

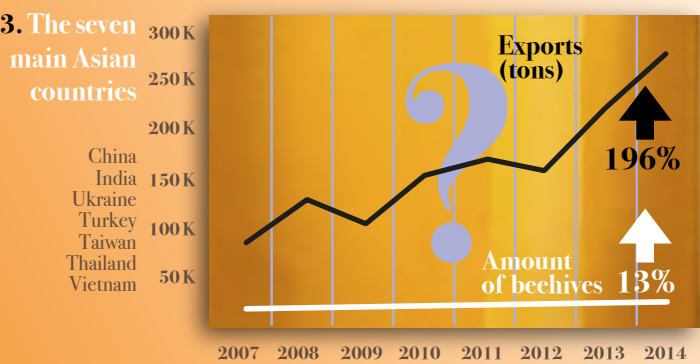
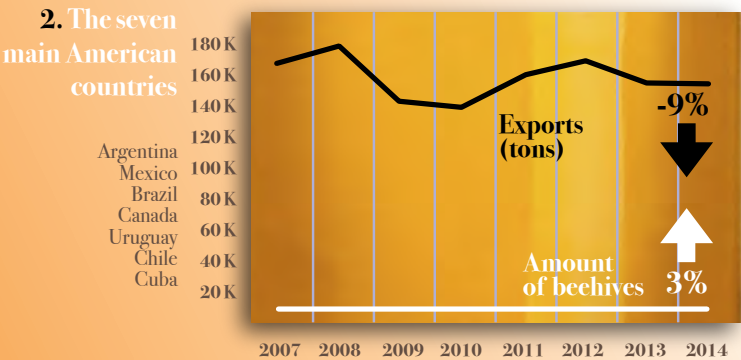
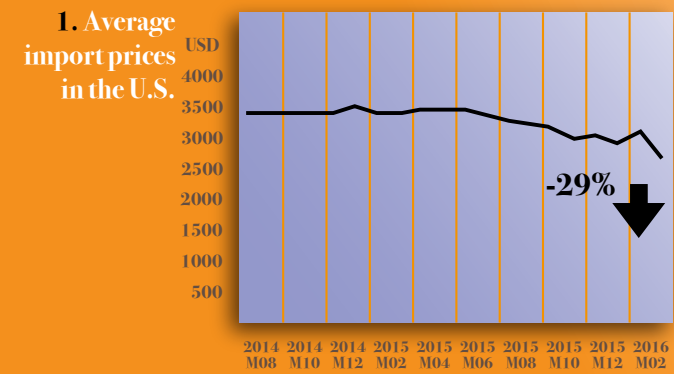
One third of honey in international trade is adulterated or 100% false



How is this possible and what are the consequences?

The alarms

- Producer prices of honey fall despite rising demand and adverse environmental conditions: deforestation, contamination and the Colony Collapse Disorder. (Graph. 1)<sup>1</sup>.
- While America exporting countries have a logical correspondence of exports and increased domestic consumption to their hive low growth (Graph. 2)<sup>1</sup>, the increase of exports by major Asian exporting countries is totally abnormal with the hive growth., (Graph. 3)<sup>1</sup>.
- The price of Chinese honey is around half the international average price, against what the rationality of the markets suggests.
- Multiple findings of mass adulteration of "honey" of Asian origin exported to Europe<sup>3</sup> and the U.S.<sup>4</sup> have been documented. One third of exported honey is from China.



What are the conditions that make fraud possible?

A. Obsolete analysis

A common way to adulterate honey is to add syrup based on corn or sugar cane. Both are plants that use a four carbon metabolic pathway to carry out photosynthesis (C4 plants); however, the composition of the sugar in the syrups made from these plants is very different from that of sugars in honey, since the bees gather nectar fundamentally of plants with metabolic pathway of three carbons (C3 plants), because they are the most abundant (90%). This substantial difference between sugars allows the method EA-IRMS<sup>5</sup> to measure the isotopic value of honey, and be totally reliable to detect C4 plants (corn or cane) adulteration.

In contrast, syrups from C3 plants such as rice, wheat, beet, cassava or potato are very difficult to detect, since the composition of their sugars can be very similar to that of sugars in honey.

The LC-IRMS<sup>6</sup> is the analysis most used today to detect C3 syrups because it was considered at the time the most reliable, however it has proved ineffective against the sophistication of methods to imitate or adulterate honey. The method has produced countless false negatives and also many false positives<sup>7</sup>.

There are also specific analyzes to detect a particular marker, such as beet, but they have also presented serious reliability problems.

B. High precision dosing

Pure honey contains a certain amount of pollen (up to 0.5%) and of a certain type, of course, associated with vegetation and the geography of the area in which the apiary is located, which gives a particular identity to honey

Likewise, diastase and proline –an enzyme and an amino acid respectively– must be present in honey in certain quantities.

For the mimicking of honey these ingredients –widely available in the market– are added by means of high precision dosing machines.

C. Abundant and cheap inputs

While a metric ton of honey reached an international price of US\$3,800, the average price of C3 syrups is US\$500, more than seven times lower.

Additionally, the world production of honey is 1.5 million tons per year, well below the more than 2.390 million tons of rice, beet, cassava, wheat and potato<sup>8</sup> per year, a huge source of inputs for fake honey syrups.

D. Purification with resin technology

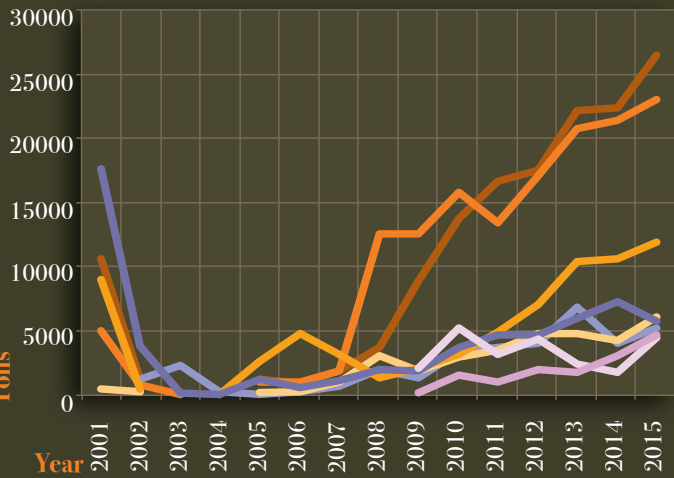
To eliminate the substances that reveal adulteration or falsification of honey, perpetrators use filtration technologies based on resins.

The European Union and Chinese honey

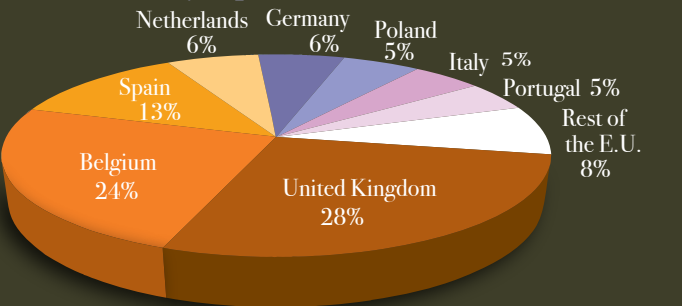
Striking import growth

4. Chinese honey imported into the E.U., 2001-2015

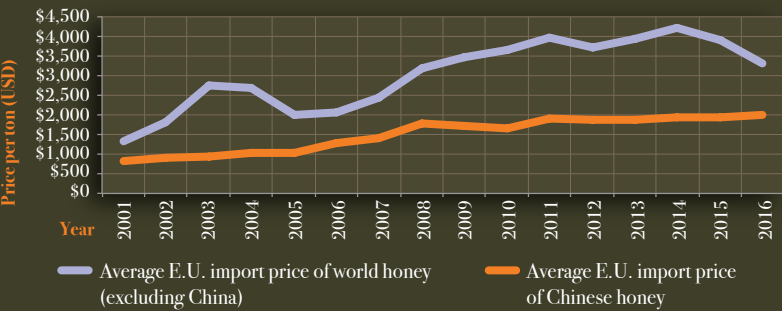
- United Kingdom
- Germany
- Belgium
- Poland
- Spain
- Italy
- Netherlands
- Portugal



5. Chinese honey imports into the E.U., 2015



6. Comparison E.U. import prices between honey from the world and from China

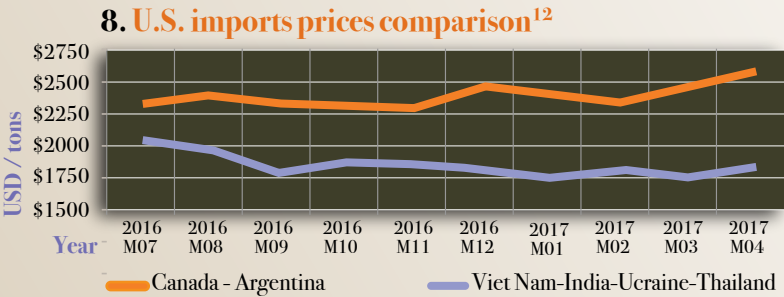


# The United States and Chinese honey

## “Honey laundering” again?

- In 2000, the U.S. determined an anti-dumping tariff for honey imports from China, due to unfair commercial practices that allowed prices well below the market value.
- As a result, imports from countries that were not historic producers and exporters of honey, increased abnormally.
- A federal investigation revealed the scheme of illegal imports of Chinese honey through intermediary countries (Russia, India, Indonesia, Malaysia, Mongolia, Philippines, South Korea, Taiwan and Thailand) that gave rise to the highest food import duties fraud in American history, named by Federal agencies prosecuting the crimes as “Honeygate”.<sup>9</sup>
- As a result of the investigation, six companies and eleven individuals were charged with a global conspiracy to illegally import Chinese honey into the U.S. (“Honey laundering”)
- The anti-dumping tariff is maintained to date.

➡ Currently honey imports from Viet Nam, India, Ukraine and Thailand into the U.S. show characteristics that suggest they are China’s intermediary countries: abnormal growth and low prices<sup>10</sup>.



## The large scale countefeiting and adulteration of honey prompts the fall of honey prices and with it, accelerates the collapse of beekeeping, the driving force to maintain bees and its pollination alive

How low prices affect bees, environment, nutrition and beekeepers?

- A peer reviewed article<sup>13</sup> published in 2015 shows that low honey prices are the main threat for honey bees, even above pesticides and pests.
- Although beekeepers lose hives because of pesticides or other threats, if honey has a good price, they work hard and recover lost hives.
- If the price falls to a level that is no longer attractive, producers go out of business and hives cannot survive on their own.
- Many indigenous producers depend on the income that beekeeping brings them. Low prices affect the peasant economy, which is already very precarious
- The falsification of honey is a crime, it discourages beekeeping. Reduced pollination impacts food production.<sup>14</sup>.

Price of imports of China origin honey as percentage of the average price of honey imports from all other origins

Australia	18.83%
Singapore	22.90%
UK	26.82%
Japan	34.63%
Portugal	38.00%
Netherlands	38.71%
Italy	43.08%
Belgium	48.35%
Spain	51.83%
Poland	55.12%
Germany	55.42%
France	61.71%

UN COMTRADE, 2015

“Any honey selling at prices lower than the cost of authentic honey will be taken as adulterated.”

Long Xuejun, Secretary General  
Bee Products Chamber, China



## The Nuclear Magnetic Resonance (NMR)

In the graph, a fraction (3%) of the spectrum of honey in general is shown in colors. In the red center are the most typical values of the different components of honey, while in the blue ends are the most atypical values. The black line is the profile of a honey adulterated with rice syrup. It is clear that part of its profile is completely outside the pure honey spectrum, which shows adulteration.

### A new powerful and promising tool against adulteration and counterfeiting

NMR spectroscopy is a technique that is already applied with great success in several foods to detect adulteration. In honey works from the development of a database comprised of multiple profiles of pure honeys, and superimposed draw a strip which represents to some extent the general profile of honey in the world (color strip in that graph). Of course, the more honey profiles are integrated into the database, the better it will represent the universal honey profile. The development, enrichment and socialization of this database is the main challenge to make the NMR the main technical tool to prevent the adulteration and counterfeiting of honey.

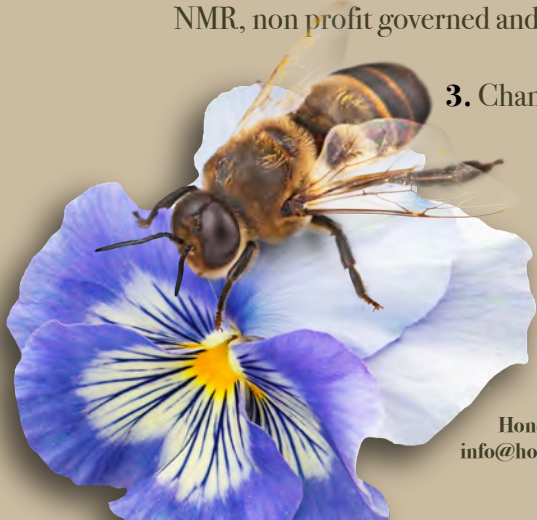
### Advantages

- Wide spectrum profile detection, almost impossible to duplicate
- Low cost
- Short measurement times
- Detection of botanical and origin aspects
- Reproducibility and comparability
- Simultaneous quantification of a wide set of parameters

Graph: QSI.

## Proposals

1. Digital traceability from the jar to the beehive  
World Organisation for Animal Health (OIE) guidelines
2. Codex Alimentarius harmonized database of planetary profile of honey based on NMR, non profit governed and with open online access to accredited world participating laboratories.
3. Change in national and international regulations.
4. Consumer action against imports of fake honey, litigation in WTO.



Graphic design and layout:  
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Honey Authenticity Project, 2018  
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### Notes

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4. Easter S. *et al.* 2014, Economically Motivated Adulteration of Honey: Quality Control Vulnerabilities in the International Honey Market, Food Protection Trends.
5. Elemental Analysis linked to Isotope Ratio Mass spectrometry
6. Liquid chromatography linked to Isotope Ratio Mass Spectrometry
7. Beckmann K. *et al.* Detection of honey adulteration with <sup>13</sup>C. Isotope ratio mass spectrometry of single sugar fractions, Quality services International GmbH
8. FAOSTAT, 2014
9. Easter, *op. cit.*
- 10, 11, 12. García N, Phipps R. 2017, International Honey Market Report: “To bee or not to bee”, based on Apimondia report.
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Graphs 4, 5 y 6: Luis Arturo Carrillo Sánchez with data from ITC and UN COMTRADE