

## 1. Introduction

In recent years Turkey has been known as a major honey and bee's wax producer in the world, ranking second in honey production after China.<sup>1</sup> In fact, with the pine honey obtained from the dense pine forests covering the Mugla province, Turkey produces 92% of the world's pine honey.<sup>2</sup> According to the State Institute of Statistics, 105.727 tons of honey were harvested in 2016 and there are 84.047 registered beekeepers and 8 million hives in Turkey. (Table 1)

With respect to the number of colonies, Turkey actually ranks first among the honey producing countries in the world. But in regards to the number of hives to production ratio, China is ranked number one with 22%. India is ranked second with 14%, and Turkey is ranked third with 8%. Although the number of beehives and production levels in Turkey are increasing steadily, average honey production per hive changes between 14-17 kilograms, and this figure is under world average of 20 kg.

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<sup>1</sup> <http://agris.fao.org/agris-search/search.do?recordID=TR2014000078> and <http://www.fao.org/countryprofiles/index/en/?iso3=TUR>

<sup>2</sup> Anonymous a <http://tiptop10ten.blogspot.com.tr/2012/09/top-10-honey-producing-countries-in.html>

Table 1. Arıcılık - Apiculture in Turkey <sup>3</sup>

	<b>Arıcılık yapılan köy sayısı</b>	<b>Arıcılık yapan işletme sayısı</b>	<b>Yeni kovan</b>	<b>Eski kovan</b>	<b>Bal</b>	<b>Balmumu</b>
	Number of villages in apiculture	Number of agriculture holdings in apiculture*	New hives	Old hives	Honey	Wax
	<b>(adet - number)</b>	<b>(adet - number)</b>	<b>(adet - number)</b>	<b>(adet - number)</b>	<b>(ton-tons)</b>	<b>(ton-tons)</b>
1991	21 540	-	3 161 583	266 859	54 655	2 863
1992	21 931	-	3 289 672	250 656	60 318	2 916
1993	21 975	-	3 450 755	234 692	59 207	3 110
1994	22 050	-	3 567 352	219 236	54 908	3 353
1995	21 987	-	3 701 444	214 594	68 620	3 735
1996	22 329	-	3 747 578	217 140	62 950	3 235
1997	22 145	-	3 798 200	204 102	63 319	3 751
1998	22 302	-	4 005 369	193 982	67 490	3 324
1999	22 447	-	4 135 781	185 915	67 259	4 073
2000	22 571	-	4 067 514	199 609	61 091	4 527
2001	22 606	-	3 931 301	184 052	60 190	3 174
2002	22 423	-	3 980 660	180 232	74 554	3 448
2003	22 110	-	4 098 315	190 538	69 540	3 130
2004	22 133	-	4 237 065	162 660	73 929	3 471
2005	22 550	-	4 432 954	157 059	82 336	4 178
2006	22 305	-	4 704 733	146 950	83 842	3 484
2007	21 560	-	4 690 278	135 318	73 935	3 837
2008	21 093	-	4 750 998	137 963	81 364	4 539
2009	21 469	-	5 210 481	128 743	82 003	4 385
2010	20 845	-	5 465 669	137 000	81 115	4 148
2011	21 131	-	5 862 312	149 020	94 245	4 235
2012	21 307	-	6 191 232	156 777	89 162	4 222
2013	-	79 934	6 458 083	183 265	94 694	4 241
	-				103	
2014		81 108	6 888 907	193 825	525	4 053
	-				108	
2015		83 467	7 525 652	222 635	128	4 756
<b>2016</b>	<b>-</b>	<b>84 047</b>	<b>7 679</b>	<b>220 882</b>	<b>105</b>	<b>4 440</b>
			<b>482</b>	<b>727</b>		

\*Arıcılık yapan köy sayısı 2013 yılından itibaren "Arıcılık yapan işletme sayısı" olarak değiştirilmiştir. Number of villages in apiculture have been revised as "number of agricultural holdings in apiculture" since 2013.

<sup>3</sup> [http://www.tuik.gov.tr/PreTablo.do?alt\\_id=1002](http://www.tuik.gov.tr/PreTablo.do?alt_id=1002)

Table 2-

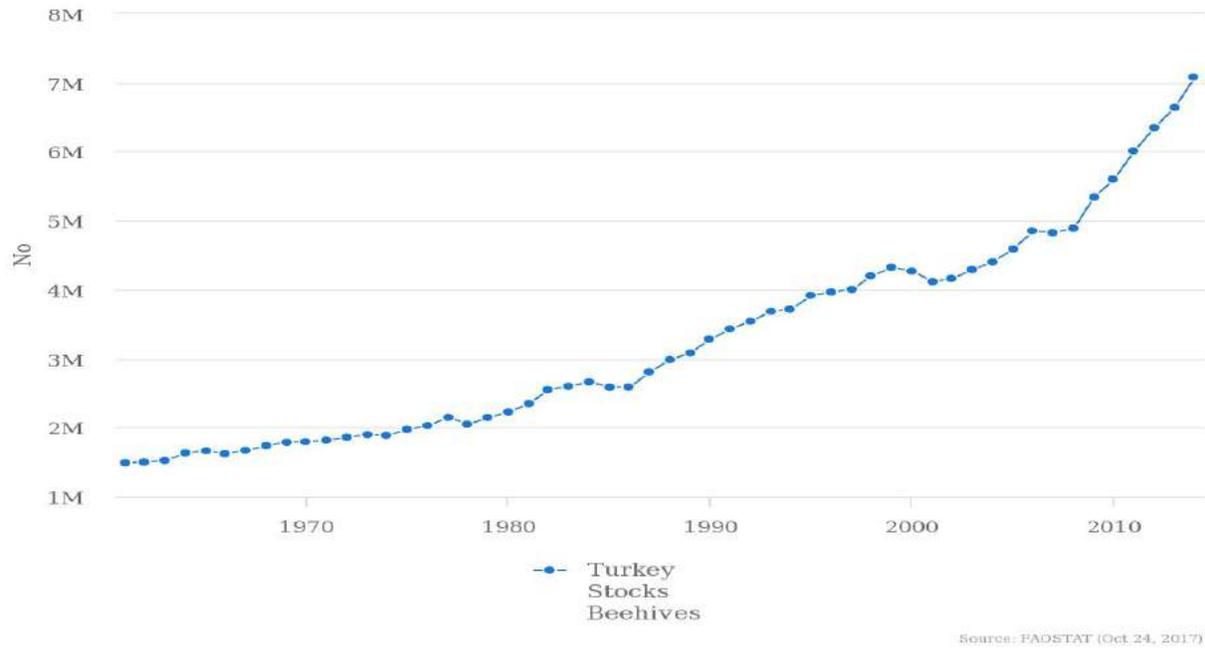
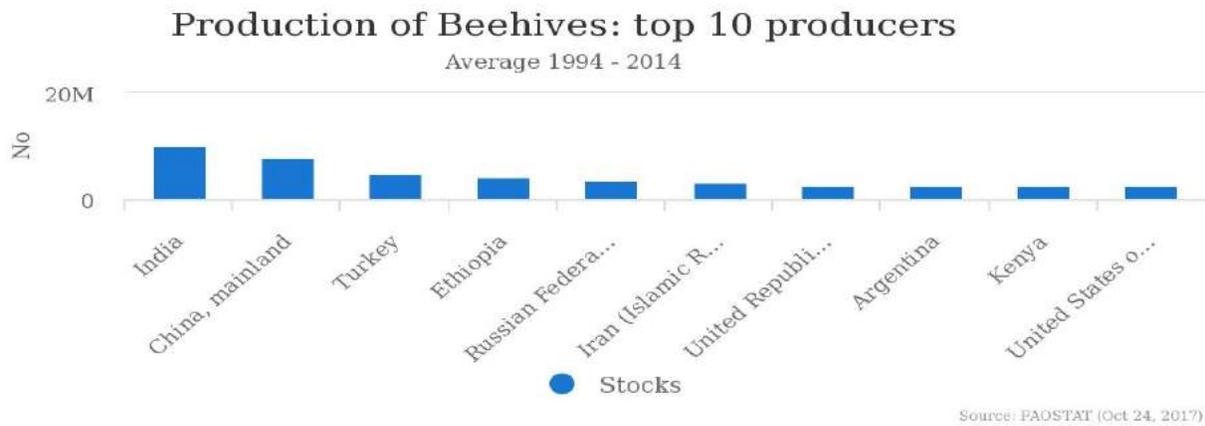


Table 3-



## 2. Beekeepers Organizations and Supports and Certification

Every beekeeper in Turkey who has at least 30 colonies has to register to their city's Beekeepers Association, and %98 of beekeepers are registered to the **Turkish Beekeepers Association**. All associations in the 81 Turkish provinces are managed by the Central Beekeeping Association in Ankara. As a member of the Association, beekeepers are automatically insured for all colonies, especially against transportation accidents in migratory beekeeping activities. They may also send honey bee samples to The Agriculture Administry Apiculture Research Ins. and Hacettepe University for laboratory analysis (diagnosis diseases or chemical analysis, pollen analysis of honey) for free. By being a member of the Association, beekeepers can take a loan from The Agricultural Bank of the Republic of Turkey (TCZB) for developing apiaries for colonies, and can also join seminars and education courses organized by the Association.

Beekeeping activities in Turkey are supported by different institutions of the State. The first one is the Ministry of Food, Agriculture and Livestock. Under the condition that beekeepers register in the beekeeping recording system in Turkey, and that they have 30 full beehives, 10 TL (€2,2) payments per full beehive are paid to the producers who are members of the Beekeeping Association. In addition, 60TL (€13,6) per colony is provided to the beekeepers having bumblebees and being registered with the greenhouse recording system to ensure natural pollination in greenhouses. 40TL (€9,1) is provided per beehive for developing and protecting the gene-pool. Also, the amount of supports given for organic beekeeping is 5 TL (€1,1) per full beehive. These supports are provided by the Ministry of Food, Agriculture and Livestock.<sup>4</sup> The Ministry of Forests and Water Affairs is also responsible for regulating beekeeping issues carried out in forests or forest related areas like grasslands. The General Directorate of Forestry is the main unit under The Ministry of Forest regarding beekeeping

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<sup>4</sup> <http://www.tarim.gov.tr/Konular/Tarimsal-Destekler/Hayvancilik-Desteklemeleri/Arıcılık/Arili-Kovan>

issues. If beekeepers want to keep their beehives inside or close to forests, they need to have permissions from this unit. This is also the case for National Parks.

The beekeeping activities in Turkey are also supported by Agriculture and Rural Development Support Agency (IPARD Instrument for Pre-Accession Assistance on Rural Development). The provision of consultancy services, which is required for feasibility studies, the purchase of essential machinery and equipment, and modernization of enterprises for producing, storing and processing of the beehive, honey and other bee products, are in the scope of support. For this purpose, 50% of the spending from €5000 to €250000 is given in the form of grants. Beekeeping loans are given to the producers who have registered with Agricultural Bank of the Republic of Turkey (TCZB) beekeeping registration system, and have produced using at least 50 full beehives or have been willing to increase the number of full beehives to 50 and more.

Organic Agriculture Law regulates the organic honey production and almost all regulations are in conformity with the EU norms. Turkey's organic honey production is very small, however interest in organic beekeeping has increased in recent years.

### **3. Climate – Regions – Honey Flows**

There are significant differences in climatic conditions from one region to the other, due to the geographical conditions. While the coastal regions enjoy milder climates, the inland Anatolia plateau experiences a dryer climate with hot summers and cold winters.

The Aegean region and Mediterranean region have similar climate conditions; there is a mild climate with average temperatures of 9°C in winter and 29°C in summer.

The climate of the Anatolian Plateau (Central region) is a steppe climate, with a great temperature difference between day and night. Rainfall is low and there is heavy snow in the winter. The average temperature is about 23°C in summer and -2°C in winter.

The climate in the Black Sea region is wet, warm and humid, with summer temperatures about 23°C, 7°C in the winter.

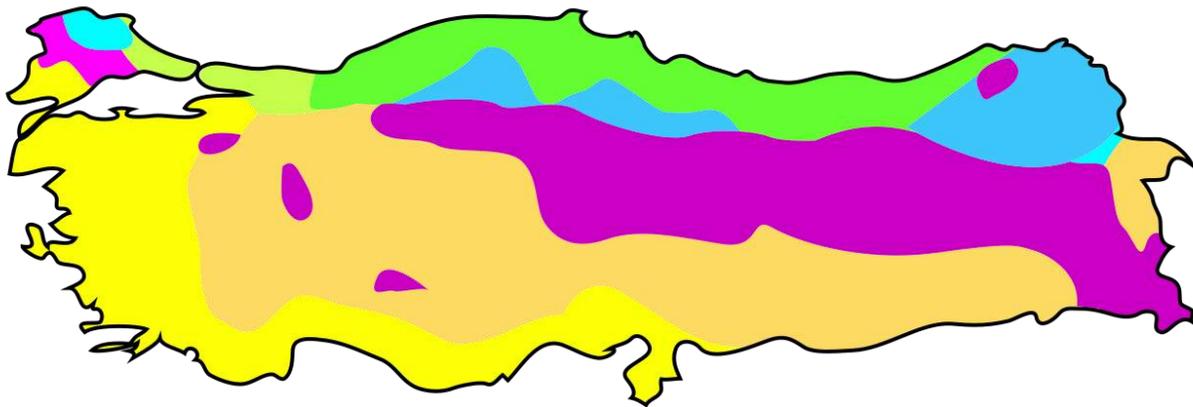
In Eastern Anatolia and South-Eastern Anatolia there is a long hard winter, where snow lies on the ground from November until the end of April. The average temperature in winter is -13°C and in summer 17°C. <sup>5</sup>

Table 4-

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<sup>5</sup> <https://www.weatheronline.co.uk/reports/climate/Turkey.htm>

## Turkey map of Köppen climate classification



- |  |   |
|--|---|
| Cold semi-arid climate (BSk)                             | Warm continental climate/<br>Mediterranean continental climate (Dsa)      |
| Warm mediterranean climate (Csa)                         | Temperate continental climate/<br>Mediterranean continental climate (Dsb) |
| Warm oceanic climate/<br>Humid subtropical climate (Cfa) | Warm continental climate/<br>Humid continental climate (Dfa)              |
| Temperate oceanic climate (Cfb)                          | Temperate continental climate/<br>Humid continental climate (Dfb)         |

Due to the different climates in each region and rich flora, seventy-five percent of beekeepers are doing migratory beekeeping in Turkey.<sup>6</sup> They change location on average three times per year for a total of 2.000 km of bee transport. Beekeepers move from north to south and from east to west following the blooming of honey plants. The colonies generally are transferred around the country in spring to the citrus groves and thyme areas, in June to the fir forests, in summer to the cotton, clover and sunflowers plants and in August, September and October

<sup>6</sup> Anonymous b <http://www.apimondia2017.org/default.asp?p=apiculture>  
<https://gain.fas.usda.gov/Pages/Default.aspx> The Turkish Beekeeping and Honey Sector

to the vast pine forests.<sup>7</sup> The map shown here provides an idea of the movement around the country. Green areas are traditional wintering grounds for beekeepers.

Table 5-



<sup>7</sup>GENERAL BEEKEEPING STRUCTURE OF TURKEY Available from:  
[https://www.researchgate.net/publication/238667459\\_GENERAL\\_BEEKEEPING\\_STRUCTURE\\_OF\\_TURKEY](https://www.researchgate.net/publication/238667459_GENERAL_BEEKEEPING_STRUCTURE_OF_TURKEY)

Honey flow periods are also regionally different around the country. The main nectar flow period of citrus honey from citrus gardens (lemon, orange, grapefruit, etc.) in the southern regions begins in May. In the northern regions, chestnut and linden grass are the main streams of nectar and begins towards the end of June. In the Western regions, the main nectar period is during June and July which is predominantly from sunflowers. In the inner and eastern regions of the country, the main nectar season is July (milkvetch, thyme etc.). October and November in the Marmara, Aegean and Mediterranean regions are the months for the pine honeydew.

#### **4. Bee Health**

There are several issues facing beekeepers around the country, but the Varroa parasite (*Varroa jacobsoni* Q.) is one of the biggest problems. In studies conducted in different regions in Turkey; the distribution of diseases found in Turkey are as follows; %96.93 Varroa disease, %79.59 foul brood, %70.40 chalk brood, %22.44 Nosemosis in 2000s. <sup>8</sup> According to another similar research, positive results ranging between 6.2-100% for varroosis, 0-100% for nosemosis and American foul brood, 0-28% for European foul brood, 0-5.86% for stone brood, 0-79.6% for chalk brood and 3-14.7% for wax moth were determined. Sacbrood and *Acarapis woodi* could not be detected in the mentioned studies.<sup>9</sup>

Beekeepers use a lot of chemicals against these diseases and due to the inappropriate or excessive use of chemicals, bees have become more susceptible to the bacterial, viral and fungal diseases. Some beekeepers apply chemicals to healthy colonies as preventative measures for the diseases. Thus, in Turkey bee health problems seem to be driven by many factors such as lack of technical beekeeping education, pesticides, starvation, incorrect

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<sup>8</sup> Kösoğlu M. and colleagues. , 2000, Turkish 3<sup>rd</sup> Beekeeping Congress Adana .

<sup>9</sup> Atatürk Üniversitesi Vet. Bil. Derg. 2016; 11(3): 339-347 <http://asosindex.com/cache/articles/turkiye-de-gorulen-bal-arisi-apis-mellifera-hastaliklari-f43108.pdf>

application for treatment of diseases, old queens, the quality of comb foundation, climatic or seasonal changes, and migratory beekeeping activity.

According to research done by beekeepers groups; the figure below can be a sample of treatment methods for honey bee diseases in Turkey, <sup>10</sup> Application of synthetic chemicals has been prohibited by regulations of organic agriculture, due to the their residues in bee products, but very beekeepers use organic or homeopathic treatments for fighting against these diseases. According to the regulations for organic beekeeping activity, formic acid, lactic acid, oxalic acid, menthol, camphor okalıptol and thymus oil can be applied for varroa treatment.

Table 6.

Natural products and pharmaceuticals used against disease and pests in inspected holdings (2006)

Name	Organic		Conventional	
	Number	%	Number	%
<b>Fumidil B</b>	1	<b>14.28</b>	-	-
<b>Apimicin</b>	-	-	3	<b>6.81</b>
<b>Teramicin</b>	-	-	3	<b>6.81</b>
<b>Neoteramicin</b>	-	-	1	<b>2.27</b>
<b>Mavrick</b>	-	-	4	<b>9.09</b>
<b>Varroset</b>	-	-	1	<b>2.27</b>
<b>Vitamix</b>	-	-	2	<b>4.54</b>
<b>Formic Acid</b>	1	<b>14.28</b>	12	<b>27.27</b>
<b>Oxalic Acid</b>	2	<b>28.57</b>	10	<b>22.72</b>
<b>Biovenol</b>	3	<b>42.86</b>	5	<b>11.36</b>
<b>Rulamid</b>	-	-	1	<b>2.27</b>
<b>Thyme</b>	-	-	1	<b>2.27</b>

<sup>10</sup> Gamze Saner and colleagues. 2011 Research held by TEPGE on the conversion from conventional beekeeping to organic beekeeping in a village of Çambel in Kemalpaşa District and analyze technical and economical aspects.

Laruel	-	-	1	2.27
Total	7	100.00	44	100.00

## 5. Strains of Bee

Turkey has many different kinds of topographic and climatic characteristics, so it is estimated that twenty percent of all native honey bee ecotypes exist in Anatolia. These are **Caucasian Bee** (*Apis mellifera caucasica*), **Persian Bee** (*Apis mellifera meda*), **Syrian Bee** (*Apis mellifera syriaca*), **Carniolan Bee** (*Apis mellifera carnica*), **Anatolian Bee** (*Apis mellifera anatolica*)<sup>11</sup> and their ecotypes such as **Muğla**, **Gökçeada Island**, **Yığılca** and **Giresun**. Each honeybee race and ecotype reflect in its morphology and environmental behavior.

*Apis m. meda* and *Apis m. syriaca* is found in the southeastern part of Anatolia, *A. m. caucasica* is found north eastern of Turkey, near the Georgian border, *A. m. anatolica* is distributed across Anatolia from north to south and east to west with locally adapted ecotypes like Muğla, Giresun and Yığılca and finally the “Carniolan type” is found in Thrace.

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<sup>11</sup> Kandemir, I., Kence, M. and Kence, A. 2000. Genetic and morphometric variation in honeybee (*Apis mellifera* L.) populations of Turkey

<sup>12</sup> Kandemir, I., Kence, M., & Kence, A. (2005). Morphometric and electrophoretic variation in different honey bee (*Apis mellifera* L.) populations. Turk J Vet Anim Sci, 29, 885-890.

The Caucasian Bee has drawn worldwide attention with its productivity and docility and has been under protection as a pure strain. The Caucasian bees are dark grey colored, and they are gentle and productive bees with low swarming tendency. They are also adapted to highlands and temperate climates, which allows them to collect high levels of propolis. Their spring development is slower than the other races, but they build up strong colonies during the summer and produce high quantities of honey. They tend to rob the weak colonies. They have long tongues which are 0.2 millimeters longer compared to other species, so it is easier for the bees to reach the bottom of flower pistil and take nectar from where others cannot reach.

The Anatolian honeybee is the most common bee race of Anatolia. They have many ecotypes adapted to different regions and show great variation in terms of body colour, productivity, and specific morphological, and physiological characteristics. The Mugla bee is a well-known ecotype of Anatolian honeybee.

The local honeybee of South-eastern Anatolia can be *Apis mellifera syriaca* or *Apis mellifera meda*. General characters of honeybees in Southeastern Anatolian are small colonies, relatively small quantity of honey storage, more aggressive than other honeybee races or ecotypes of Turkey, and easily swarming. These characters are well fit to the fluctuating hot conditions they live in, but not suitable for the beekeeping sector.

## **6. Bee Flora**

Flower honey is produced mainly from cultivated plants, such as oranges, cotton, sunflower, heather, chestnut, linden trees as well as from different orchards. Wild Nectar yielding plants in the all regions of Turkey are clovers, acacia, raspberries, strawberry, bee balms etc. Thyme honey comes from the Central Anatolia, Aegean, Black Sea and Marmara regions. Turkey has a lot of pollen yielding plants, such as almond trees (*Amigdalus*), *Castanea sativa*, *Castanea vulgaris*, *Salix alba*, *Robinia pseudoacacia* and *Erica*.<sup>13</sup>

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<sup>13</sup> Recep SIRALI,

[https://www.researchgate.net/publication/238667459\\_GENERAL\\_BEEKEEPING\\_STRUCTURE\\_OF\\_TURKEY](https://www.researchgate.net/publication/238667459_GENERAL_BEEKEEPING_STRUCTURE_OF_TURKEY)

The Black Sea region is known for the most popular and most precious variety of honey made by high plateau plants of Anzer. These plants only flowers at the end of June, and last until the beginning of August. Thus these bees have to make haste, being their unique opportunity to collect nectar.

The final type is pine honey from the Mugla province. The Mugla bee is an ecotype of *A. m. anatoliaca* which has a quite different life history adapted to foraging on the scale insect *Marchalleina hellenica* on pine trees, so that it continues to produce brood to build up a large population in the autumn while Anatolian bees in other regions stop producing brood in order to prepare for winter. 75% of Turkey's pine honey comes from this province.

A medicinal honey (the Turks call it "Deli bal=Crazy honey") is produced from the *Rhododendron ponticum* in September and October, in the northern part of the Central Anatolia, stretches from east to west and parallel to the Black Sea.

## **7. Commercial Beekeeping System**

### Hive types

The most common type of hive used in Turkey is the 10 framed Langstroth. Different sized hives with 10 frames have also been observed in different regions. Some beekeepers still use traditional carved tree trunks, basket hives (skep-like) or cob-hives. Although yields of traditional beehives are low, they are much more expensive than conventional ones.

### Swarm management

Beekeepers are constantly trying to prevent swarming. The artificial swarm is probably the most commonly recommended method in Turkey. Nests of the queen bees are destroyed,

and a second story is added to the beehive early in the season. The combs that begin to swarm are eliminated.

#### Varroa treatments

Most commonly, chemicals are used against varroa disease and due to inappropriate or excessive use of chemicals, bees became more susceptible. Organic methods are employed on a small scale.

#### Sugar feeding

Feeding of syrup made by industrial sugar is widespread. Although beekeepers know that giving excessive amounts of syrup leads to a reduction in honey quality and honey bee biology, most of them still prefer to use industrial sugar instead of natural pollen or honey for feeding. Commercial companies who produce sugar cakes, are using GMO corn syrup, fructose or glucose syrups instead of honey in production. These food supplements for the bees threaten general bee and human health.

#### Honey preparation and sale

In sales, wholesale is more common but smaller scale producers also do retail in jars. Unlike other countries, honeycomb is produced and sold widely.

#### Pollination work

Using the bees for controlled pollination is not a popular practice, however, in recent years they have been used in pollination of sunflowers, apples and almonds in small numbers.

#### Queen breeding and sales

There are 110 queen breeding facilities in Turkey. <sup>14</sup> 300.000 queen bees are bred and sold yearly. <sup>15</sup> The most common strains are Anatolian ecotypes and the Caucasian honey bee.

Other relevant items

In addition to honey, beeswax, pollen and royal jelly is produced. Royal jelly has become commercially used within the past 5 years.

Turkey ranks third in the world in production per hive, and second in terms of overall honey production. According to 2016 data, honey export is about 583,000 tons and Turkey's share of exports is only around 1%, while China is placed on top with 21% share. <sup>16</sup> The majority of the honey produced in Turkey is consumed domestically. The annual honey consumption per capita in Turkey is 1.3 kg on average and it is higher than the world average and many EU countries.<sup>17</sup>

## **8. Hobby Beekeeping**

It is assumed that the number of hobby beekeepers are more than commercial/professional beekeepers. It is not possible to have a certain number but there are hundreds of blogs and websites about beekeeping and several forums with over 15.000 members. Hobby beekeepers are more knowledgeable and sensitive towards natural methods and bee health.

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<sup>14</sup> <http://www.tarim.gov.tr/Konular/Hayvancilik/Aricilik>

<sup>15</sup> <http://www.tab.org.tr/ari>

<sup>16</sup> <http://www.revagrois.ro/PDF/2016-1/paper/42.pdf> - CURRENT STATUS AND DEVELOPMENT IN BEEKEEPING SECTOR IN TURKEY AND IN THE WORLD

<sup>17</sup> The Turkish Beekeeping and Honey Sector <https://gain.fas.usda.gov/Pages/Default.aspx>

## 9. Ecological Beekeeping

Turkey's organic honey production is very small, but interest in organic beekeeping has increased steadily in recent years. As shown in the figures below, beekeepers who have an organic certification has doubled in the last six years.

Table 7. Organic Honey Production in Turkey <sup>18</sup> (1998-2010)

Yillar (Years)	Organic Honey Yield (Organik Bal Üretimi)
1998	680
1999	1129
2000	508
2001	557
2002	923
2003	1100
2004	937
2005	572
2006	524
2007	497
2008	181

<sup>18</sup> <http://www.tepge.gov.tr/upload/attachments/195.pdf> and <http://www.tarim.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler>

2009	208
2010	207

Table 8.

<b>2016 ORGANIC BEEKEEPING STATISTICS</b>		
<b>Çiftçi sayısı Toplamı (Total Beekeepers)</b>	<b>Kovan Sayısı Toplamı (Total Bee Hives)</b>	<b>Bal(ton) Toplamı Yield/ Tone</b>
<b>276</b>	<b>40,371</b>	<b>349</b>
<b>2016 ORGANIC BEEKEEPING STATISTICS /TRANSITIONAL</b>		
<b>Geçişte olan Çiftçi sayısı (Transitional Beekeepers )</b>	<b>Kovan sayısı Toplamı Total Bee Hives</b>	
<b>370</b>	<b>35871</b>	

There is traditional method called “karakovan” Karakovan refers to the dark combs produced by bees in the wild and beekeepers mimic this for their bees, placing them in empty tree trunks and log hives. No foundation is used in this method, and the comb is entirely natural.

Difficulty in accessing organic sources such as frames, organic feeding products, organic medicines and high certification fees cause lower numbers in ecological activity. As a result of our agricultural practices and use of chemicals, organic beekeeping regions are gradually decreasing and both lower productivity and more bee deaths due to prohibitions about feeding and chemical use, sometimes leads beekeepers to give up and continuing with conventional methods.

## 10. Other relevant information

### **Experience**

In rural areas, beekeepers gain their experiences from their forefathers. Lack of technical beekeeping knowledge and lower productivity leads young ones to use conventional methods instead of traditional methods. Traditional beekeeping knowledge is disappearing with the death of old beekeepers so it is extremely important to record all the traditional methods.

### **Training**

Regional beekeeping research centers and associations in provinces give vocational education courses sometimes. Besides private lessons given by the commercial beekeepers, there are also public courses given periodically such as ISMEK<sup>19</sup> in Public Education Centers. In order to be a member of a beekeepers association, it is compulsory to have a certificate from these courses.

### **The Queen Bee**

The qualified queen bee provides high income and productivity to producers. In regard to this, some beekeepers prefers to change the queen bee every year, and widespread use of young queens has a negative effect on the yield.

### **Migratory Beekeeping**

Beekeepers try to go the most valuable place of both floral source and climatic conditions to get the maximum production from colonies. Since there is not enough planning in migratory

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<sup>19</sup> <http://www.ismek.ist/tr/branslar.aspx?branscode=2837>

beekeeping, hosting regions exceed capacity, which results in insufficient food for the bees. Migratory beekeeping has also been criticized by certain scholars because it leads to genetic contamination/ cross breeding and the genetic loss of local ecotypes.

### **Genotypes**

Choosing proper genotype is also very important. For example, caucasian bee colonies, whose native region has a cold climate, do not like the extreme temperatures in the South. When they are brought to the Mediterranean shores, they abandon their hives. There is also no chance of survival for the Mugla ecotype in the eastern or Black Sea regions.