

Honey fraud

One third of the international honey trade is not produced by bees from flowers

...but from syrups in factories

That is a crime

Facts



A number of recent studies point to a huge, active and hi-tech economically motivated adulteration (EMA) of honey¹, made possible because the old style sugar cane or corn syrup additions, known as "C4" plants adulterations, evolved to falsify honey manufactured from beet, rice and other "C3" plant syrups, similar in nature to the nectariferous plants bees forage², prompting standard authenticity analysis methods to become obsolete. Until now, no single test has been reliable. The European Parliament March 1 2018 resolution³ and the Apimondia Statement on Honey Fraud⁴, January 2019, contain comprehensive measures that if implemented can stop this food crime. Both were published after the results of an European Commission analysis over honey adulteration⁵ (2016), which showed that of 893 samples, 14.7% were not compliant. The fraud is carried out by some exporters from Asian countries, where mislabeled honey is manufactured and sold at a price up to one third of the commercial value of authentic honey⁶ to European food chains. This is food crime, affecting not only consumers and bee keepers around the world but also our environment.⁷

However, despite evidence and official statements, counterfeit honey trading in Europe continues to prevail.

Honey fraud around the world... and especially in the UK



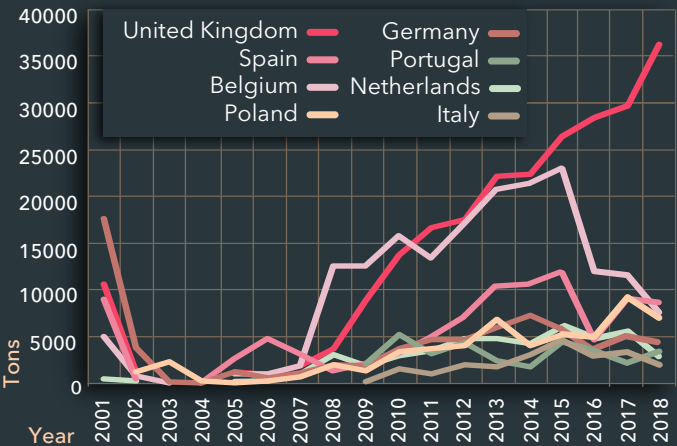
The fraud has reached the media with scientific evidence from Australia, Spain, France, the US and India. Yet, despite the EU Parliament Resolution and the Apimondia Statement on Honey Fraud, this food crime is devastating beekeepers, the front line families in the effort to save bees. Latin American Beekeepers inspired by the recent success against the Monsanto attempt to convert Mexican agriculture into GMO, are determined to put evidence before responsible authorities and

courts where adulteration is hurting consumers. Action began by buying jars of honey from major food retailers of the UK, the world main importer of Chinese honey. Jars were immediately sent to a fully accredited laboratory in Germany to be analyzed under a broad spectrum approach, meaning not only using one single adulteration detection method –as the fraud industry chooses for its cover up– but an array of methods. The results confirm honey fraud.

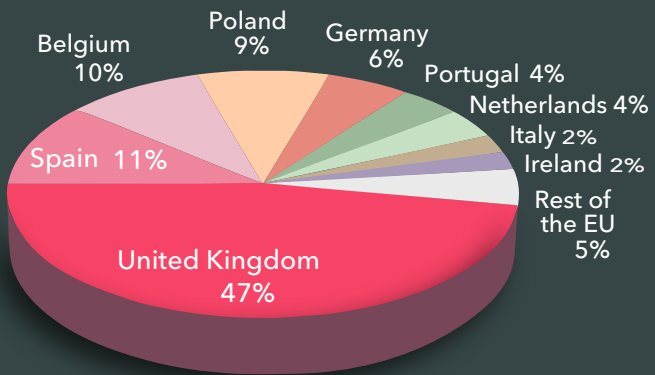
The European Union and Chinese honey

Striking growth in UK imports

1. The eight largest importers of Chinese honey in the EU, 2001-2018⁸



2. Chinese honey imports into the EU, 2018⁹



3. Import prices of honey in the UK, 2007-2018¹⁰

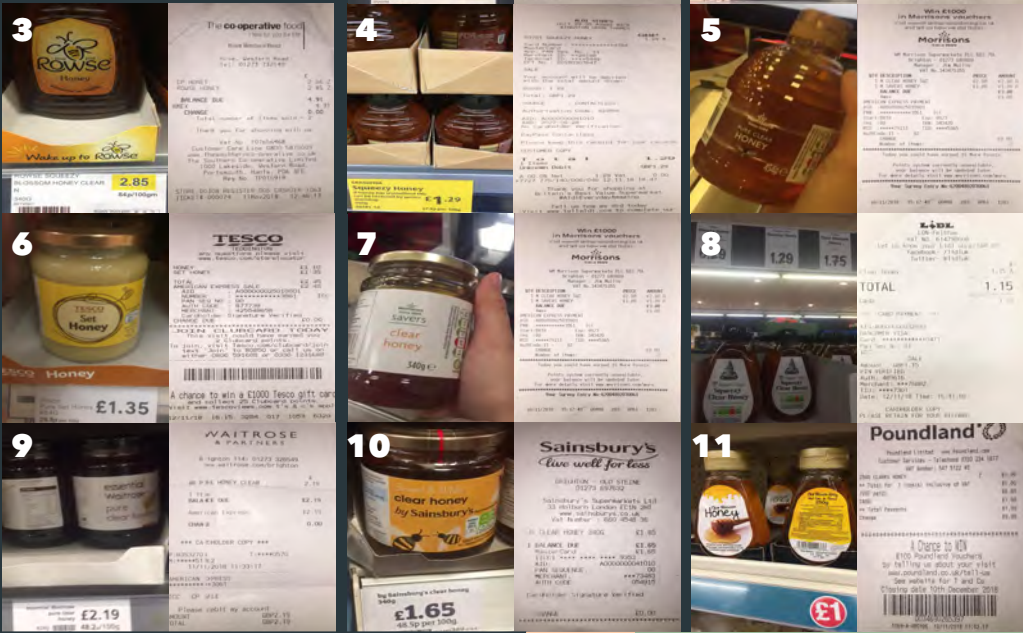


Sampling

Eleven samples, all labeled as a “blend of EU and non EU honey”, were purchased at nine retail supermarkets in Brighton and London, UK, with selection criteria of a low price, and purchased between 10 -12 November 2018 in: The Coop (2), ASDA (1), Aldi (1), Lidl (1) Tesco (1) , Morrisons (2), Waitrose (1), Sainsbury’s (1) and Poundland (1). All honey jars but one –Rowse, bought in The Coop– are Retailers own label.

All were sent to FoodQS, an accredited German laboratory in Langenzenn.

in main supermarkets in the UK



Under broad approach testing, no single sample was found fully compliant. Under cover up test, all were compliant¹¹.

Findings

- All have Psicose a generic fraud marker.
- Over 50% have honey foreign substances.
- Glycerol, develops when fraud impedes honey ripening in the hive, byproduct of fermented nectar dehydrated in factories.
- Only one brand demonstrated legal diastase biological activity.
- All EA/LC-IRMS C3/C4 results negative to adulteration, point this test as the fraud industry choice for cover-up. This explains why manufacturers of Fructose "Honey Syrup" advertise "passes C3/C4 analysis"¹². Laboratories collaborate with fraud while performing this method without a warning statement in their analysis reports¹³.
- To grasp the UK fraud size, the exactly comparable experiment in 10 Spanish Retailers shelves yielded 4 authenticity test faults, whilst 72 for the UK jars.¹⁴

BROAD SPECTRUM ANALYSIS				SAMPLES											% faults of total
Analysis category	Analysis	Unit	Values Typical for Honey	(1) The Coop clear Honey	(2) ASDA Set pure Honey	(3) Rowse Honey	(4) ALDI Grandessa Honey Squeezy Clear	(5) Morrisons Pure clear	(6) Tesco Set Honey	(7) Morrisons Savers Clear Honey	(8) LIDL Highgate Fayre clear Honey	(9) Essential Waitrose pure clear	(10) Sweet & Mild by Sainsbury's	(11) Poundland Clear Blossom Honey	
Biological Properties:	HMF	mg/kg	max 40	34.4	29.6	41.4	34.2	44.1	50.8	26.2	56.4	58.2	39.8	25.6	45.5%
	Diastase	DZ	min 8	3.1	n.d.	6.0	2.5	3.3	2.7	5	6.6	9.6	4.6	5.7	90.9%
	Saccharose	U/kg	min >20	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	100.0%
Composition of Honey and Physical Characteristics	Moisture	%	max 20.0%	17.0	18.8	18.1	18.5	18.4	18.7	18.1	19.1	17.9	18.5	18.4	0%
	Electrical Conductivity	mS/cm	0.09 - 1.99	0.13	0.15	0.12	0.12	0.111	0.13	0.06	0.13	0.25	0.1	0.09	0%
	pH		3.4 - 6.1	4.4	4.41	3.94	4.34	4.3	4.15	4.25	4.13	4.06	4.03	4.43	0%
	F/G	ratio	1.0 - 1.7	1	1.03	1.02	1.05	1.08	0.97	1.05	1.01	1.06	1.02	1.07	9.1%
	Fructose	g/100g	27.25 - 44.26	39.2	40.1	38.8	38.2	39.6	35.4	39.2	37.1	37.7	36.4	39.9	0.0%
Bee Activity Markers:	Glucose	g/100g	21.78 - 40.75	39.3	38.8	38	36.3	36.7	36.3	37.3	36.8	35.5	35.8	37.2	0.0%
	Proline	mg/kg	min 200	64	89	105	52	62	47	140	50	136	60	21	100.0%
Geo-Botanical Markers:	Pollen: botanical origin	Region	EU and non EU	Vietnam/c China	Asia	Asia/ South America	Asia	Asia	Asia	Asia	maybe China, Asia	Asia and South America	China, Central South America	Asia	100.0%
Generic Fraud Markers:	Sugars (SCIRA & ICSCBA)	Pos/Neg	negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	0%
	% C4 sugar	%	7.00%	0.031	0	0.3	0	0.1	0	5.3	1	1.3	0	3.5	0%
	EA/LC-IRMS C3/C4	dC13/C12	<2.5 dC13/C12	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	0%
	Psicose	%	0.15%	0.15%	0.42%	0.17%	0.39%	0.26%	0.32%	0.13%	0.06%	0.05%	0.19%	0.41%	100.0%
Targeted Fraud Markers:	NMR	Adulteration	negative	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Negative	Positive	Positive	90.9%
	Color E150c	mg/kg	n.d.	366	n.d.	125	n.d.	n.d.	n.d.	154	n.d.	n.d.	n.d.	32	36.4%
	Color E150d	mg/kg	n.d.	314	n.d.	109	n.d.	n.d.	n.d.	144	n.d.	n.d.	n.d.	20	36.4%
	Honey Foreign alpha-amylase	Positive/Negative	negative	Positive	Positive	Positive	Negative	Positive	Negative	Positive	Positive	Negative	Negative	Negative	54.5%
	RSM- Rice Syrup Marker.- Glucosylisomaltol	mg/kg	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	0%
	B-fructofuranosidase.- Marker for some invert syrups	Positive/Negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	0%
	gamma-Amylase	Positive/Negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	0%
	Honey Foreign Oligosaccharides	Positive/Negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	0%
	beta-Amylase	Positive/Negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	negative	0%
	thermostable amylases	DZ	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0%
Organoleptic	Glycerol	mg/kg	max 300	744	801	295	588	478	475	462	426	303	381	421	90.9%
Test				comply	comply	comply	comply	comply	comply	comply	comply	comply	comply	comply	100.0%
Faults to best regulation				11	9	11	8	10	10	12	10	7	8	10	106
PRODUCTION LOT #s				unreadable	8263C	8294D	8283D	8282D	8292C	8283A	8262C	5268C	5281 B	N.A.	

Comprehensive defence against the crime

Creating a strategy to defend authentic honey supported by a growing multidisciplinary international team:

1. Acting legally so competent courts order detailed and comprehensive analyses to be performed to every container of imported honey.
2. Providing information to specialised media and social networks to make the fraud knowledgeable to consumers, building respect and awareness for real honey and beekeepers, UK and worldwide, who already endure many hardships.
3. Sharing the science behind fraud findings and how honey fraud dramatically impacts the world's bee population.
4. Encourage consumers and retailers to boycott companies committing honey fraud.



Protocol to avoid honey fraud

To avoid honey fraud, the best strategy is to require mandatory broad spectrum analyses performed by an independent third party on every container imported.

1. Biological, nutritional properties and Composition of honey (Diastase, Invertase, Sugar profile, Nutritional Profile)
2. Geo-botanical origin (Pollen & botanical markers)
3. Bee activity markers (Proline and other Amino acids)
4. Generic Tests (Psicose, NMR, HRMS, IR, Laser)
5. Targeted markers (glycerol, foreign substance markers: colors, enzymes, etc.)
6. Sensory tests (Organoleptic)
7. Culminating in an expert determination of authenticity, assessing the origin and fair market value.

Authenticity is concluded after several analyses and a final expert determination, never one sole analysis.

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Honey Authenticity Project, 2019
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Notes

1. Easter S. *et al.*, 2014, Economically Motivated Adulteration of Honey: Quality Control Vulnerabilities in the International Honey Market, Food Protection Trends.
2. 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 carbon (C3 plants), because they are the most abundant (90%). This substantial difference between sugars allows the method EA-IRMS 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 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.
3. Prospects and challenges for the EU apiculture sector
European Parliament resolution of 1 March 2018 (2017/2115(INI)) P8_TA(2018)0057.
<http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2018-0057+0+DOC+XML+V0//EN>
4. Apimondia statement on honey fraud, January 2019.
https://www.apimondia.com/documents/apimondia_statement_on_honey_fraud.pdf
5. Scientific support to the implementation of a Coordinated Control Plan with a view to establishing the prevalence of fraudulent practices in the marketing of honey" N° SANTE/2015/E3/JRC/SI2.706828. E. Aries, J. Burton, L. Carrasco, O. De Rudder, and A. Maquet. JRC Technical Report 2016, JRC104749, 38 p.
https://ec.europa.eu/food/sites/food/files/safety/docs/cc_control-progs_honey_jrc-tech-report_2016.pdf
6. Data from ITC and UN COMTRADE.
7. Moritz R., 2015, Lost colonies found in a data mine: Global honey trade but not pests or pesticides as a major cause of regional honeybee colony declines, Agriculture, Ecosystems and Environment.
- 8, 9 y 10. Carrillo, A. with data from ITC and UN COMTRADE.
11. Link to Analysis 11 samples UK.
https://drive.google.com/open?id=1_jp9ymu_2KvuhTfH4uVvYIGRk7EXFr
12. Link to Alibaba advertisements of syrup for honey passes C3 C4 tests.
<https://drive.google.com/open?id=18HgVXXAWZf33Jg1DMDMvEsmC3A8VTN>
13. Beckmann K. *et al.*, Detection of honey adulteration with ¹³C Isotope ratio mass spectrometry of single sugar fractions, Quality services International GmbH.
14. Link to UK and Spain samples comparison.
<https://drive.google.com/open?id=1FZMzyH0x6pN-HzMpZnzW0MHOdgNjRL>