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# The Current Situation on the International Honey Market

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# The Current Situation on the International Honey Market

**Norberto L. García**

## Introduction

Global beekeeping is currently affected by many adverse factors that threaten its sustainability. The advance of agriculture, the destruction of natural environments, the contamination of bee forage lands with pesticides, the appearance of new bee diseases, and the increasing average age of beekeepers have affected beekeeping activities during the last few decades. Additionally, honey fraud has become a phenomenon that is nearly out of control. According to the US Pharmacopeia's Food Fraud Database, honey ranks as the third "favorite" food target for adulteration, ranking only behind milk and olive oil (United States Pharmacopeia, 2018). As long as economically motivated adulteration, customs fraud, and the violation of international and national trade laws persist, the well-being and stability of the world beekeeping community remain in jeopardy.

This article will first review the biological foundations that make honey a unique product of nature, the main regulations regarding its purity, and the generally recognized forms of honey adulteration. In the second part of this article, statistical information regarding the world honey trade will be presented in order to describe current tendencies, regional peculiarities, and detect possible abnormalities. Statistical information can be used as a valuable tool by authorities to more efficiently investigate and combat the scourge of honey adulteration, which takes on diverse forms and magnitudes depending on the source countries and import markets.

Trade data used in this article were sourced from International Trade Centre – UNComtrade – Argentine Chamber of Exporters (CERA)'s High Performance Platform.

## Authentic vs. adulterated honey

Honey is a miraculous product, the fruit of a unique interaction between the plant and animal kingdoms. Plants and bees co-evolved over 100 million years to create this complex and healthy product, which contains around 200 different substances. Honey is mainly composed of sugars, but also contains many other substances, such as proteins and enzymes, amino acids, organic acids, vitamins, minerals, phenolic, and volatile compounds (Da Silva, Gauche, Gonzaga, Oliveira Costa, & Fett, 2016; De-Melo, de Almeida-Muradian, Sancho, & Pascual-Maté, 2018). Water, the second largest component of honey, influences some of its important physical properties, such as viscosity, crystallization, color, flavor, taste, specific gravity, solubility, and conservation (Escuredo, Míguez, Fernández-González, & Seijo, 2013).

The Codex Alimentarius (1981), the internationally accepted standard for foods, defines honey as "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". And then adds: "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… No pollen or constituent particular to honey may be removed except where this is unavoidable in the removal of foreign inorganic or organic matter". The European Honey Directive 2001/110/EC (2001) is in complete alignment with Codex Alimentarius regarding this last restriction.

To gather a full crop load of nectar, a bee forager visits up to 1,000 flowers, and may make around 10 trips per day (Gary, 2015). Once the nectar has been passed on to food-storing bees, a long process begins within the hive that turns this nectar into honey. Food-storing bees ripen nectar by manipulating it many times, and finally deposit the liquid in a honey storage cell, which is capped once it is full.

The transformation of nectar into honey requires the following steps (Crane, 1980):

- Addition of enzymes by foraging and storing bees: invertase, diastase, glucose oxidase, and phosphatases.
- Addition of other substances that originate in the bee's salivary glands.
- Lowering the pH through the production of acids in the honey stomach of the bee.
- Changes to the chemical composition, especially the sugar ratios.
- Evaporation of water. The water content of nectar may be as high as 80%, while the humidity of honey should be between 16% and 20%.

This transformation of nectar into honey starts while the foraging bees complete their load of nectar in the field (Nicolson & Human, 2008) and finishes inside the hive. The allocation and relocation of the content of many cells before final storage is part of the ripening process, which concludes when cell capping begins (Eyer, Neumann, & Dietemann, 2016).

A division of labor exists between foraging and food-storing bees in a colony, and the colony can adapt the nectar collecting rate by stimulating non-foragers to become foragers (Seeley, 1995). If honey is harvested by the beekeeper when still unripe, the work of non-foragers is reduced, and they can become foragers at an earlier age, thus, increasing the harvesting capacity of

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the colony and giving an unfair economic gain to the producer.

Asian beekeepers frequently harvest unripe honey with high water content, which as explained before means higher yields and diminished costs. This production system makes "honey factories" absolutely necessary. These factories firstly filter, dilute, and eliminate residues, and finally dehumidify and pack the product. The process of drying and maturation partially happens in a factory instead of inside the hive. The resulting product seems not to be hazardous to the consumer's health but does not have some of the positive properties cited for honey. The production of honey by bees is indeed a long and laborious process that man can imitate but never emulate.

Furthermore, the method of processing described above is not in accordance with the Codex Alimentarius (1981), because this prohibits the intrusion or extraction of any substance from honey, as opposed to the activities of the bees themselves.

The Chinese mode of honey production is more in accordance with their own honey standard (National Standards of People's Republic of China GB 16740-2014, 2015), which defines honey as "a natural sweet substance produced through fully brewing when the nectar, secretion and sweet deposits from plants are gathered, mixed with the secretion of their own, modified and stored in the honeycomb by honey bees". The words "produced through fully brewing" seem ambiguous, and nothing is said about the impossibility of adding or extracting substances from honey.

The "Slow Honey" concept launched by Haefeker (2018), as opposed to the "Quick Honey" model developed in Asia, emphasizes the importance of preserving the natural process of honey ripening. Only the unique, natural transformation of nectar into honey made by bees, which may take several days under natural conditions, guarantees the final physical, biochemical, and healthy properties of honey.

The temptations for honey adulterators have increased in recent years because of the higher prices of honey compared to adulterants, and the obsolescence of official methods to detect instances of fraud. The current version of the phenomenon has a tremendous magnitude and impacts both the price of honey and the viability of the beekeeping industry (García, 2016).

According to the US Food and Drug Administration (FDA), economically motivated adulteration (EMA) is the fraudulent, intentional substitution or addition of a substance for the purpose of increasing the apparent value of the product or reducing the cost of its production, i.e., for economic gain. EMA is often referred to as food fraud. In a broad sense, EMA in food is considered to include knowingly selling any food product that does not meet standards (Strayer, Everstine, Kennedy, 2014).

Different forms of honey adulteration can currently be found (Dübecke et al., 2018):

1. Intentional dilution with cheap syrups (corn, rice, beet, etc.).
2. Extracting immature honey and dehumidifying it by mechanical means.
3. Use of ion exchange resins to remove residues and lighten honey color.
4. Masking the geographical and/or botanical origin of honey.
5. Feeding hives during a nectar flow.

Elemental Analysis Isotope Ratio Mass Spectrometry (EA-IRMS), developed some 25 years ago, is still the official method of the main import countries for adulteration detection and is effective for the detection of honey adulteration with syrups from C4 plants like corn or sugar cane. However, the recent use of other syrups made from C3 plants (mainly from rice) to adulterate honey has made the detection of fraud much more difficult, since these are undetectable by EA-IRMS. Sugar syrups made from rice are normally produced in Asia but are also available in many countries of the world that import those syrups, including some honey export countries (Figure 1). Nowadays, there are two possible testing strategies that can be used to detect the addition of C3 sugars in honey:

- Nuclear magnetic resonance (NMR).
- A combination of targeted methods, which are used to examine a single or a small number of highly specific parameters, e.g., honey-foreign enzymes, syrup-specific markers, honey-foreign oligosaccharides, artificial food ingredients, and acids indicative for invert sugar.

The limitations of these targeted methods are that their effectiveness in terms of detecting honey adulteration normally decreases over time due to the successful learning process on the fraudster's side (Dübecke et al., 2018). The NMR is the most powerful single

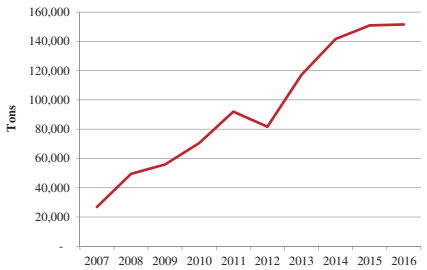


**Figure 1.** China exports of fructose and related products (code 170260) and artificial honey and related products (code 17029000) to the top 25 honey-export countries.

technique that is used to detect the five different forms of honey adulteration described above, and it is sophisticated enough to keep fraudsters from cheating it easily. This technology can be used to perform not only a targeted analysis of many substances in honey, including the traditional quality parameters, but additionally offers the possibility of performing an untargeted detection of many substances in a single analysis, providing a "fingerprint" of the honey sample (Dübecke et al., 2018).

### *Honey imports*

Global honey consumption has steadily increased over the past decades for two main reasons: (i) the increase in the world population, and (ii) the preference toward natural foods by a growing number of consumers, including young people. As the world population and the demand for natural and healthy products increase, many countries cannot meet their honey demand with domestic production and need to import increasing volumes from export countries. In addition, some honey-import countries require large quantities of cheap honey from the international market to re-export it, probably in some cases, as locally produced. The US, Germany, Japan, the UK, and other European countries currently lead the ranking of honey-import countries (Table 1).

Since 2010, net global honey demand has grown at a rate of 19,504 tons per year (García, 2016). Net honey imports result from subtracting exports from total imports for each import country. By examining net import data, we can gain a more accurate estimate of honey demand linked to the consumption in each country. Import and re-export activities are, hence, excluded. However, honey consumption is still far from reaching its immense potential. A new positive agenda has to emerge among so many worrisome messages,

**Table 1.** World top 25 honey import countries during 2016.

| Country | Imported honey (Tons) |
|---|---|
| USA | 166,477 |
| Germany | 81,959 |
| Japan | 48,445 |
| U.K. | 41,135 |
| France | 35,433 |
| Spain | 27,988 |
| Belgium | 26,509 |
| Poland | 23,869 |
| Italy | 22,568 |
| The Netherlands | 16,348 |
| Saudi Arabia | 12,185 |
| Australia | 9,927 |
| UAE | 8,487 |
| Switzerland | 7,865 |
| Austria | 7,490 |
| Canada | 6,560 |
| Denmark | 6,094 |
| China | 6,032 |
| Portugal | 5,675 |
| Taiwan | 5,531 |
| Sweden | 4,813 |
| Hong Kong | 4,259 |
| Ireland | 4,086 |
| South Africa | 3,986 |
| Malaysia | 3,668 |

and we must fully develop and market the health benefits of different honeys.

### *The US market*

The US honey import market has grown constantly and steeply. During the last years, the US domestic honey production decreased at a rate of 705 tons/year, while honey imports increased at a rate of 6,956 tons/year (Figure 2). Domestic production only met 25% of total US honey demands in 2017. The US honey imports have shown a changing pattern after the "Honeygate", the investigation of illegal importation of honey from China led by the US authorities, i.e., after 2008. In 2012, the five main honey-export countries from the Americas (Argentina, Brazil, Canada, Mexico, and Uruguay) represented 62% of total US imports, while in 2017, the US only imported enough honey to meet 41% (84,003 tons) of its total demand from these five countries. In 2017, India, Vietnam, Ukraine, Thailand, and Taiwan provided 53% (107,104 tons) of the total US honey imports.

The lack of a US standard for honey and the need to update the official controls

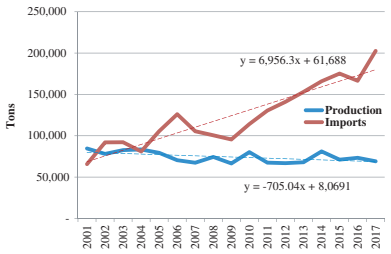


**Figure 2.** Evolution of US honey production and imports from 2001 to 2017. Dotted lines and equations were obtained by linear regression.

for honey adulteration are opening the doors to a risky shift in the US consumer honey market in terms of honey quality and protection. Fortunately, current and developing attempts by the USDA and the US Pharmacopeia to establish honey standards offer hope regarding the future of this important market.

### *The EU market*

Over the last 15 years, EU honey imports grew at an average rate of 10,284 tons/year, with China being the main source of that increase in imports (Figure 3). The prices paid by EU countries for Chinese honeys are quite heterogeneous, which could be related to the different quality requirements by importers (Table 2). A high price does not guarantee honey purity, but cheap honey, indeed, has a higher probability of being adulterated. The import price can, thus, provide the first indication of a lack of honey quality and should drive the need for further studies to investigate the purity of the product.

The UK honey import market constitutes a clear case of honey substitution from other regions by importing increasing volumes of relatively inexpensive Chinese honey (Figure 4 and Table 2).

As discussed later in this article, the importation of cheap honey and its possible re-exportation by some European countries has increased the chances of masking the geographical origin of some

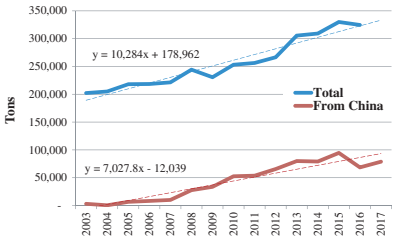


**Figure 3.** EU honey imports total and from China from 2001 to 2017. Dotted lines and equations were obtained by linear regression.

**Table 2.** Unit prices of Chinese honey (January–October 2017).

| Import country | USD/kg |
|---|---|
| Sweden | 2.49 |
| Ireland | 2.22 |
| Belgium | 2.20 |
| Lithuania | 2.18 |
| Germany | 2.13 |
| World Average | 2.09 |
| Romania | 2.09 |
| The Netherlands | 2.04 |
| Spain | 2.02 |
| Portugal | 2.00 |
| Poland | 1.98 |
| Italy | 1.89 |
| Croatia | 1.85 |
| UK | 1.83 |
| Bulgaria | 1.76 |

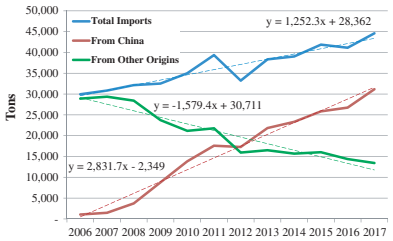


**Figure 4.** Evolution of UK honey imports. Dotted lines and equations were obtained by linear regression.

honeys. Honey labeling rules are not homogeneous throughout the EU. Efforts should be made to encourage all countries to create labeling regulations that require the declaration of all geographical origins of honeys contained in a jar. In this way, all European consumers would have the same opportunities to know what they have chosen and paid for.

In 2015, the European Commission started a coordinated monitoring plan to study the prevalence of adulterated honeys in the European market. In December 2016, the results were published. The first report showed that 15% of samples were noncompliant with the Honey Directive 110/2001.

The samples recognized as compliant were then sent to the Commission's Research Center for further examinations with LC-IRMS, a method that couples high-performance liquid chromatography with isotope ratio mass spectrometry. Test results showed that 14% of the samples contained added sugars (European Commission, 2016), although LC-IRMS can only be used

to detect some types of adulteration. These results potentially underestimate the real problem of honey adulteration in the EU, since neither NMR nor other, newer, targeted tests that can be used to detect honey adulteration were actually used. The NMR requirements set forth by some European retailers and the extraordinarily large 2016 honey harvest in Argentina caused a reduction in Chinese honey imports by these European countries in 2016. However, EU imports from China increased once again in 2017 (Figure 3).

### *The Japanese market*

The third most important honey-import market, Japan, mainly imports Chinese honey for industrial use, but this tendency is decreasing. Nevertheless, Japan has been increasing its honey imports from Argentina, Canada, and Hungary mainly for direct table consumption (Figure 5).

### *Honey Exports*

The aforementioned increased demand for honey has, in turn, led to an increase in global honey exports, which have grown at an average rate of about 30,000 tons per year (García, 2016). In order to gain a better understanding of the different profiles or models of honey-exporting countries, the evolution of export volumes for each of the 25 major exporting countries during the last 10 years was studied (Table 3 and Figure 6).

As might be expected, export volumes have increased in some countries but decreased in others over the last 10 years. The average annual variation of honey exports for each country was calculated by linear regression in order to compare the changes in the export volumes (Figure 6).

The most extreme average annual variations were shown by China (average increase of 8,281 tons per year) and Canada (average decrease of 1,019 tons per year).

Differences in the profiles or groups among the 25 major honey export countries can be found when considering the recent changes in their honey trade, export–import traditions, modes of production, and exported honey types:

- Group 1: Eastern countries that have shown significant increases of their honey export volumes (Figure 6, bars in red).
- Group 2: Countries like Belgium, Poland, Spain, Italy, Portugal, Bulgaria, and Romania, which have shown increases in both exports and imports volumes during recent years (Figure 6, bars in blue).
- Group 3: Countries that mainly export bottled honey, such as Germany, USA, France, and Australia, which have not shown a marked increase in their export volumes during recent years. These countries are considered net honey importers (Figure 6, bars in violet).
- Group 4: Countries like New Zealand and Brazil that mainly export specialized products, like Manuka and organic honeys (Figure 6, green bars).
- Group 5: Traditional conventional honey export countries such as Argentina, Mexico, Canada, Hungary, Uruguay, Cuba, and Chile, which have shown only moderate growth rates (Mexico) or decreases in the export volume rates and prices during recent years (Figure 6, yellow bars).

This country grouping is carried out primarily to provide the reader with a better understanding and characterization of different honey-export models. However, it should be noted that this characterization implies generalizations which, of course, are always accompanied by exceptions or influenced by the different behaviors of export companies within each country.

### *Group 1: Eastern honey export countries*

Asian countries have responded to the growing global demand for honey with massive exports of low-priced products. A group of five countries (China, India, Ukraine, Vietnam, and Thailand) experienced an increase in their total exports of 21,241 tons per year (Figure 7), with individual rates of increase ranging from 8,281 tons/year (China) to 1,385 tons/year (Thailand) (Figure 6, bars in red). These honey export increases have occurred without parallel growths in the number of hives, and it is impossible to attribute that change to improvements in hive productivity. The increase is also striking given the environmental degradation of land and water systems in India and China (García, 2016; García & Phipps, 2018; Phipps, 2016). Obviously, adulteration might be a likely explanation for such an increase in export volumes.

In addition, some Asian countries like Thailand increased their honey exports (mainly to the US) by increasing their

**Table 3.** World top 25 honey export countries in 2016.

| Country | Exported honey (Tons) |
|---|---|
| China | 128,330 |
| Argentina | 81,183 |
| Ukraine | 54,442 |
| Vietnam | 42,224 |
| India | 35,793 |
| Mexico | 29,098 |
| Spain | 26,874 |
| Germany | 25,325 |
| Brazil | 24,203 |
| Belgium | 20,816 |
| Hungary | 18,805 |
| Canada | 17,954 |
| Poland | 13,731 |
| Romania | 10,371 |
| New Zealand | 9,626 |
| Bulgaria | 8,894 |
| Thailand | 8,267 |
| Italy | 7,815 |
| Uruguay | 7,716 |
| USA | 7,405 |
| Chile | 7,137 |
| Portugal | 6,901 |
| Cuba | 5,543 |
| France | 5,079 |
| Australia | 4,457 |

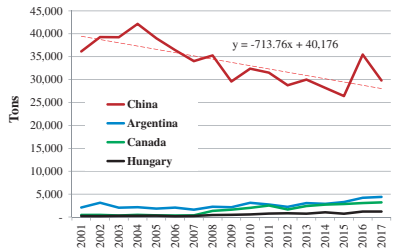


**Figure 5.** Evolution of Japan honey imports from different origins from 2001 to 2017. Dotted line and equation obtained by linear regression.

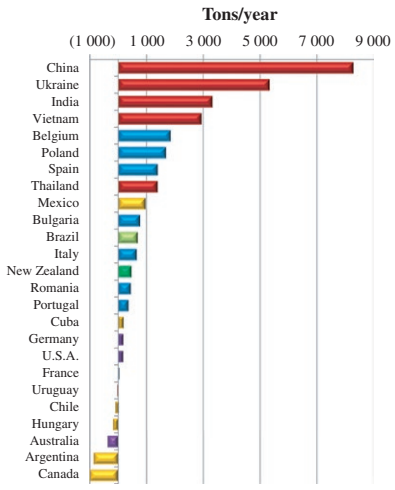


**Figure 6.** Average annual variation of honey exports of the top 25 honey export countries during the last 10 years.

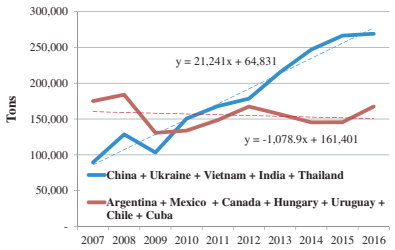


**Figure 7**. Evolution of total honey exports by five eastern and seven traditional honey export countries. Dotted lines and equations were obtained by linear regression.

imports of Chinese honey, thus, generating new possible routes of transhipping to the US, where companies importing Chinese honey must pay very high antidumping duties (True Source Honey, 2015). Experience has shown that this "Honey factory model", although attractive at the beginning, is really perverse, especially for honest beekeepers of all nationalities. The use of cheap adulterated honeys, with its initial profits, tempts many new actors. Competition then pushes them to use increasing percentages of that cheap honey in their blends in order to maintain profits and achieve market dominance. Equilibrium is finally reached when the use of the cheap product is maximized, profits disappear, and the cycle concludes with packers/traders having to deal with a low-price food that has serious quality problems and being engaged in operations that are borderline illegal. During this entire process, honest beekeepers receive less and less money for their pure honey, causing many of them to abandon their operations.

The honey-export explosion from the Eastern countries has resulted in at least three visible consequences on the international market: (i) downward pressure on pure honey prices as a result of the product's oversupply, (ii) the disincentive to produce and export pure honeys by several traditional countries, which have shown significant decreases in their export volumes over the past 10 years, and (iii) the appearance of new important exporters, which may re-export those cheap imports, straight or in blends, as locally produced.

### *Group 2: Re-exporting European countries*

The heterogeneity of honey prices according to their geographic origin may have constituted an incentive for several EU countries to import honey from cheap origins and then re-export it as produced locally (García, 2016). Probably the most outstanding cases are Spain, Belgium, Poland, Italy, and Portugal, which have shown a 200% increase of their total honey export volumes over the last 10 years (25,362 tons in 2007 compared to 76,137 tons in 2016). That increase cannot be explained by an increase of their number of beehives, which only grew by 2.7% over that period according to FAOSTAT (2018) and also cannot be explained by an increase in the productivity per hive given the increasing difficulties faced by beekeepers when trying to achieve good honey crops in Europe. This important increase in the export capacities of those five EU countries can be explained with 95% certainty ($R^2$ = 0.9524) by the increase in honey imports from eastern countries like China and Ukraine (Figure 8).

As explained before, masking the geographical origin of honey is one form of honey adulteration. Authorities in honey import and export countries should re-evaluate and improve their traceability systems and their methods of testing the geographical origins of honeys in order to more effectively protect consumers from this type of fraud.

### *Group 3: Export countries of bottled honey*

As opposed to the previous model, there are other countries, also net importers of honey, which have shown low rates of export increases, such as Germany, USA, and France. In Australia's case, there is indeed a decline (Figure 6). These countries have shown respect for the traceability of the product and have not taken advantage of short-term economic advantages by boosting their honey exports through re-exportation of imported honey.

### *Group 4: Export countries of special honeys*

Within the context of some honey-exporting countries experiencing great difficulties, we can focus on the cases of New Zealand and Brazil, which have exhibited interesting increases in both their export volumes (Figure 6, green bars) and prices (Table 4), thanks to the clear differentiation and creative marketing strategies for their honey products. New Zealand has magnificently developed and marketed Manuka honey (Cramp, 2013), while Brazil has globally led the export of organic honey. Mexico has also expanded its exports of organic honey. These countries have shown a sustained growth in their honey exports during the last few years, and they constitute a model that demonstrates that a positive growth in honey exports can be achieved by marketing special honeys. Of course, niche markets usually demand limited quantities of honey, require years of marketing effort, development, and investment, and are not a solution for all beekeepers.

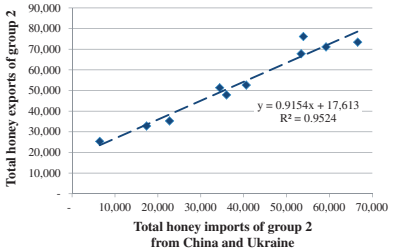


**Figure 8**. Relationship between total honey exports from 5 EU countries (Belgium, Italy, Poland, Portugal, and Spain) and total honey imports from China and Ukraine between 2007 and 2016. Dotted line and equation obtained by linear regression.

### *Group 5: Traditional export countries of conventional honey*

The main traditional export countries of conventional honey in America and Europe (Argentina, Mexico, Canada, Uruguay, Hungary, and Chile) have suffered from the growing honey exports from Eastern countries (Figure 6, in yellow and Figure 7). These traditional countries' commitment has been to export pure honey with various high-quality parameters, including traceability. However, this group of countries should urgently review their approaches and objectives, because their export model is obviously no longer working as it did previously. Some important import markets apparently fail to reward their efforts to produce and export conventional and high-quality pure honeys.

Although it mixes unit prices of bulk and bottled honey in some cases, Table 4 presents a general picture of prices obtained from the different groups of countries.

**Table 4**. Average unit prices of honeys from different countries or groups of countries in 2016.

| Exporters | Export unit value USD/Ton |
|---|---|
| New Zealand | 21,415 |
| Group 3 | 5,754 |
| Brazil | 3,802 |
| Group 2 | 3,443 |
| Group 5 | 2,860 |
| Group 1 | 2,051 |

Manuka honey should be an inspiring case study for these conventional honey exporters. They should develop other honeys with special properties or benefits to human health. The health halo of honey is a historical phenomenon, and we now need to romanticize honey and utilize advanced modern science to investigate and substantiate the variety of health benefits pertaining to honey. The honey industry should also gain from the experiences of other industries like tea, wine, coffee, nuts, etc.

## Conclusions

The constant increase in production costs, the diminishing honey yields per hive due to the growth of industrial agriculture, and decreasing prices leading to diminished profits combine to make honey production economically unattractive in many cases. Somehow, the countries which are mainly focused on the production of pure honey for export seem to be succumbing to the export model employed by Eastern countries. This, in turn, is a model that has been adopted by many importers and packers in different countries, because it results in short-term gains and low prices on the shelves. All this goes against attempts to defend honey's image as a natural product and efforts to protect honest beekeeping as an essential component of a company's social responsibility practices. It also happens at the expense of consumers, who often do not receive the product they pay for. The overall result is a threat to food safety, food security, and ecological sustainability.

Countries like New Zealand and Brazil have developed more successful models of differentiated honeys that could at least be partially imitated by conventional honey producers. The process will probably require some years and may not work in all instances.

The sustainability of the honest beekeeping industry requires: (i) the creation of a positive agenda, (ii) more scientific research on honey properties related to human health, (iii) marketing and promotion of the health properties of honeys, (iv) providing consumers with a deeper awareness of the benefits and values of honey products; (v) new uses of honey in foods, (vi) the constitution of a world honey reference collection, (vii) more open databases for honey laboratories, (viii) harmonization and validation of honey adulteration tests by national authorities, (ix) continual research on screening techniques, (x) the harmonization of honey standards, (xi) improvements in the traceability systems, (xii) better and more harmonized labeling regulations, and (xiii) a constant fight against honey adulteration, which should include both the media and legal authorities when necessary.

This important challenge can only be met by a joint and collaborative effort of beekeepers, honest traders, scientists, private and public laboratories, and legal authorities. The environment, honey consumers, and beekeepers deserve protection!

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