Honey

Control and Trade

HONEY TRADE

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CONTROL STEPS

Honey control is carried on different levels. The beekeeper himself can perform a self control, following the guidelines of good apicultural practice. Honey control according to the scheme given below will be carried out by apiaries, honey companies and food control authorities. Laboratory control will include the conformity to the standard. Trade honeys should conform to the Honey Standard of the Codex Alimentarius

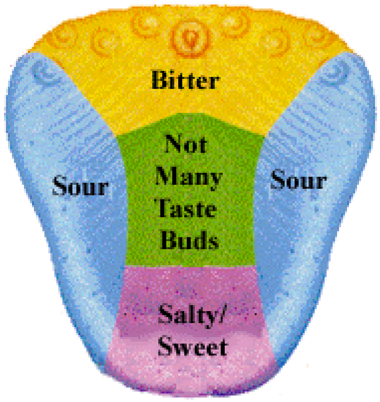
Characteristics, Parameter	Control method	Requirements, Remarks
	Tests at producer site	
Container	direct observation	Adequate material and condition
Homogeneity of lot	direct observation	Apparent homogeneity according to observable characteristics in whole shipment
Impurities	Direct observations of honey surface in container, filtration	Absence of bee and wax particles, other extranous matter
Organoleptic characteristics	Organoleptic analysis on an average sample	Absence of defects: off odours and tastes abnormal crystallisation
	Laboratory testing	
Colour	Pfund units with a Lovibond grader	Correspondence to market requirements
Moisture content	Refractometer measurements	General: maximum 20 % Top grade: < 18 %
Geographical authenticity	Microscopic examination	Correspondence to declared origin
Botanical authenticity	Sensory, microsscopic and chemical tests	Correspondance to limits, need of specialized personel
Authenticity of production Adulteration	Official methods	Absence of adulterants, Absence of fermentation
Contaminants	Official methods	According to legal limits
Heat damage	Test HMF, diastase	HMF not more than 40 mg/kg Diastase not less than 8 Schade units

SENSORY ANALYSIS

The honey consumer establishes the quality of honey with eye, nose and mouth. Therefore, the sensory properties of honey have a great importance. Sensory evaluation enables us to distinguish the botanical origin of honey and to identify and quantify certain defects (fermentation, impurities, off odours and flavours). It also plays an important role in defining honey products in the honey industry. There, honeys from different origin are mixed in order that a honey with specific sensory property be attained. The method for honey sensory analysis have been introduced by Gonnet [17]. The modern methods for honey sensory analysis were recently laid down [29]. Honey should be assayed by a panel of a minimum of 7 trained assessors. However, in practice this number is difficult to attain, but any number more than one is better than a single opinion! Here it will not be dealt in detail with these methods, but the different principles of honey sensorics will be shortly discussed.

Honey colour is an important quality factor. In honey trade the honey price will be determined by the colour, lighter honey achieving generally a better price. Honey colour is determined by Pfund or Lovibond graders. The Lovibond graders are easier to handle. Presently, Lovibond graders with Pfund grading are available on the market.

Honey aroma will be judged directly by smelling with the nose or indirectly – in the mouth through the nose channel. It is difficult to characterise the aroma with words. Mostly, associations are used. For instance: Linden honey: menthol-like, pharmacy; fresh



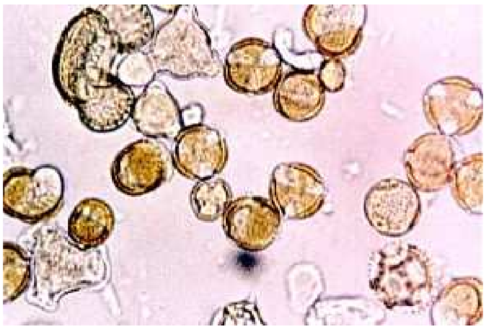
The **honey taste** will be judged by evaluation after ingestion (see tongue taste regions left). The three basic tastes sweet, sour and bitter will be judged (salty is absent). All honeys are sweet, due to the presence of the sugars fructose and glucose. However fructose is 2.5 times sweeter than glucose. Thus fructose rich honeys, e.g. acacia are sweeter than glucose rich ones, e.g. rape. Also, the sweet taste will be influenced by the acidity, by aromas and by the cristalisation. Bitter honeys like linden and sweet chestnut seem less sweet than honeys with weak taste like acacia. The sour taste depends on the acidity of honey. If treatments of Varroa with organic acids are not carried according to the prescriptions during the honey flow, they can influence honey taste and make it more sour.

The bitter taste is characteristic for sweet chestnut and linden honeys, and is a special characteristics of the world´s most bitter honey, harvested in Italy from Arbutus [15].
The **tactile** properties of honey originate in the tactile sensation on lips and tongue. The tactile feeling depends on honey granulation. Coarse and hard honeys feel pleasant, while fine crystalline and cream honeys are felt as pleasant.
Sensory defects should be judged objectively. On the other hand, honey consumers tend to judge honey according to their preferences.
Honey will absorb foreign odours if stored in the vicinity of strong aroma emitents and if stored in improper vessels.

Sensory tests

Two methods are used. The first one is **descriptive** [17]. It is easy and can be used for routine work. It requires an overall assessment, that takes into consideration all the components perceived. With **the profile method** honey is characterised in respect to reference standards of aroma and taste [18, 29]. The sensory characterisation of the European unifloral honeys was carried out by the **descriptive method**. This method is also used in honey competitions and fairs. Such competitions have a long tradition in countries like Germany, Italy, France and Spain. The quality of honey will be judged according to sensory criteria and the honeys will be then assigned to different quality classes. The assigned quality predicates serve beekeepers as an advertisement for their honey sales.

MELISSOPALYNOLOGY



Pollen analysis of honey or mellisopolynology was introduced at the beginning of the 20th century. The pollen analysis method has been described by the International Commission for Bee Botany [24] and improved recently [48]. This method can be used for the microscopic determination of the pollen grains, contained in honey. It is used for the determination of the botanical and the geographical origin of honey.
The determination of the botanical origin of honey is based on the knowledge, that nectar contains a certain number of pollen grains. Some nectars, e.g. *Robinia* and *Citrus*, contain less pollen grains, others, like *Castanea*, have more pollen grains than average. This knowledge is considered while determining the botanical origin of honey. Due to considerable variation also of other pollen grains melissopalynology alone can not determine the botanical origin of honey. Honeydew honey contain algae and fungi spores, but no relation between the number and the type of these components to the origin of the honeydew could be determined.
For the determination of the determination of the geographical origin of honey the pollen contained in honey are placed in relation to the geographical distribution of plants. With this method, greater geographical regions can be determined.
Osmophilic yeast can also be detected with the same method, but they can not quntified. Honey microscopy mirrors also the purity of the product. Too many extraneous starch, wax and bee particles in the sediment point at improper honey production and can be a subject of objection due to inpurities.

CONFORMITY TO THE HONEY STANDARD

Traded honey is generally analysed for its conformity to the international honey standard, put down in the Codex-Alimentarius (Link)
This includes the measurement of different quality criteria and will generally assure that the honey has been produced and stored properly. However only specific control regarding its authenticity and purity can give a definitive answer on the quality of honey.

AUTHENTICITY TESTING

Adulteration by sweeteners

Adulteration by sweeteners is the most important authenticity issue. As a natural product of a relatively high price, honey has been a target for adulteration for a long time. Addition of sweeteners, feeding the bees during the nectar flow or extracting combs containing bee feed may adulterate of honey. The following sweeteners have been detected in adulterated honeys: sugar syrups and molasses inverted by acids or enzymes from corn, sugar cane, sugar beet and syrups of natural origin such as maple.
Many methods have been tested for adulteration proof but most of them are not capable to detect unequivocally adulteration [5]. We discuss here only the most promising methods.

Adulteration by addition of cane- and corn sugar can be screened microscopically [22] and verified by measuring the 13C/12C isotopic ratio [8, 36, 50, 51]. Recently this method has been further developed to include Site-Specific Natural Isotopic Fractionation (SNIF) measured by Nuclear Magnetic Resonance [11]. A recent development is further the inclusion of sugar chromatography in this method [9, 13], claiming, that the addition of beet sugar can also be detected. The addition of high fructose corn syrup may be detected by detection of oligosaccharides naturally not present in honey through capillary GC [25] Recently infrared spectroscopic methods have been described for the detection of adulteration by adding beet and cane sugar to honey [19, 20, 44] These results were obtained by adding the adulterants to honey and comparing to the products with the original product. In practice, this differentiation should be more difficult, due to the wide natural variation of honey. Also, when the adulterants were fed to bees both infrared spectroscopy and front phase fluorimetry were unable to detect 50 % honey adulteration [37].

Fermentation

Harvesting of honey with high moisture content, or subsequent addition of water can result in honey fermentation and spoilage. Fermented honey cannot be sold. Honey fermentation depends mostly on the water content and on its content of osmotolerant yeasts, the higher the water content and the higher the concentration of osmotolerant yeast, the higher the probability for fermentation. There is a relation between the water content (water activity) and the concentration of osmotolerant yeast. Increasing the water content of honey by 1 g/100 g causes a 5 fold increase of yeast content[45]. Stable honey should contain less than 18% water. Beekeepers should check the water t before harvest with simple hand refractometer, see Chapter 2. Honey spoilage can be first tested by a microscopic yeast count [1, 43]. This test on its own does not yield conclusive results, as counted yeast could be in an inactive status not taking part in the fermentation process. Determination of the fermentation products is more reliable (Beckh and Lüllmann 1999) i.e. by determining the glycerol or ethanol content [2, 42, 52]

Heat and storage defects

The use of excessive heat in honey processing for liquefaction or pasteurisation has adverse effects on honey quality, i.e. loss of volatile compounds, accumulation of HMF and reduction of invertase and diastase activities. Quantification of HMF content and enzyme activities are useful tools to detect heat induced defects in honey. However, it should be noted that improper storage of honey leads also to similar changes of HMF and enzyme activity.

Honey filtration

Honey should not be strained with a mesh size smaller than 0.2 mm in order to prevent pollen removal. On the other hand, the recently revised Codex Alimentarius Honey Standard (Codex Alimentarius Commission 2001) and EU Directive relating to honey (EU Council 2002) allow a removal of pollen if it is unavoidable for the removal of foreign matter. Such honey should be labelled as “filtered”. Since microscopical pollen analysis is still the most important tool for the determination of botanical and geographical origin of honey, any removal of pollen by filtration will make authenticity routine testing much more difficult, if not impossible.

Organic honey, raw or unheated honey

The production of organic honey implies organic beekeeping which is defined in European regulation EEC No 2092/91, Annex I. The qualification of beekeeping products as being from organic origin depends on environmental beekeeping issues, contaminants originating from the latter being by far more important [4]. A recent examination of 250 pesticides in organic Swiss honeys confirmed this, as only traces of one pesticide were found in 2 out of 33 samples [12]. Thus, only the detection of residues in honey from synthetic veterinary drugs, not allowed in organic beekeeping can prove mislabelling of organic honey.
The term ‘natural’ honey should be avoided. It is misleading, since honey is natural by definition. The terms raw and unheated honey are also misleading, as honey is not heated during the harvest.

Pasteurisation is not mentioned in the Codex or European honey regulations. These regulations do not allow overheating of honey such as to significantly impair its quality. Quick pasteurisation does not significantly influence the honey quality and is often carried out in some countries. However, the labelling of honey pasteurisation is not compulsory as in milk. On the other hand, the pasteurisation of organic honey is not allowed.

Misdescription of botanical source

sensory

microscopic

physico-chemical testing

The botanical source may be labelled if the honey originates totally or mainly from a particular source and has the organoleptic, physico-chemical and microscopic characteristics of that origin. As bees forage on different plants, absolutely pure unifloral honeys are extremely rare. The different unifloral honeys show typical sensory, melissopalynological and physico-chemical properties.
Pollen analysis is the classical method for the determination of the botanical origin of honey [23, 48]. However, due to the considerable variation of the pollen content it is now regarded as a side method, besides sensory and physico-chemical analysis. Recently the International Honey Commission has worked out standards for the main European unifloral honeys, comprising sensory, melissopalonogical and physico-chemical characteristics [28].
In summary, the routine control of honey botanical origin includes organoleptic, physico-chemical and pollen analysis and a decision to whether a honey is unifloral or not is based on a global interpretation of all results [27].

Unifloral honeys have also specific honey, markers, e.g. minerals, amino acids, carboxylic acids, aroma compounds and flavonoids, which can be quantified [7] However this approach is generally not suitable for botanical authentification.

Another approach is the chemometrical evaluation of physico-chemical parameters (sugars, electrical conductivity, optical rotation, nitrogen content etc.). The combination of these methods allows a good separation of some unifloral honeys [3, 33, 46]. However, it should be noted than these methods may not allow discrimination between unifloral and polyfloral honeys. Of all honey measurands analysis of the volatile and aroma components is most promising [7]. Both quantitation and statistical evaluation of the volatile components can be used, but the quantitation approach should be the more successful, as it is the more robust one. Recently promising in-situ spectroscopic techniques, combined with statistical analysis have been successfully used for the authentification of unifloral honey.: front phase fluorimetric spectroscopy [40], near-infrared [39] and mid-infrared spectroscopy [41]. Of all the mentioned techniques the mid-infrared technique is the most promising, as it allows also the measurement of the principal honey parameters [38].

Misdescription of geographical origin

Generally, in Western Europe and also in countries like the United States and Japan, honey imported from the Far East or South America has a lower price than the locally produced honey, and is therefore prone to mislabelling because of economic reasons.
Pollen analysis is at present mostly used to determine the geographical origin of honey. The possibilities of pollen analysis for the determination of the geographical origin of honey have been reviewed recently [30]. Indeed, the differences of the pollen spectrum between honeys from quite different geographical and climatic zone are easy to detect. However, if the geographical zones are closer, differences are more difficult to distinguish. In such cases more sophisticated melissopalynological methods should be used. In recent years pollen analysis has been used for the determination of honeys originating from close geographical zones by the use of special statistical software [14, 16].
Recently the analysis of stable isotopes by IRMS has been developed for the authenticity proof of different foods [21, 32]. These isotopes depend theoretically more on the climate and are added theoretically to honey rather through rain water than through the honey plants. This method should be tested first on unifloral

honeys of different geographical origin in order to decide if it is useful for the determination of the geographical origin of honey.

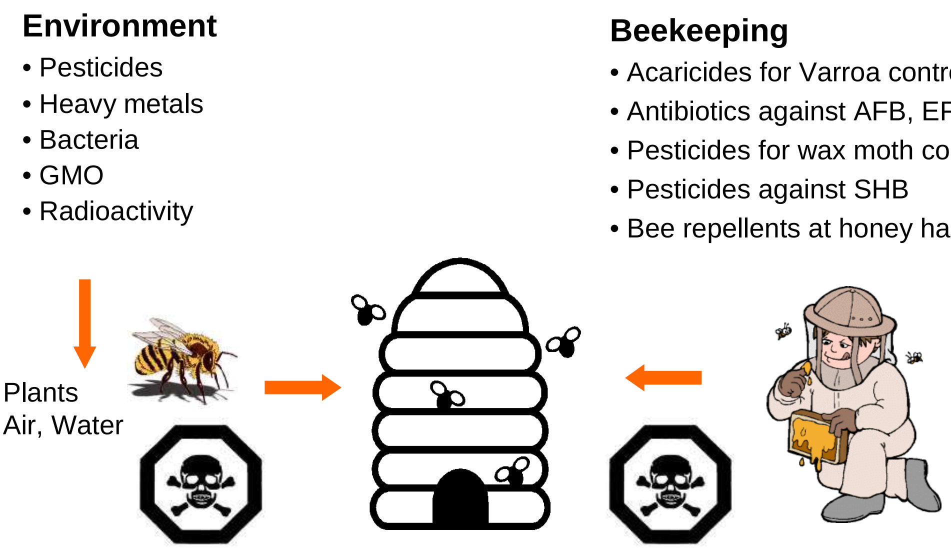
Misdescription of the entomological source

The present EU Directive definition defines honey as derived from *Apis mellifera*, while according to the Codex standard honey is the product of all honey bees. This contradiction needs to be resolved. *Apis mellifera*, originally indigenous to Africa and Europe, has been introduced into major exporting countries such as China, where now only a small part of the honey is also produced from *Apis cerana.* At present *Apis mellifera* honey is the main honey on the market and other honeys have only a local importance. For such purposes it is now necessary to characterise the honey from species other than *Apis mellifera* so that the honey from these species can be accepted in international trade. These honeys are either almost indistinguishable from *Apis mellifera* honey (e.g. *Apis cerana* honey) or has compositional limits of its own (*Apis dorsata*, stingless bees). The honeys of bees others than *Apis mellifera* should also be characterised and included into a separate standard.

RESIDUE CONTROL

Residues have become recently a major consumer concern. A recent review on the subject shows that the trace quantities of the residues in honey will pose in most cases cause no health risk[4]. This control activity needs nowadays a very sophisticated instrumentation and can be performed only by specialized laboratories. It has become evident that residues of honey originate mostly not from the environnment but from improper beekeeping practices[4]. Presently antibiotic residues are the major concern. Antibiotic residues can originate from treatments against the brood diseases American Foul Brood (AFB) or European Foul Brood (EFB). Treatments with antibiotics are not allowed in the EU, while in many other countries they are widely used. Thus, in most EU countries there are no MRL levels for antibiotics, which means that honey containing antibiotic residues are not permitted to be sold. As no residues are permitted, no MRL are established. The residues of the antibiotics, encountered in honey are not very problematic from toxicological point of view, as MRL for many of them are common in many foods of animal origin. At present, the problem with antibiotics in honey is the most serious for honey trade. However, the use of antibiotics for the control of AFB is not necessary and cannot control this pest. Antibiotic residues can be avoided, as AFB can be successfully controlled without the use of antibiotics [47, 49]. Indeed, the experience in different EU countries and New Zealand shows that a long-term efficient AFB control can be carried out without the use of antibiotics.

Contamination Sources for Honey



The review of the subject has shown that the contamination of honey originates less from environmental and more from the beekeeping practice [4]

Production of honey without residues by Good Apicultural Practice

Contaminant bee product concerned	Source of Contamination	Control measure
Antibiotics in honey	Control of bacterial diseases with antibiotics (AFB, EFB, Nosema)	Alternative control without the use of antibiotics
Synthetic acaricides in beeswax, propolis and honey	Varroa control with synthetic acaricides	Alternative Varroa control without synthetic acaricides
Pesticides in honey and beeswax	Control of wax moth with pesticides	Wax moth control by alternative measures.
	Chemical control of the Small Hive Beetle (SHB)	Alternative control of the SHB
Repellants in honey	Use of synthetic repellents at the honey harvest	Use of water or smoke
Toxic metals or organic substances	Honey recipients	Use recipients which do not diffuse contaminants into honey.
Wood protectants in honey	Pesticides in wood protectants	Use of wood protectants containing no pesticides

The above table summarises the measures, that can be taken by the beekeepers to insure a minimal contamination of honey. Production of honey according to Good Apicultural Practice, without the use of toxic chemicals is a guarantee for a good, nature-pure honey. Organic beekeeping is the best alternative to produce residue free honey.

Further reading:
Sensory testing: [17, 29, 31].
Melissopaynology: [26, 34, 35]
Routine chemical and residue testing: [4, 6].

HONEY PRODUCTION AND TRADE

Today, honey is one of the last untreated natural foods. At present the annual world honey production is estimated at about 1.66 million tons which is less than 1% of the total sugar production.

Faostat provides the official data of the FAO member states. The latest figures are given in the tables below.

China is the leader in honey production and honey export.

USA and Germany are the biggest honey importers. Germany is importing 3 times more than it is producing. However it re-exports a good part of the imported raw honey as conditioned or packed honey. Other big honey importers are the United Kingdom and Japan. Japan is importing the 15 fold of the quantity it produces.

Many West European countries and also the USA have a low degree of honey self sufficiency and have to import most of their honeys. In Europe from the mentioned countries only Greece and Hungary have a high self sufficiency and are net exporters of honey. The important honey export countries like Argentina, China, Mexico and Australia have all a high degree of self sufficiency, but their consumption per capita is very low.

World production, thousand tons, after FAOSTAT

Continent	1970	1980	1990	1995	2000	2005	2010	2011	2012	2013
Africa	76	88	117	134	144	161	167	154	164	169
Americas	221	258	285	297	341	345	319	331	321	332
Asia	144	213	336	382	449	543	682	729	737	761
Europe	333	311	413	317	290	343	349	337	348	372
Oceania	28	33	31	27	32	26	30	20	22	29
total	**802**	**903**	**1182**	**1157**	**1256**	**1418**	**1547**	**1571**	**1593**	**1663**

Top honey producing countries during the years
data after FAOSTAT, in thousand tons

	1995	2000	2005	2010	2013	2014
China mainland	178	246	305	303	466	462
Turkey	67	61	80	74	95	103
Argentina	70	93	84	81	80	
USA	95	100	70	80	68	81
Ukraine	63	58	76	71	74	66
Mexico	49	57	56	55	57	
Russian Federation	58	53	55	51	68	75
India	56	52	52	60	61	62
Ethiopia	26	41	44	44	45	61
Iran	23	28	36	36	44	76
Brazil	18	32	36	38	35	38
Canada	31	34	48	31	35	37
Spain	19	37	31	31	31	32
Tanzania (United Republic)	25	27	27	27	30	31
Germany	37	25	18	23	16	20

Top honey exporting countries

according to FAOSTAT, in thousand tons

Country	2011	2012	2013
China, mainland	99,990	112,960	128,650
Argentina	72,400	75,1350	65,180
India	28,9400	24,500	30,100
Mexico	26,900	32,000	33,460
Viet Nam	12,600	13,200	34,900
Brazil	22,400	16,700	17,180
Germany*	18,950	21,100	20,890
Spain	18,770	20,460	21,580
Belgium	16,830	16,560	20,140
Uruguay	14,550	11,170	12,350
Hungary	12,420	14,530	18,360
Romania	9,900	11,540	12,650
Canada	9,570	18,340	12,290
Ukraine	9,870	13,340	21,670
Chile	7,530	8,290	8,190
Bulgaria	6,850	9,300	12,660
Italy	6,440	8,350	11,500
New Zealand	5,470	7,720	8,760

* a major part of the exported honey was imported as raw and was exported as conditioned

Top honey importing countries

according FAOSTAT , thousand tons

Country	2011	2012	2013
USA	130,490	141,000	152,840
Germany	77,360	84,410	88,200
Japan	40,580	36,820	39,030
United Kingdom	35,640	34,820	38,140
France	27,150	25,720	28,670
Belgium	21,050	20,810	24,350
Spain	20,650	21,160	22,100
Italy	15,150	15,220	18,490
Saudi Arabia	14,000	16,550	17,400
Poland	13,610	14,170	20,160
Netherlands	11,960	11,830	12,640
Switzerland	7,430	7,820	8,170
Austria	6,060	8,590	8,620
Russian Federation	5,400	3,200	1,240
Denmark	5,190	4,620	4,880

HONEY PRODUCTION, TRADE, CONSUMPTION AND BEEKEEPING

The validity of the data on bee colonies and beekeepers is approximate, because the data on the number of bee colonies in www.beekeeping.com is not validated. There is no official data on these figures. Some data (e.g. on China, India, Ethiopia) were complemented with data found in Internet sources.
On the other hand it is assumed that the honey production and trade data are reliable as they are based on data supplied to FAO by the different countries.

Honey production, import, export and consumption per capita

Honey production generally does not correlate to honey consumption. Two leading producing countries have a lower honey consumption between 0.1 and 0.25 kg/C, while Turkey and Ukraine, other two leading honey producing countries have a higher pC consumption of 1.1-1.2 kg. While China would still be a low honey consuming country if it did not export honey, Argentina would be a high consuming country if it did not export most of its honey. Many countries, mainly developed ones, both export and import honey, probably exporting expensive honey and importing cheaper one. .In the European Union, the biggest honey consumer is Greece with 1.5 kg, followed by Germany with 1.0 kg, other EU countries like Spain, France and Hungary are in the intermediate range with 0.5-0.9 kg, while the UK a large honey importer, consumes 0.6 kg/pC. The developing African countries with a large honey production consume most of its honey and do not export it.

Colonies per beekeepers

This number gives some information on how professional the beekeeping is. Low numbers means that the majority of the beekeepers are hobbyists, or that the beekeeping is traditional (e.g. Ethiopia). In the European Union there are remarkable differences: In the above table most countries have low to average number of bee colonies, i.e. below 50. The highest numbers are in Israel, meaning that the percentage of the more professional beekeepers is the highest. It is astonishing that the biggest honey exporter China has mostly small beekeepers with an average of 12 colonies per beekeepers, while the second honey exporter Argentina has much more big scope beekeepers with 106 colonies per beekeeper. Astonishingly Chinese beekeepers harvest twice as much honey per colony. Ethiopia has the highest number of bee colonies in the world, about 10 milions, but its production is relatively low, due to the low productivity of traditional beekeeping.

Honey production, trade, consumption and beekeeping in selected countries

Data on honey production, export and import were averages from 2009, 2010 and 2011 from FAOSTAT. The other data were taken from www.beekeeping.com, but they are generally not based on scientific publications, and also are not updated.

Country	Prod t/year *	Export t/year*	Import * t/year	Cons. t/year	Cons kg p cap	Bee-keepers	Col. p beek	Col. p. km^2	harvest kg/col
China	**411'000**	**90'000**	2'300	**323'000**	0.25	600'000	12	0.7	59
Turkey	86'000	1'100	3	84'900	1.1	150'000	29	5.5	21
Argentina	65'600	63'000	120	**2'700**	0.1	18'000	106	0.7	35
Ukraine	61'600	7'600	43	54'000	1.2	50'000	60	5	21
USA	71'200	7'400	**113'400**	177'200	0.6	125'000	24	0.3	24
Mexico	56'600	26'800	40	35'800	0.3	45'000	44	1.0	28
Russia	55'000	130	4'400	51'600	0.4	300'000	10	0.2	18
India	58'300	20'000	1'500	39'800	**0.05**	150'000	67	0.2	6
Ethiopia	45'000	500	2	44'500	0.5	**1'000'000**	10	**10**	**4.5**
Brazil	39'500	23'000	**0**	16'500	0.1	300'000	8	0.3	16
Spain	33'600	18'900	17'900	32'600	0.7	25'000	72	3.6	18
Canada	33'700	12'000	4'000	25'500	0.8	13'000	38	**0.05**	**68**
Germany	21'800	20'000	83'300	85'100	1.0	89'000	10	2.4	24
Hungary	18'800	13'500	248	**5'300**	0.5	16'000	38	6.5	65
France	14'400	3'900	25'000	35'500	0.5	84'000	16	2.5	11
Greece	14'900	700	2'100	16'300	**1.5**	23'500	54	9.7	12
Australia	14'200	6'200	3'700	11'700	0.5	6'300	**107**	0.1	21
UK	6'900	2'300	32'500	37'100	0.6	43'900	**6**	1.0	26
Japan	**2'600**	**100**	39'200	41'700	0.3	7'235	31	0.6	12
Min.	**2600**	**100**	**0**	**2'700**	**0.05**	**480**	**4**	**0.05**	**4.5**
Max.	**411'000**	**90'000**	**113'400**	**323'000**	**1.5**	**1'000'000**	**106**	**10**	**68**

* - these high calculated figures are in contrast with a low figure of 8.5 kg/col. indicated in www.beekeeping.com

Bee density

Bee density is the limiting factor for honey production if bee hives are placed in one site. While high bee numbers will produce more honey beekeepers are advised not to keep too many bee hives at the same site. The bee density depends also on the nectar resources. In most countries there are enough honey resources for much more bees. The data in the above table shows that there is no correlation between the colony density and the honey yield per colony, which might mean that the colony honey yield depends on other factors.

- Highest bee densities are in Ethiopia: 10 and Greece, 9.7 colonies/km2,
- Lowest, in Canada, 0.05 colonies/km2 .

Honey yield per colony

India, UK, Brazil and Ethiopia have the lowest honey harvest per colony, while the highest is in, Canada, Hungary and China.

Traditional Honey Production

In most countries of the world honey is produced in modern hives. In Africa and in some Asian countries, however, honey is still produced mostly in traditional hives. The big honey producing countries Ethiopia and Tanzania produce most of its honey in traditional hives. See more information on http://www.beesfordevelopment.org/ In Latin America some stingless bee honey is produced, but only for local consumption.

Organic Honey

In the European Union by 2009 organic honey represented 1 to 2 % of the total marketed honey, while about 2500 tons were marketed in Germany[10] European leaders are countries like Italy, Bulgaria, Romania, see more information on organic honey at http://www.bee-hexagon.net/en/organic.htm

In many countries most of the honey is sold directly from the beekeeper.

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