participants demonstrated tremendous commitment and impressive knowledge. The nine best young beekeepers can now look forward to a special award: They have been nominated for the German-speaking beekeeping competition in Bavaria, which will take place in September.

The winners

1st place: Fabio Rieder (Vorarlberg) & Kilian Steer (Styria)

3rd place: Elija Raab (Lower Austria) & Matthias Schaidreiter (Salzburg)

5th place: Lukas Maurer (Styria)

6th place: Valerie Asprian (Tyrol)

7th place: David Kienberger (Styria)

8th place: Lia Marie Tache (Lower Austria)

9th place: Alexander Greunig (Vorarlberg)

With this successful weekend, Austria's young beekeepers once again demonstrated that beekeeping is in the best hands with the next generation and that their expertise and work methods are extremely impressive. The next national championship will take place in Vorarlberg in 2026.

Andrea Lenzhofer



BEEES LIFE



ANOTHER SUCCESSFUL CZECH COMPETITION

This year's Czech national beekeeping competition "Zlatá včela" ("Golden bee") took place from 6th to 8th June 2025. It was hosted at the beekeeping school in Nasavrky.

Friday

All the competitors were selected through previous rounds. There were over 500 participants in total. This year we even had students older than 15 for the first time in the history of the competition. Because of this, they finally have the opportunity to visit the IMYB (International Meeting of Young Beekeepers), where competitors are aged between 12 and 18 too.

After their arrival, everyone filled in the knowledge-based test. Next, the thesis defense presentation started. Everyone had to write a 2-4-page-long thesis about a beekeeping-related

topic. The papers ranged from laboratory research to raising queens and other practical activities.

During the day, we also had a visit from the Czech national television station, who came here to film a short report.

Saturday

The next day, participants went through several theoretical and practical disciplines. They had to recognize important plants, parts of a bee under a microscope, unusual beekeeping tools and honey based on its taste and appearance. Next they had to construct and wire a frame. Lastly, they had to show their experience and knowledge while working with photo frames.

In the afternoon, the six best beekeepers were selected to go to the Libáň apiary, where





they were working with life bees. First they marked drones. Then they grafted larvae to make queens, did standard control of the colony and

then a bit more theory. There was also one new discipline: beekeeping conversation in English. Next we had a lecture about unusual reproduc-



**BEES
LIFE**

BEE LIFE





tion in the world of animals. After that, we played different beekeeping-related games, talked about our experience and enjoyed the time together.

Sunday

On the last day, many important figures in Czech beekeeping joined us to reveal a new

sculpture built to celebrate the school's 75th anniversary.

Afterward, the closing ceremony finally came. Everyone got a generous award gifted by the competition's sponsors. For the best ones, there were even several hives, frame drill and hive scale.

The first three spots were taken by Jan Kopáček, Lukáš Loukota and Adam Šimoník, who are all proud to be part of the next IMYB 2026 in Belfast.

Lukáš Loukota
Marek Matulík

Young Czech
beekeepers (15, 23
years old)

Photos by
Petr Kolář
Czech
Beekeepers
Association



WORLD BEE DAY IN TÜRKİYE

Düzce University (DU) Beekeeping Research, Development and Application Center (DAGEM) organized an awareness event as part of "World Bee Day" on May 20.

Children dressed in bee costumes and carrying banners that read "Let the flowers not fade, let the bees not die" and "Without bees, there will be no people" were admired for the performances they gave.

Students and citizens visiting the booths in the area received information from DAGEM academicians about bees and bee products. The artworks of young students who won awards in the painting competition were also exhibited as part of the event.

Düzce Nature Conservation and National Parks Branch Manager Mr. Mevlüt Şanlı Şimşek and Provincial Director of Agriculture and For-

estry Ms. Esra Uzun spoke at the program, emphasizing the importance of bees for the climate and nature, and celebrated World Bee Day.

DU Rector Prof. Dr. Nedim Sözbir highlighted the importance of understanding the value of bees for nature and sustainable life. He said, "We are here with our children to draw attention to the importance of bees and to raise awareness. Our aim is to create social consciousness and help people embrace the importance of these vital insects. We like bees very much. Bees not only produce honey, but they also maintain the balance of the world's climate and nature."

Bees are essential in Agriculture

Rector Prof. Dr. Nedim Sözbir drew attention to the vital importance of bees for both the eco-





system and agriculture, emphasizing their indispensable role in agricultural production. He highlighted the critical contributions of bees to sustainability in agriculture, food security, and the preservation of biodiversity. “On the occasion of May 20, World Bee Day, we are once again gaining a deeper understanding of this important reality,” he said.

Türkiye is ranked 2nd in the world in terms of total number of hives and bees and honey yield

DAGEM Director Prof. Dr. Meral Kekeçoğlu stated that bees are the most important living beings on Earth and said, “Bees play a crucial role in pollination. While they are often only known for producing honey, their true significance lies in their role as pollinators. Today, 77 percent of the fruits people consume are pollinated and fertilized by bees. This is incredibly important — without bees, there would be no plants, no animals, and eventually, no humans.”

Emphasizing that Türkiye holds a significant position globally in beekeeping, Kekeçoğlu said,

“Türkiye ranks second in the world in terms of total number of bee colonies and honey production. This is a remarkable achievement. Given Türkiye’s key role in beekeeping, the awareness activities and celebrations for World Bee Day held across the country are of even greater importance.”

The Most Important living Beings in the World: Bees

DAGEM Director Prof. Dr. Meral Kekeçoğlu, who delivered the opening speech of the pro-





gram, emphasized that bees are not only essential for honey production but also play a critical role in sustainable agriculture through their often-overlooked contributions.

Stating that bees are among the most important living beings in the world for the ecosystem, Prof. Dr. Kekeçoğlu expressed her gratitude to all stakeholders who contributed to the organization of the World Bee Day event.



If There Are Bees, There Is Life!

Düzce Provincial Director of Agriculture and Forestry Esra Uzun expressed her pleasure in attending the event and drew attention to the fact that approximately two-thirds of the food we consume can be produced thanks to the pollination activities of bees.

Uzun emphasized that 466 tons of chestnut honey produced annually in the province, thus being an important agricultural value for Düzce.

The 5th Traditional World Bee Day Painting Competition Award Ceremony was held at May 20 world Bee Day

The Traditional World Bee Day Painting Competition, organized every year for primary, secondary and high schools, was organized exclusively for preschools for this year. The “5th Traditional World Bee Day Painting Competition Award Ceremony” was held within the scope of World Bee Day events.

The “5th Traditional World Bee Day Painting Contest Award Ceremony”, organized exclusively for preschools by Düzce University Beekeeping Research, Development and Application Center (DAGEM), with the sponsorship of Turkish Beekeepers Association (TAB) BEEO Propolis, Apimaye, NeoBee, companies and with international participation, was held at the University campus Square.

The program was attended by Düzce University Rector Prof. Dr. Nedim Sözbir, Vice Rector Prof. Dr. Ali Öztürk, Düzce Provincial Director of Agriculture and Forestry Esra Uzun, DAGEM Director and event coordinator Prof. Dr. Meral Kekeçoğlu, Düzce Nature Conservation National Parks Provincial Director Mevlüt Şanlı Şimşek, Düzce Provincial Beekeepers Association President Mr. Cafer Kaba, protocol members, aca-

demicians, preschools' students and teachers attended.

Small Painters Explained the Value of Bees with Pictures

Following the opening speeches, students who won awards in the painting competition themed “If There Are Bees, There Is Life” organized for preschool students received their awards from Düzce university Rector Prof. Dr. Nedim Sözbir and protocol members.

Ertuğrul Bozkurt from Özel Doğuş Ata College Kindergarten with his work titled “Bees in the Rainbow”; Kerem Kökağaç with his painting themed “If There Are Bees, There Is Life”; Mehmet Selim Biçer with his drawing titled “Queen Bee and Soldier Bees”; and Çiğdem Sevinç with her work titled “Bees Swarming to Make Honey”, created meaningful works by combining their imagination with their love of nature. Zümra Çakırhan from Körpeşler preschool received her awards with her elegant work titled “Lavender Scented Bee”, Sare Ada Özdal from Hayalimiz preschool received her awards with her work titled “Bees and Flying Pollens”, and Kaptan Altay Altuğ Kızılay preschool student Hümay Şengül received her awards with her work titled “Bee Brothers”.

Following the award ceremony, Düzce university's Rector Prof. Dr. Nedim Sözbir and protocol members visited the promotion and application stands set up in the campus area and received information about bee products, propolis, hive systems and beekeeping equipment at the stands prepared by DAGEM and sponsor companies.

The program continued with children's games and folk dance shows and took on a festive atmosphere, drawing attention to the life force that bees add to nature.



TÜRKİYE IS LOOKING FOR BEE AMBASSADORS

We aim to create a youth awareness
that produces just like bees

The future of the ecosystem is in the wings of bees

Honey bees pollinate 77% of the plant resources consumed ahuman food worldwide. Bee pollination is absolutely essential for 40 plant species in particular. Therefore, bee colonies are necessary during flowering periods to ensure adequate pollination. Not only plant production but also the sustainability of forests, flowers, other animal species, and even the overall ecosystem is indirectly connected to honey bees.

In recent years, due to global warming, forest fires, and the depletion of water and food re-

sources, the importance of sustainable agriculture and ecosystems has been increasing day by day. For a sustainable future, it is crucial for children and young people to understand not only the products produced by honey bees but also their role in pollination and maintaining the ecosystem. Sustainable development depends on education and environmental awareness.

To this end, an awareness project was launched by the Düzce University Beekeeping Research, Development and Application Center (DAGEM), sponsored by Bee'o Propolis company, under the slogan "TURKEY IS LOOKING FOR YOUNG BEE AMBASSADORS." The primary goal of the project is to highlight the impor-





tance of pollination for environmental sustainability and food security, and the critical role of bees in this process. The project, which aims to raise awareness among children and young people about the importance of honey bees in the ecosystem, is a first both in Türkiye and globally.

The first event of the project took place at DAGEM on May 14, with the participation of 9th and 10th-grade high school students from all dis-





tricts of Düzce. A total of 35 "Bee Ambassadors" attended, representing the following schools: Akçakoca Barbaros Anatolian High School, Akçakoca Science High School, Akçakoca Piri Reis Vocational and Technical Anatolian High School, Akçakoca Social Sciences High School, Arsal Anatolian High School, Atatürk Anatolian High

School, Cumhuriyet Anatolian High School, Düzce Anatolian Imam Hatip High School, Düzce Science High School, Düzce Fine Arts High School, Düzce Girls' Anatolian Imam Hatip High School, Düzce Mevlana Vocational and Technical Anatolian High School, Düzce 15 July Martyrs Anatolian High School, Farabi Anatolian High



School, Gümüşova Anatolian High School, Private Düzce Culture Science High School, Private Düzce Culture Anatolian High School, and Turgut Özal Anatolian High School.

The event began with a breakfast and meet-and-greet session, followed by both theoretical and practical training. Students first received theoretical instruction on bee colonies, bee physiology, bee products and their health benefits, and the ecological role of honey bees. This was followed by practical training at the hives, where

students had the opportunity to open a hive and observe bees and their products up close.

Activities continued with candle-making, planting nectar-producing plants, and baking cakes with honey. The day concluded with a certificate ceremony and the presentation of gift packages containing bee products provided by Bee'o Propolis.

The long-term goal of the project is to expand these activities with volunteer bee ambassadors from across Türkiye.

The aim is to create widespread environmental awareness and to nurture a society that, like bees, continuously produces rather than consumes natural resources.



JANŠA'S BEES

Children's Hands that Preserve Heritage

It is vital that we respect our cultural heritage and pass it on to younger generations. Cultural heritage helps us understand who we are and where we come from. It connects us to the past and gives us a sense of belonging.

Next to our kindergarten, which operates within the Žirovnica Primary School, there is an alley of famous men. Among them is Anton Janša, a pioneer of modern beekeeping. It was he who encouraged me to enter the world of the past together with my children and set out on the path of cultural heritage. The beginnings of Slovenian beekeeping date back to the village below the mountain Stol, where Janša once worked as a beekeeper.

As part of the project of the Tourist Association of Slovenia and the Association of Kindergartens of Slovenia, I designed a project called Janša's Bees, the purpose of which was to bring the cultural heritage of Slovenian beekeeping closer to children, with an emphasis on the historical role of Anton Janša and the symbolism of beehive panels. The project promotes the preservation of cultural heritage and strengthens the connection between children and nature, as well as their connection to cultural heritage.

One of the main activities of the project was a hive painting workshop. These artfully painted wooden tiles, which once adorned beehives, are almost disappearing today. An essential part of our identity is thus also disappearing. Consequently, we decided to revive this old custom with our children. The children used brushes and paints to convey their imagination, feelings and



joy to the wooden tiles. A truly unique, honest children's artwork was created.



In cooperation with the Beekeepers' Association, we organised a beekeeping workshop led by Tina Žerovnik from the Beekeeping Center of Gorenjska. Tina took the children through an engaging and interactive workshop into the world of the bee family. The children met the queen, the drone, and the worker and learned that the drone does not sting and that the bee dies after stinging. They learned about bee products, felt, smelled and tasted them – from chestnut to flower honey, as well as pollen and honeycomb.

In the creative part of the workshop, they made their own candles out of waxed honeycombs by twisting them - step by step, with patience and help from adults, and with a lot of independence and pride at the end.



BEES LIFE

The highlight of the project was the handover of children's beehive panels to Mr. Boštjan Noč, president of the Slovenian Beekeeping Association. Mr. Noč proudly installed our artwork on his new apiary, located in the area of Jezersko Golf Course. At the end of the kindergarten year, we went there with the parents, visited the apiary and admired the installed beehive panels. The children immediately recognised their creations, and their eyes and hearts lit up with joy.

As a souvenir, each child also received a glass of honey produced by Mr. Noč – as a sym-



bol of gratitude, nature, and tradition united in children's creativity.

Let it pour honey!

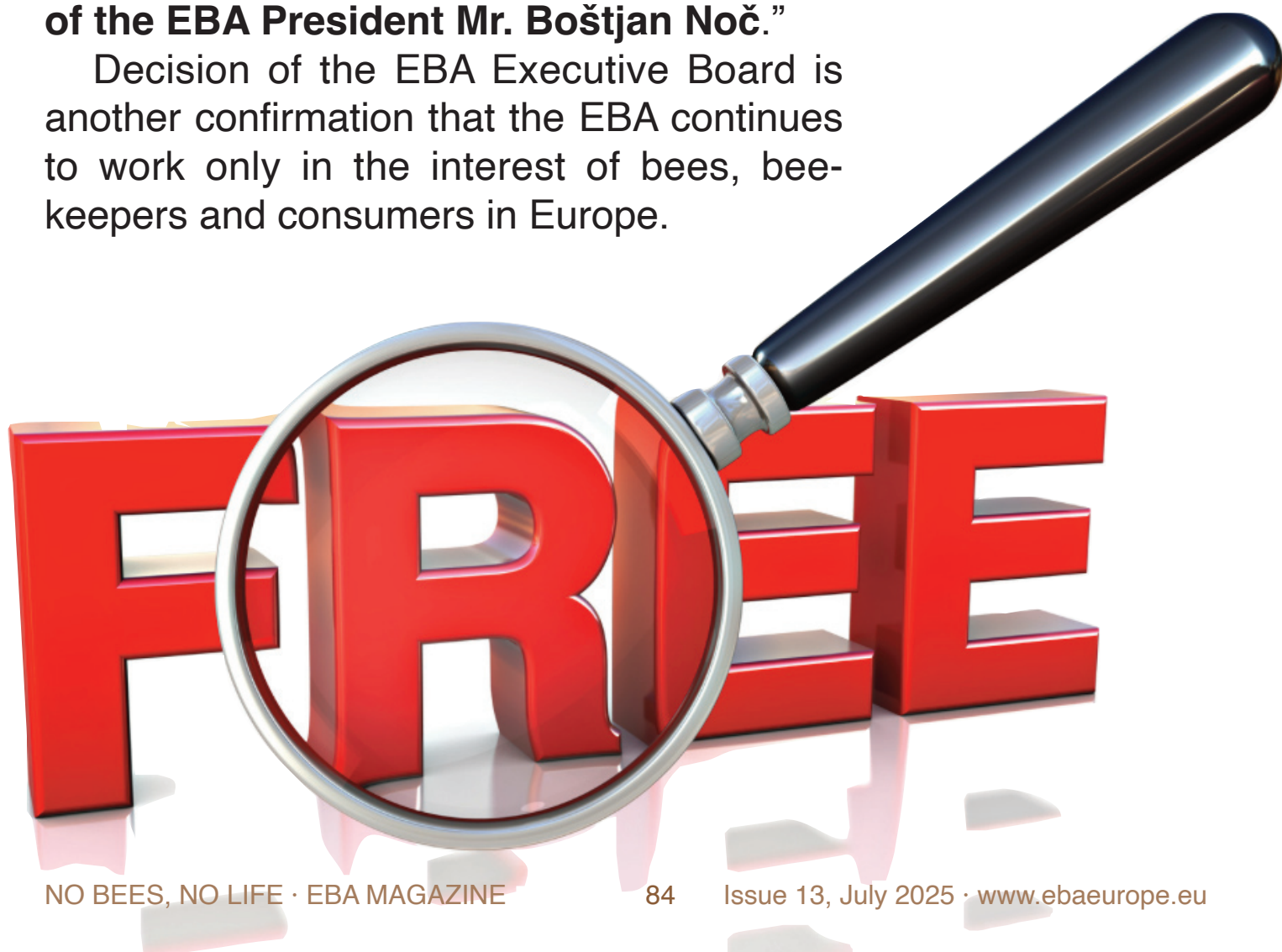
Sabina Tavčar



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, beekeepers 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 without 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



EBA

sponsorship packages

GOLD sponsor - 5.000 euros:

Advertisement on the EBA website

Presentation at all EBA events, logo on all EBA correspondence

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

SILVER sponsor - 3.000 euros:

Advertisement on the EBA website

Presentation at all EBA events, logo on all EBA correspondence

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

BRONZE sponsor - 2.000 euros:

Advertisement on the EBA website

12 advertisements in the EBA monthly e-magazine in the size of 1/4 A4 page

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

- 8 A YEAR OF DEDICATION: THE FIRST ANNIVERSARY OF
EBA SCIENTIFIC COMMITTEES
- 9 LETTER TO THE EUROPEAN COMMISSION REGARDING THE HONEY PLATFORM
- 10 POSITION PAPER: EBA'S PROPOSAL ON ENZYMATIC ACTIVITY,
POLLEN CONTENT AND TRACEABILITY
- 19 DECISION ON THE ELECTION OF A NEW MEMBER OF THE EBA
EXECUTIVE BOARD UNTIL THE END OF THE MANDATE PERIOD OF THE
PREVIOUS MEMBER
- 20 THE SCIENTIFIC YOUTH COMMITTEE OF THE EBA
- 23 WHEN THE HIVE IS INNOCENT THE LEGAL TRAP OF DRUG RESIDUES IN HONEY
- 28 TEMPORAL INCREASE OF VARROA MITES IN TRAP FRAMES USED FOR DRONE
BROOD REMOVAL DURING THE HONEY BEE SEASON
- 36 MEDICAL-GRADE HONEY: ITS DEFINITION AND REFINED STANDARDS
- 53 THE BEEKEEPERS' MANIFESTO: HONEY, OBESITY, AND THE HUNGRY BRAIN
- 57 BEES, CHILDREN AND HEALTH: ADVANCING APITHERAPY GLOBALLY
- 59 YOUNG BEEKEEPER NATIONAL COMPETITION IN SLOVAKIA
- 65 YOUNG BEEKEEPERS' NATIONAL CHAMPIONSHIP IN AUSTRIA
- 68 ANOTHER SUCCESSFUL CZECH COMPETITION
- 72 WORLD BEE DAY IN TÜRKİYE
- 76 TÜRKİYE IS LOOKING FOR BEE AMBASSADORS
- 80 JANŠA'S BEES: CHILDREN'S HANDS THAT PRESERVE HERITAGE
- 84 TO THE EBA WITHOUT MEMBERSHIP FEE
- 85 SPONSORSHIP REQUEST AND METHOD OF ADVERTISING IN THE MAGAZINE



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The contents of the texts and advertisements are the responsibility of the authors.

The responsibility for the correctness of the English language in the magazine lies with the authors of the texts.

The editor reserves the right to publish a larger advertisement than the size specified by the sponsorship package, if it improves the design of the magazine.

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.

The total number of pages in the magazine is not fixed.

There are no fees for published texts and photos.

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