APIMONDIA STATEMENT ON HONEY FRAUD

JANUARY 2020

1. PURPOSE

APIMONDIA Statement on Honey Fraud is the official position of APIMONDIA regarding honey purity, authenticity, fair modes of production, and the best available recommended methods to detect and prevent honey fraud.

This Statement aims to be a trusted source for authorities, traders, supermarkets, retailers, manufacturers, consumers, and other stakeholders of the honey trade chain to ensure they stay updated with the current concepts and new testing developments regarding honey purity and authenticity. It is also a guide to promote best practices for the prevention of honey fraud and all of its insidious negative side effects on bees, beekeepers, crop pollination, and food security.

2. RESPONSIBILITY

The APIMONDIA Working Group on Adulteration of Bee Products * is the responsible body for the preparation and review of this Statement at annual intervals or whenever significant new information becomes available that the group becomes aware of.

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The Working Group will ensure through consultation with the leading honey scientists, technical experts, specialist honey laboratories, or others with sufficient market and beekeeping knowledge, that the Statement is reflective of the most up-to-date information and collective thinking on the topic.

APIMONDIA Executive Council will publish the Statement on the APIMONDIA website and in other appropriate publications.

3. OVERVIEW OF HONEY FRAUD

Honey fraud is a criminal and intentional act committed to obtain an unfair economic gain by manipulating honey and selling a product that does not meet globally accepted standards for honey.

It is historically well documented that honey has long been subject to fraud (Crane, 1999), however the conditions for honey fraud have never before been so conducive or aligned. They include:

1. World honey demand seems to be growing at a faster rate than global production of the pure product (Garcia, 2016 and 2018).
2. There is an opportunity for strong profits through fraud.
3. The modes of honey adulteration have rapidly changed and multiplied.
4. Honey is a complex product to test.
5. The official method, EA-IRMS (AOAC 998.12), cannot detect current modes of honey adulteration with C3-type sugars (Zábrodská and Vorlová, 2014) leaving the market exposed to an outdated and inappropriate detection method.

Different types of honey fraud can be achieved through (but not limited to):

1. Dilution with different artificially manufactured syrups produced, e.g., from corn, cane sugar, beet sugar, rice, wheat, etc.
2. Harvesting of immature honey (before the bees have had a chance to transform nectar into a product which has the chemical constituents and composition of authentic honey) as a planned, systematic and purposeful mode of production, coupled with the active dehydration of the extracted immature product by the use of technical equipment including, but not limited to, vacuum dryers.

3. Using Ion-exchange resins to remove/reduce residues and/or constituents of honey such as HMF and/or lighten honey color.
4. Masking and/or mislabeling the geographical and/or botanical origin of honey.
5. Artificial feeding of bees during a nectar flow.

The product which results from any of the above described fraudulent methods shall not be called "honey", neither the blends containing it, as the most widely accepted international standards like Codex Standard (1981) and the European Honey Council Directive 2001/110/EC (2001) only allow blends of pure honeys.

4. THE TRANSFORMATION OF NECTAR INTO HONEY

Honey is a one-of-a-kind product, the result of a unique, complex, and sustained interaction between the plant and animal kingdoms.

The transformation of nectar into honey is the result of thousands of years of evolution by bees to achieve a long-term provision of food for their own use when there is no nectar flow from the surroundings of the colony. The reduced water content, the elevated concentration of sugars, the low pH, and the presence of different antimicrobial substances make honey a non-fermentable and long lasting food for bees. An eventual fermentation of food reserves is an undesirable process for bees since it produces ethanol, which is toxic to them and affects their behavior in a similar way than to other vertebrates (Abramson *et al*., 2000). During the ripening process, bees also add enzymes like invertase, which helps to invert sucrose into more stable simple sugars as glucose and fructose, and glucose oxidase, essential for the production of gluconic acid and hydrogen peroxide, which in turn prevent fermentation (Traynor, 2015).

Honey maturation starts with the uptake of nectar and/or honeydew in the bee honey stomach while the foraging bees complete their load of nectar in the field and in their return flight (Nicolson and Human, 2008). It is inseparable from the drying process, and involves the addition of enzymes and other bee-own substances, the lowering of pH through the production of acids in the bee stomach, and the transformation of nectar/honeydew-own substances (Crane, 1980). Furthermore, a considerable microbial population exists at the initial stages of the maturation process that could be involved in some of these transformations, such as the biosynthesis of carbohydrates. (Ruiz-Argueso and Rodriguez-Navarro, 1975).

The transformation of nectar continues inside the hive when non-foraging bees ripen nectar both, by manipulating it many times with their mouthparts and by reallocation. As nectar is passed from bee to bee, more enzymes are added and more water is evaporated (Traynor, 2015). Actually, the allocation and relocation of the content of many cells before final storage is an important part of the ripening process, and needs sufficient space in the beehive for its normal occurrence (Gary, 2015). Bees finally cap the cells when they are full of mature honey.

Eyer *et al.* (2016) provide evidence for the occurrence of both passive and active mechanisms of nectar dehydration inside the hive. Active dehydration occurs during 'tongue lashing' behavior, when worker bees concentrate droplets of regurgitated nectar with movements of their mouthparts. By contrast, passive concentration of nectar occurs through direct evaporation of nectar stored in cells and depends on the conditions inside the beehive, being faster for smaller sugar solution volumes, displaying a larger surface area (Park, 1928).

As the nectar is dehydrated, the absolute sugar concentration rises, rendering the ripening product increasingly hygroscopic. Bees protect the mature product by sealing off cells filled with honey with a lid of wax. Therefore, the ripening process finishes when capping has already started, suggesting the possibility of a race against honey dilution (and unwanted fermentation) due to the high hygroscopic nature of mature honey (Eyer *et al*., 2016).

A colony possesses a division of labor between foraging and food-storing bees, and can adapt its nectar collecting rate by stimulating non-foragers to become foragers (Seeley, 1995). If honey is systematically and purposefully harvested when still unripe, as the mode of production by the beekeeper, non-foraging bees would become foragers earlier, thus increasing the harvesting capacity of the colony. This mode of production violates the principles of honey production, makes human intervention necessary for completing the moisture reduction process, and alters the composition of the final product which does not meet the expectations of consumers

5. MODES OF HONEY PRODUCTION

APIMONDIA has a role in continually guiding the sustainable development of apiculture globally, and always supporting the production of high quality authentic natural honey containing all the complex properties given by nature.

APIMONDIA supports only those production methods that allow bees to fully do their job in order to maintain the integrity and quality of honey for the satisfaction of consumers, who seek all the natural goodness of this product.

APIMONDIA rejects the development of methods intended to artificially speed up the natural process of honey production through an undue intervention of man and technology that may lead to a violation of internationally accepted standards. Table 1 outlines such practices and how they violate the Codex Standard (1981) and the European Honey Council Directive 2001/110/EC (2001).

6. THE EXPECTATION OF CONSUMERS

The expectation by human beings about honey has been transmitted from generation to generation up to the modern honey consumer, who appreciates the properties and nature of honey as never before in history. As opposed to other foods, whose manufacturing practices and consumer tastes have mostly changed, honey perception by humans stands quite the same in this era of comprehensive information, of traceability, of the rule of law, of enhanced food safety, and of creative marketing (Phipps *et al.*, 2015).

Stone paintings from prehistoric times (Paleolithic period, 15,000 to 13,500 B.C.) show us that humans were indeed hunters of this natural and sweet food entirely prepared by bees that needs no manipulations by humans to be ready to eat. Honey was the only sweetener for thousands of years, as the use of sugar cane is reported since approximately the 4th century B.C. and restricted to those parts of the world where it was endemic (Warner, 1962). Sugar beet was the result of breeding in the 18th century (Biancardi, 2005).

The product that was accessible to early honey hunters can be assumed to be mainly mature honey (with sufficient time given to bees to fully do their job), instead of an immature product, which would be simply too difficult to handle (lower viscosity, storage) and would not have the desired microbial stability for long-term storage. Consequently, early humans were mainly exposed to ripe honey, giving rise to certain expectations regarding the organoleptic properties of this food.

Table 1: Modes of honey production and processing that violate the Codex Standard (1981) and the European Honey Council Directive 2001/110/EC (2001).

	PRACTICE	WHAT IS VIOLATED?
PRODUCTION	Harvesting of immature honey as a systematic and purposeful mode of production	- Bees have insufficient time to mature honey and add specific substances of their own by multiple manipulations. - The transformation of nectar into honey is only partially made by bees, and human intervention completes the process in an illicit manner.
	Artificial feeding of bees during a nectar flow.	- Honey must only be 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.
PROCESSING	Honey dilution with syrups.	- Any additions to honey other than honey are ruled out (including those substances that are contained naturally in honey).
	Dehydration of extracted immature honey with technical devices, such as vacuum dryers, etc.	- Moisture reduction of immature honey is an inseparable part of the maturation process, which must be done exclusively by bees.
	Use of Ion-Exchange Resins to remove residues, offensive aroma, constitutes important for quality control (HMF), and lighten the color of honey.	- Honey shall not be processed to such an extent that its essential composition is changed and/or its quality is impaired. No pollen or constituents particular to honey may be removed.
	Pollen addition to honey with the purpose of disguising the botanical and/or geographical origin of the product.	- Any additions to honey other than honey are ruled out (including those substances that are contained naturally in honey).
	Masking and/or mislabeling the geographical and/or botanical origin of honey.	- Honey may be designated by the name of the geographical region if the honey was produced exclusively within the area referred to in the designation. Honey may be designated according to floral or plant source if it comes wholly or mainly from that particular source and has the organoleptic, physicochemical and microscopic properties corresponding with that origin.

7. ABOUT THE DEFINITION AND ESSENTIAL COMPOSITION OF HONEY

Codex Alimentarius (1981), the internationally accepted standard for foods issued by the FAO, contemplates the biological aspects of honey production and defines:

"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 honey comb to ripen and mature."

APIMONDIA adheres to the Codex Alimentarius (1981) definition of honey and to its description of essential composition and quality factors:

"3.1 Honey sold as such shall not have added to it any food ingredient, including food additives, nor shall any other additions be made other than honey. Honey shall not have any objectionable matter, flavour, aroma, or taint absorbed from foreign matter during its processing and storage. The honey shall not have begun to ferment or effervesce. No pollen or constituent particular to honey may be removed except where this is unavoidable in the removal of foreign inorganic or organic matter".

APIMONDIA understands that the use of "shall" or "shall not" of Codex Alimentarius (1981) makes it not optional but mandatory.

Codex Alimentarius (1981) rules out any additions to honey (including those substances that are contained naturally in honey such as water, pollen, enzymes, etc.), nor any treatment intended to change honey's essential composition or impair its quality.

Such non-permitted physical, chemical or biochemical treatments include, but are not limited to, the use of ion-exchange resins to remove residues and offensive aromas, and lighten the color of honey.

Honey for table consumption should not be heated (e.g. when processed to avoid crystallization) to such an extent that its essential quality parameters exceed the limits of international standards. These parameters must be met during the whole shelf life of the product, and not only immediately after processing. However, honey used as an ingredient in food may sometimes be heated as part of the manufacturing process of the food.

As defined by Codex Alimentarius (1981), the transformation of nectar into honey must be completely made by bees. No human intervention in the process of maturation, neither any removal of constituents particular to honey are permitted.

A constituent particular to honey is any substance naturally occurring in honey within its typical range of concentration. Interpretation of the term “particular” in the sense of “unique to honey” is not accurate. There are many specific constituents which are inherent in, and universal to, all authentic honey. These constituents include, but are not limited to sugars, pollen, proteins, organic acids, glucose, fructose, amino acids, enzymes, water, chemical compounds which add flavor and color, and other minor substances. None of these substances, in and of themselves, are unique to honey, but as a group they are essential and particular constituents of authentic honey produced according to the modalities described in this APIMONDIA Statement. Water, as well as glucose, fructose, other sugars, proteins, organic substances, and other natural components are definitely considered constituents particular to honey.

Moisture reduction of nectar is an inseparable part of the maturation process of honey and must be done exclusively by bees. For *Apis mellifera*, the process of nectar drying normally continues until the final product has less than 18 % of water (Maurizio, 1975). However, very humid areas, seasons, and/or weather conditions may be exceptions since bees may cap honey although its water content is over 18% (Traynor, 2015). According to Buawangpong and Burgett (2019), even under the warm and humid conditions of Thailand, honey from *Apis mellifera,* if not prematurely extracted through human intervention, is produced with a moisture content under 20% and within recognized international standards for mature honey. In contrast, for some Asian honey bee species, the average honey moisture content of mature honey contained in capped cells may be up to an average of 22.7%, e.g. for *Apis dorsata* (Buawangpong and Burgett, 2019). Honeys produced by other *Apis* species –different to *Apis mellifera*- should prove its entomological origin in order to be exempted of internationally accepted limits regarding moisture content. A novel real-time polymerase chain reaction (PCR) method with high resolution melting analysis has been developed for the authentication of honey samples produced by Asian and European bees (Soares *et al*., 2018; Zhang *et al*., 2019).

Frames with fresh nectar that can be shaken out of the cells like water should not be harvested by the beekeeper (Matheson, 1993; Horn and Lüllmann, 2019). Of course, the beekeeper is not always in the fortunate position to harvest only 100% capped frames. The possibility of harvesting partially capped honey combs normally depends on the ambient humidity conditions of the year and/or the region. Under normal ambient humidity conditions, beekeepers may harvest some frames with different capping percentage, since even uncapped frames may contain mature honey. The beekeeper can assure the maturity of the harvested lot by giving bees enough time to process honey and not harvesting beehives too frequently. Horn and Lüllmann (2019) provide guidelines for harvesting honey with an adequate moisture content. However, it must be emphasized that in areas or seasons where air humidity is high, only fully capped frames should be harvested (Warhurst and Goebel, 2005).

If honey combs have to be stored for a few days in the honey extraction room, the beekeeper should also ensure that the honey does not deteriorate by taking up moisture from the environment (Horn and Lüllmann, 2019).

Considering that honey with a water content over 17 % may ferment according to the yeast count (Traynor, 2015), the process of moisture reduction of mature honey, e.g. from 20% to around 18% may sometimes be necessary during processing before bottling in order to reduce the risk of fermentation. The intent of this process is absolutely different from the use of vacuum dryers to remove large quantities of moisture from immature honey. Extraction of water from extracted immature honey is considered a human intervention that interferes with the natural process of maturation, and transforms a product that may not be called honey according to internationally accepted standards into a product that technically better fulfils some of the criteria for honey, thereby clearly constituting an illegal action (Lang and Schwartzinger, 2020). It also results in a significant loss of honey aromatics and flavonoids which are stable at normal atmospheric pressure (Cui *et al*., 2008).

APIMONDIA adheres to the maximum moisture content of 20% established by Codex Alimentarius (1981), which constitutes the practical limit to differentiate mature honey from the immature product. Calluna honey currently being the only exemption.

In summary, according to APIMONDIA, honey is the result of a complex process of transformation of nectar/honeydew that occurs exclusively inside the beehive. Honey is unique because of its production process and its composition.

8. THE IMPACT OF HONEY ADULTERATION

Information coming from global honey trade statistics, official surveys, government activities, and private laboratories on the prevalence of honey fraud, allow us to conclude that fraud mechanisms are responsible for the presence of a very important volume of diluted and/or non-conforming honeys into the market (Dübecke *et al*., 2018; García, 2016)

The current critical crisis of the honey market has an extensive global magnitude, and impacts on both, the price of honey and the viability of many beekeeping operations. A situation has been created where the offered quantities of pseudo honey are virtually unlimited with prices that seem to have no floor. The current crisis of the honey market has led Prof. Michael Roberts to introduce the concept of beekeepers as an "endangered species." (Roberts, 2019).

The Executive Council of APIMONDIA has defined honey fraud as one of the two major challenges to the viability of beekeeping globally. APIMONDIA, as the voice that represents beekeepers around the world, aims to play an increasingly important role in driving solutions to honey fraud in the future.

According to the U.S. Pharmacopeia's Food Fraud Database, honey ranks as the third "favourite" food target for adulteration, only behind milk and olive oil (United States Pharmacopeia, 2018). Similarly, the European Union has identified honey to be at high risk to be fraudulent (European Parliament, 2013).

The European Commission (2018) considers that four essential elements must be present in a case of food fraud:

1. Intentionality,
2. Violation of law (in this case, the Codex Alimentarius definition of honey),
3. Purpose of economic gain, and
4. Consumer's disappointment.

Honey fraud in its five different modes has resulted in at least three visible consequences in the international market:

1. A downward pressure on pure honey prices due to an oversupply of product,
2. A disincentive to produce and export pure honeys by several traditional countries, which have shown significant decreases in their export volumes during the past years, and
3. The appearance of new exporting countries, that re-export cheap imports, straight or in blends, as locally produced (García, 2018).

As long as honey fraud, customs fraud, and the violation of national and international trade laws persist, the wellbeing and stability of beekeepers around the world remains in jeopardy. With only some exceptions, current honey prices paid to the beekeeper are not sustainable. If the current situation of low prices persists, many beekeepers will abandon the activity, and those who decide to continue will not be incentivized to keep their current colony counts.

Honey fraud threatens honey’s image as a natural product and its attractiveness and appeal to consumers, and harms honest beekeeping. It also happens at the expense of consumers who often do not receive the product they expect and pay for. The overall result is a threat to food safety, food security and ecological sustainability.

In order to better understand the magnitude of the problem, we must remember that honey is the best-known product of bees but surely not the most important one. Bees, through their pollination work, are essential for the maintenance of the planet's biodiversity, and absolutely necessary for the pollination of crops that represent 35% of all our food. Moreover, bee pollination is not only important in terms of quantities of produced food but also because many of the pollinator-dependent crops are also among the richest in micronutrients essential to human health (Chaplin-Kramer *et al*., 2014).

9. THE SOLUTION

The strategy to combat honey fraud must include:

- Awareness of the beekeeping community through presentations and publications;
- Awareness of consumers through the media;
- Awareness of retailers and packers on the need to improve testing of honey produced in countries with regulations that do not fulfill the criteria of internationally accepted standards, and whose product could not be exported to countries where those standards apply;
- Awareness and collaboration with national authorities and retailers who should periodically review their honey standards and use the best and most advanced available methods for the detection of honey fraud. The sole use of the official AOAC 998.12 method is no longer sufficient to prevent exposure of consumers and other stakeholders of the honey sector to food fraud. More advanced and powerful methodologies such as Nuclear Magnetic Resonance (NMR) and Liquid Chromatography High Resolution Mass Spectroscopy (LC-HRMS) should be applied to test multiple parameters which are relevant to multiple modes of adulteration.
- Awareness and collaboration with multinational authorities and institutions.
- Full and effective enforcement of all local laws pertaining to food fraud must be encouraged.
- Full implementation of third-party audits in order to verify the compliance of internationally recognized standards, the food safety of the product, the Honey Fraud Management System of the company (which includes a fraud vulnerability assessment and a mitigation strategy), and the traceability of honey back to the apiary and the beekeeper.

10. RECOMMENDATIONS FOR ASCERTAINING AUTHENTICITY OF HONEY

APIMONDIA considers that all beekeepers should strictly follow Good Beekeeping Practices in order to avoid contamination of honey with products used for artificial feeding of beehives. Beekeepers should keep records that document all their treatment and production processes.

Accordingly, each company dedicated to trading, processing, manufacturing, and/or packing honey should have a documented honey fraud management system in place that includes a vulnerability characterization to fraud, a mitigation strategy, and a program for implementation and review.

Some important tools used for the prevention of honey fraud are the traceability of honey, laboratory testing, and auditing systems.

a. Traceability

APIMONDIA recommends that honey should be able to be traced back to the beekeeper, to the botanical floral source from which the bees gathered the nectar, and to the geographic location of the apiary. Traceability should also include transparency of beekeeper's practices. In agreement with HACCP requirements, beekeepers shall keep records that document their production processes and their extraction methods and storage conditions, as consumers demand transparency of the whole supply chain. APIMONDIA considers this an integral part of modern Good Beekeeping Practices. Honey's vulnerability to fraud increases with the complexity of the supply chain, and traceability systems without adequate controls do not preclude the vulnerability to fraud.

Considering the challenges of global trade chains, traceability of honey shall be aligned with standards in the food sector, such as BRC or IFS, which require a Vulnerability Assessment and Critical Control Points (VACCP) be put in place, including organizational as well as analytical measures.

b. Testing

Honey fraud, as other modes of food fraud, is a dynamic phenomenon. Effectiveness of methods to detect honey fraud normally decreases after some time due to the successful learning process on the fraudster's side (Dübecke *et al*., 2018). Ethical stakeholders of honey trade and processing should always go a step forward, and not a step back, in their commitment to minimize the probability of occurrence of fraud by consistently using the best available method/s to detect it.

Many different kinds of syrups are currently available, some of them specially designed to adulterate honey, i.e. syrups were optimized to match certain testing criteria. These syrups display varying patterns of minor components and trace compounds, which are often used as analytical markers. It is practically impossible to have a single and permanent method able to detect all kinds of honey fraud. By contrast, as fraud involves criminal intentions, variations in fraud practices have to be expected.

The importance of applying suitable testing regimes, and not only the methods required by authorities, has to be emphasized due to the dynamic nature of fraud and the limitations of official methods, e.g. the AOAC official method 998.12 "Internal Standard Stable Carbon Isotope Ratio". It is well known that the AOAC official method can detect reliably and sensitive additions of syrups derived from C4-plants, but fails to detect many other types of syrup. The argument of solely using the AOAC method to reduce the vulnerability to fraud because it is the only official method may be deliberately used to whitewash adulterated honey. APIMONDIA does not endorse such practice because it neglects other certain risks and ignores the requirement of establishing a risk-assessment program with the corresponding mitigation strategies in their operations. Hence, using AOAC 998.12 as the sole testing method has to be considered a violation the principles of VACCP required by IFS, BRC and other standards of food sector.

APIMONDIA highly recommends a choice of method/s tailored to each specific situation making risk assessment (including VACCP) a mandatory first step when deciding about tests. In all cases, a proper honey fraud detection strategy should include a powerful screening method like NMR (Bertelli *et al*., 2010, Spiteri *et al*., 2015; Schwarzinger *et al*., 2015) and/or LC-HRMS (Du *et al*., 2015; Senyuva *et al*., 2015). Screening methods have the advantage of monitoring a larger number of parameters in the course of one analysis, thereby addressing multiple aspects of fraud. However, as various methods have strengths and weaknesses, it is advisable to combine methods complementing each other. At the time of preparation of this Statement, this is the case for NMR and LC-HRMS-based approaches in terms of variety and concentration ranges of analyzed molecules, which cover a wide range from traditional quality markers to newly available adulteration markers. For best performance, at this stage all tests shall be carried out in the context of meta information regarding variety, geographical origin, and – if applicable – special purchase specifications.

For many modes of fraud, such combinations of complimentary screening methods will provide clear results.

In case non-conformances or suspicious results (which cannot be ruled out as a response of ever improving fraud practices) are found, other targeted test methodologies may be useful to compliment in order to better clarify the origin of deviations indicative of fraud. Such methods include, but are not limited to, e.g. EA-IRMS, LC-IRMS, honey-foreign enzyme activities, small molecule or DNA-based syrup-specific markers, and honey-foreign oligosaccharides from incomplete starch degradation (see for e.g. Soares *et al*., 2017).

Pollen and organoleptic testing, along with other honey components, are considered good complementary parameters to determine the geographic and botanical authenticity of honey. However, it should be noted that during the last years, cases of purposeful addition of extraneous pollens used to disguise country of origin and floral source of honey have been found (Phipps *et al*., 2015). Care should be taken also for some specific regions where some plants are known to secrete nectar but not pollen. In those cases, pollen analysis must be complimented with geographic location of the beehives, with local beekeepers´ knowledge, and with the apicultural value of the different botanical species. As the NMR test is based on the constituent pattern of a honey, which can be correlated with its botanical and geographical origin, this test may be used to verify variety/origin claims even in the case of honeys that have been filtered or where exogenous pollen has been added.

It is interesting to note that, due to the nature of honey fraud, it is not infrequent that the results of a method may need to be clarified by the use of other alternative tests. In the contemporary context the development of multiple modes of detection of fraud is imperative.

The decision taken regarding the best testing method/s to be used shall always be within the frame of a detailed honey fraud management system (or the VACCP), which should consider the supply chain of the product, the relationship with the supplier, the history of honey adulteration cases from that origin and/or supplier, economic anomalies of the region related to honey, and the most usual modes of production and adulteration currently used in the region of origin. It has to be strongly noted that the election of method/s has to be periodically checked in accordance with new scientific insights, change of regulations, etc.

APIMONDIA supports the development of new techniques to detect honey fraud, available at reasonable costs for the majority of stakeholders, and supports the constitution of an international database of original honeys with a more open exchange of analytical information between the different government, academic and private laboratories specialized in honey analysis.

c. Auditing of Food Fraud Management Systems

As previously stated, APIMONDIA recommends that business stakeholders, who import, export, or process honey have a documented Food Fraud Management System in place.

Audits including anti-fraud measures should be performed on-site during the productive season by professionals who have an adequate knowledge of beekeeping, good beekeeping practices, and honey quality parameters in order to detect eventual deviations in the modes of honey production (e.g. production of immature honey, and artificial feeding during nectar flow) and/or illicit processing technologies that may result in a non-genuine product (e.g. ion-exchange resin technology, vacuum dehumidifiers, and presence of sugar syrups in honey processing facilities). As auditing for fraud aspects deviates from a regular quality audits, auditors have to receive according training too. Such third-party audits should be conducted with absolute independence, integrity and professional expertise.

Audits at the processing facilities should check the Honey Fraud Management System (including the VACCP) of the company, the integrity, traceability, and security of the supply chain. After reviewing raw materials receiving, auditors should inspect the integrity of the process used in processing raw materials (eventual existence of illicit processing technologies), and check mass and financial balances.

Auditors should always take samples at different stages of the production and processing chain for laboratory analysis of honey moisture and purity.

11. CONCLUSION

The crisis provoked by Food Fraud has deepened and broadened. At the same time, awareness of the crisis has grown.

There has never been a period in human history during which the importance of and concern for the world's bees and their keepers has been so widespread. This means the importance and imperative of APIMONDIA's work is acute and encouraging.

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