Authent-Net Commodity Status Report

Commodity: Honey

State of the Art of the commodity:

1. Market Share of Commodity:

European apiculture is a niche sector of agricultural production. Although globally in EU most of the beekeepers are non-professional, the percentage of beehives controlled by professional beekeepers shows differences between countries. For the period 2014-2016, in Mediterranean countries (Spain, Greece and Italy) this percentage was around 80% (40% for EU).

Overall, EU honey production has been increasing slowly with annual variations depending on climatic conditions, bees' health and environmental constraints. With a production of around 250 000 tonnes per year in 2015, the EU is the second largest producer of honey after China. Other main honey producers are Turkey with a steady output increase, Ukraine and the United States of America.

On a global scale, the EU is the largest importer of honey as the EU production covers only 60% of its consumption in 2015. The three main honey producers in the Union are Romania, Spain and Hungary (each one produces around 30 000 tonnes). Other important producing Member States are Germany, Italy, Greece, France and Poland.

2. Process Specificity of commodity (production/welfare):

Honey has a long history of human consumption, and is commonly consumed in its unprocessed state (i.e. liquid, crystallised or in the comb). The FAO/WHO Codex Alimentarius issued STAN 12-1981 (revised in 2001), which outlines the provisions related to the naming, chemical properties, level of contaminants and labelling of honey, among other characteristics.

The European Council Directive 2001/110/EC defines honey and establishes minimum quality standards for honey when placed on the market as honey or used as an ingredient in products intended for human consumption. The regulations generally aim to preserve the purity of honey as an unprocessed raw agricultural product, with limited modifications to its chemical composition. The Directive defines honey as the natural sweet substance produced by Apis mellifera 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 (honeydew), which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in honeycombs to ripen and mature.

The colour and flavour of honeys differs depending on the nectar source, age, and storage conditions. Honey made primarily from one type of flower is called monofloral honey, whereas honey made from several types of flowers is called polyfloral honey. Monofloral honey typically has a high commercial value in the marketplace due to its distinctive flavour. However, most commercially available honey is a blend of honeys differing in floral source and geographic origin.

The composition of honey is rather variable and depends primarily on its floral and geographical source, but certain external factors, such as processing, packaging and storage conditions, also play an important role. Sugars are the main components of honey. The nectar and sugar rich secretions, respectively, are transformed into honey by the bee enzymes diastase (amylases) and invertase (α-glucosidase) during storage and maturation in the beehive. During this process, diastase and invertase catalyse the conversion of the sugars of nectar and honeydew into fructose and glucose, the main constituents of honey. The result is a complex mixture made up of about 70% monosaccharides and 10-15% disaccharides composed of glucose and fructose with the glycosidic bond in different positions and configurations. In addition, there are also minor components consisting of about 25 oligosaccharides.

As nectar flows can vary strongly from region to region and according to the season, additional feeding at certain moments could be necessary to maintain breeding activities and to meet food requirements. When this feeding consists of sugar of external origin, the harvesting of honey is forbidden at this stage and reflects bad beekeeping practices.

3. Trade of Commodity:

In 2015, the EU imported around 200 000 tonnes of honey, representing in volume around 75% of EU total production. Half of these imports came from China (around 100 000 tonnes). The other two main suppliers were Mexico and Ukraine. It is important to note the increase of honey suppliers from another non-EU countries (Argentina, Uruguay). Honey imported from third countries is much cheaper than honey produced in the EU. In 2015, the average import unit price for Chinese honey was 1.64 €/kg while the average EU price of multi-floral honey sold in bulk at wholesalers was 3.78 €/kg. Due to higher production costs EU producers can hardly compete with imported honey.

The EU exported 18,000 tonnes of honey in 2015. Germany (29%) and Spain (25%) were the main exporting countries.

In relation to distribution channels, in Spain in 2015, more than 60% of the honey was distributed in supermarkets and hypermarkets, 10% at specialized establishments, and 7% is used for self-consumption. In 2015 Spain imported 30 600 tonnes, a 25% increase in relation to the previous year. China is the first origin of Spanish imports (60%), and the second country is Poland. In 2016, the local Spanish market showed a stabilization.

Key KNOWN Authenticity Issues with this commodity (links)

List of known beef authenticity issues by topic

1. Addition of sugar (syrups) from non-honey origin.

The simplest way to adulterate honey involves the addition of sugar (syrups) directly to honey. Honey adulteration has evolved from the basic addition of sucrose and water to specially produced syrups which mimic the sugar composition of natural honey. For instance, the addition of fructose or industrial glucose could change the fructose /glucose ratio, which has to be 1 – 1.2 in pure honey. Moreover, some other carbohydrate ratios could be used to ascertain honey authenticity.

2. Mixtures of industrial honeys with harvested honeys.

This practice is not allowed for direct human consumption. Industrial honey has different characteristics and must be used as a complement in other industries.

3. Mixtures of honeys of known origin with another honeys.

Mixture of honeys from different origin is not forbidden, but could be considered a fraudulent practice in labelling of certain honeys from a specific origin.

4. Bee feeding products from an external origin.

The traditional substitute for honey is a sucrose solution. As a rule, sugar and water are mixed in a 3:2 ratio or, less frequently on a 1:1 basis. Different sucrose based bee feeding products exist varying in their composition (e.g. mainly sucrose or sucrose and its building blocks, fructose and glucose) and depending on their uses (e.g. winter feeding, spring stimulation feed or early winter feeding). Next to sucrose a number of sweeteners and sugar syrups are commercially available for feeding bees: syrups made from starch (corn, wheat and rice), sugar cane, sugar beet, agave or syrups of natural origin such as maple. They contain in variable proportion a mixture of several sugars (glucose, fructose, maltose, maltotriose, dextrins, etc) and their price is usually very competitive. Correct beekeeping practice should ensure that sugars used to feed bees do not adulterate honey.

5. Labelling polifloral honey as monofloral.

Existing relevant information on methods:

1. Relevant ISO standards:

ISO 11035:1994 Sensory analysis -- Identification and selection of descriptors for establishing a sensory profile by a multidimensional approach

https://www.iso.org/standard/19015.html

2. Other international laboratory methods:

2.1. Chemical methods:

Different chromatographic techniques have been developed for the detection of adulterated honey including thin-layer chromatography [1], gas chromatography−mass spectrometry [2] and high-performance liquid chromatography with electrochemical and evaporative light scattering detection [3, 4]. Markers of honey adulteration include difructose anhydrides (DFAs) [2], polysaccharides [5] and 2-acetylfuran-3-glucopyranoside (AFGP) [6] based on the type of syrup used for the adulteration of honey. However, these methods require complex sample preparation and are highly time-consuming. Alternatively, methods based on spectroscopy, notably nuclear magnetic resonance (NMR), have been proposed as screening methods [7].

1. Puscas, A., A. Hosu, and C. Cimpoiu, Application of a newly developed and validated high-performance thin-layer chromatographic method to control honey adulteration. Journal of Chromatography A, 2013. 1272(0): p. 132-135.

2. Ruiz-Matute, A.I., et al., A New Methodology Based on GC−MS To Detect Honey Adulteration with Commercial Syrups. Journal of Agricultural and Food Chemistry, 2007. 55(18): p. 7264-7269.

3. Wang, S., et al., Detection of honey adulteration with starch syrup by high performance liquid chromatography. Food Chemistry, 2015. 172(0): p. 669-674.

4. Zhou, J., et al., Analysis of maltooligosaccharides in honey samples by ultraperformance liquid chromatography coupled with evaporative light scattering detection. Food Research International, 2014. 56: p. 260-265.

5. Megherbi, M., et al., Polysaccharides as a Marker for Detection of Corn Sugar Syrup Addition in Honey. Journal of Agricultural and Food Chemistry, 2009. 57(6): p. 2105-2111.

6. Xue, X., et al., 2-Acetylfuran-3-Glucopyranoside as a Novel Marker for the Detection of Honey Adulterated with Rice Syrup. Journal of Agricultural and Food Chemistry, 2013. 61(31): p. 7488-7493.

7.Spiteri, M., et al., Fast and global authenticity screening of honey using 1H-NMR profiling. Food Chemistry, 2015. 189: p. 60-66

2.2. Isotopic methods.

Cabañero, A.I., J.L. Recio, and M. Rupérez, Liquid Chromatography Coupled to Isotope Ratio Mass Spectrometry: A New Perspective on Honey Adulteration Detection. Journal of Agricultural and Food Chemistry, 2006. 54(26): p. 9719- 9727.

AOAC, AOAC official method 998.12 C-4 plant sugars in honey: Internal standard stable carbon isotope ratio method - First action 1998, in AOAC Official Methods of Analysis. 2010. p. 33-36.

AOAC official method 978.17, for detecting adulteration for addition of sugar C_4

AOAC official method 991.41, for comparing carbon isotopic ratio of protein and honey (detection limit 7%)

2.3. Determination of geographical and botanical origin: pollen analysis

Werner von der Ohe, guest editor. Extra issue on European unifloral honeys. Apidologie, 35 Suppl. 1 (2004) S1-DOI: https://doi.org/10.1051/apido:2004060

Livia Persano Oddo and Stefan Bogdanov. Determination of honey botanical origin: problems and issues. Apidologie, 35 Suppl. 1 (2004) S2-S3 DOI: https://doi.org/10.1051/apido:2004044

Werner Von Der Ohe, Livia Persano Oddo, Maria Lucia Piana, Monique Morlot and Peter Martin. Harmonized methods of melissopalynology. Apidologie, 35 Suppl. 1 (2004) S18-S25 DOI: https://doi.org/10.1051/apido:2004050

Livia Persano Oddo, Roberto Piro, with the collaboration of, Étienne Bruneau, Christine Guyot-Declerck, Tzeko Ivanov, Jirina Piskulová, Christian Flamini, Joel Lheritier, Monique Morlot, Harald Russmann, Werner Von der Ohe, Katharine Von der Ohe, Panagiota Gotsiou, Sophia Karabournioti, Panagiotis Kefalas, Maria Passaloglou-Katrali, Andreas Thrasyvoulou,, Angeliki Tsigouri, Gian Luigi Marcazzan, Maria Lucia Piana, Maria Gioia Piazza, Anna Gloria Sabatini, Jacob Kerkvliet, Joana Godinho, Antonio Bentabol, Alberto Ortiz Valbuena, Stefan Bogdanov and Kaspar Ruoff. Main European unifloral honeys: descriptive sheets. Apidologie, 35 Suppl. 1 (2004) S38-S81. DOI: https://doi.org/10.1051/apido:2004049

Livia Persano Oddo, Lucia Piana, Stefan Bogdanov, Antonio Bentabol, Panagiota Gotsiou, Jacob Kerkvliet, Peter Martin, Monique Morlot, Alberto Ortiz Valbuena, Kaspar Ruoff and Katharine von der Ohe. Botanical species giving unifloral honey in Europe. Apidologie, 35 Suppl. 1 (2004) S82-S93. DOI: https://doi.org/10.1051/apido:2004045

3. Relevant Hungarian standards:

MSZ 6926_1981 Méz mintavételi módszerei fizikai kémia.pdf

MSZ 6943-6-1981 Méz diasztáz.pdf

Méz pollenvizsgálat szabvány.pdf

MSZ 6943-5-89 Méz HMF meghatározás.pdf

MSZ 6943-1-79 Méz víz és szárazanyagtartalom meghatározás.pdf

MSZ 6943-4-82 Méz cukortartalom meghatározás.pdf

MSZ 6943-4_1982 Méz kémiai és fizikai vizsgálata - Cukortartalom maghatározása II.pdf

MSZ 6943-4_1982 Méz kémiai és fizikai vizsgálata - Cukortartalom meghatározása I.pdf

MSZ 6943-5_1989 Méz kémiai és fizikai vizsgálata - Hidroxi-metil-furfurol-tartalom (HMF) meghatár.pdf

MSZ 6943-3_1980 Méz kémiai és fizikai vizsgálata - Savfok és pH meghatározása.pdf

MSZ 6943-1_1979 Méz kémiai és fizikai vizsgálata - Víz-, illetve szárazanyag tartalom meghatározá.pdf

MSZ 6943-2_1980 Méz kémiai és fizikai vizsgálata - Vízben oldhatatlan szilárd anyagok és hamutar.pdf

MSZ 157_1982 A méz érzékszervi vizsgálata I.pdf

MSZ 157_1982 A méz érzékszervi vizsgálata II.pdf

Official Bodies/ Countries involved in control funding of this commodity:

International:

- European Council Directive 2001/110/EC (modified by 2014/63/EC) relating to honey

  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:010:0047:0052:EN:PDF

National:

Hungary: National Food Chain Safety Office as central competent authority

https://www.nebih.gov.hu/en/

Spain: Royal Decree (RD) 1049/2003 (modified by RD 473/2015): Quality Standards of Honey

https://www.boe.es/boe/dias/2003/08/05/pdfs/A30181-30183.pdf

Gaps:

1. Update the EU Directive as a tool in the authenticity control of European honey
2. Control aspects in relation to filtering (limits for grid size)
3. Control of imported products related with plant or geographical origin or authenticity
4. Harmonized protocols for definitions of types of monofloral honeys
5. Development of methodologies for detection of lower limits of sugars from non-honey origin (C_3 and mixed)
6. Control of industrial honeys to prevent deviations to direct consumption
7. Harmonize European labelling of honeys in relation to country of origin