

HONEY FORESTS AS AN EXAMPLE OF AGROFORESTRY PRACTICES IN TURKEY

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Abstract

Forest villagers are one of the poorest people in Turkey. Almost 7,8 million people live in forest villages. That's why agroforestry is very strategic tool for supporting this people. In recent years, General Directorate of Forestry in Turkey has given very much importance to establish "Honey Forest". For this reason, various trees and shrubs are used in different regions. The objective of this paper is to present information about convenient species for establishing "Honey Forest" in different regions and as a special honey production in the natural *Pinus brutia* forests in the Mediterranean forests of Turkey. Moreover, one fourth of all the honey produced in Turkey is directly from pines, especially from Forestry Regional Directorate of Mugla. Having about 5 million beehive and approx. 80,000–90,000 tons of honey production, Turkey is an important country for honey production. However, the 16–17 kg production for each beehive is lower than the world average (20–22 kg/beehive). As a result, all agroforestry systems in Turkey need scientific support, institutional financing and legal arrangements to stimulate the increase of production. Promotion of agroforestry in Turkey will help the country to solve various problems, such as environmental degradation, lack of food security, and deforestation.

Key words: beekeeping, diversity, forest villagers, honey plants, production of honey, silvopastoralism.

Introduction

Honeydew honey or forest honey is excreted by plant sucking insects like aphids. It is usually produced from trees but also from grasses and plants. In ancient times people believed honeydew fell from the stars and this belief was held for centuries until the French naturalist Reaumur determined in 1740 that it is produced by aphids. Forest

honey is also named after particular source plant "Fir Honey", "Pine Honey", "Lime Tree Honey", "Oak Honey" etc. Forest honey has higher contents of minerals and aminoacids, as well as higher molecular weight sugars. It tends to be darker, less sweet, less acid and resists crystallization when compared to blossom honey (Anonymus 2014a).

More than 9000 years ago, in a rock shelter in the mountains of Eastern Spain,

an early artist recorded the exploits of a person surrounded by bees reaching inside a cavity to steal their honey. Honey bees appear as an art also in the temples and tombs of Ancient Egypt as far back as 2400 B.C. (Anonymus 2014b).

Tualang tree (*Koompassia excelsa* (Becc.) Taub.) is Asia's rainforests tallest tree and it's best known as bee's tree. It can reach about 75–80 m and these trees draw world's largest honeybees (2.54 cm) called Asian giant bees to build their colony of hives. This giant bees source the nectar from the native flowers and plants in the deep forests to produce raw honey. The color is darker, compared to other organic raw honey in the market. The price of royal black honey is around 20 euro/kg (340 RM/gallon) (Anonymus 2014b).

Bashkiria is the world's only place where the forest has survived to this day as beekeeping industry. It is located between the Volga River and the Ural Mountains. A real forest beekeeper has a very broad knowledge and diverse skills. So, he knows if the current year is a good "beekeeping year", whether it was time to collect honey and how much. Beekeeping knowledge here goes from family to family. Wild honey is collected only once a year and in one day you can harvest 15 to 25 kg of honey. Forest honey is currently the most expensive honey in the world. In Moscow the price of this honey is between 120 and 200 euro per kilogram (Anonymus 2014c).

In several areas in Indonesia, honey is a major commodity that contributes to improving communities' economies. Honey is also a part of a communities' cultural identity. Many indigenous communities preserve their forests for sustainable honey production. Aside from being consumed directly, honey is also mixed with other foods, drinks and even soap. Honey

is still processed traditionally by groups of honey hunters usually consisting of 3-4 people. In sustainable honey production hygiene and post-harvesting processes are important, because it achieves higher selling price. The price for drained honey is IDR 44,000–55,000 (2.88–3.60 euro) while the price for squeezed honey is IDR 20,000–30,000 (1.30–1.96 euro). Furthermore, drained honey can be stored up to 8 years without losing its quality, while squeezed honey only lasts for 2 years (Adnan et al. 2014).

Turkey has 21.7 million ha of forest areas. It means that the forest land covers approx. 27 % of the country's territory. However, approximately 50 % of this forest land is degraded and unproductive. So, it is accepted by FAO that forest areas of Turkey cover only 13 %. According to 9th Forestry Commission Report, 7.8 million villagers live in 20,974 villages. These villagers live inside or around the forest and their livelihood mostly depends on products obtained from forest areas. Their income level is the lowest compared to people living in urban areas. Property ownership for the villagers is also very low – around 0–2 ha per family. Low income level, insufficient property for crop production and being away from health and education services result on high migration rates (40 %) to big cities (Ministry of Development 2013).

Anatolia's geographical location, its land formation, climate types and plant species and also people have brought a natural synthesis. These conditions have generated different agroforestry systems and several plants combination.

Apiculture is the important sub-agroforestry system in the world, including Turkey (Büyükkşahin 2010) and also perhaps the oldest system (Sağkaya and Kamiloğlu 1987, Şefik 1995, Yavuzşefik and Akbulut

2005, Tolunay et al. 2007). Implementation of mixed tree species in apiculture describes that it is the sub-practice of agrosilvopastoral system. In this system, various honey (nectar) producing trees and shrubs frequently visited by honeybees are planted on the boundary of the agricultural fields (Anonymous 2013a), forest lands and also natural vegetations. Depictions of humans collecting honey from wild bees date back to 15,000 years ago, efforts to domesticate them are shown in Egyptian art around 4,500 years ago (Anonymous 2013b).

Apiculture is a technical procedure and an economic activity done by most of the regions in Turkey. Apiculture makes a great contribution to provide food and income security for the people living in rural areas. It is important to have grassy and woody plants in forest vegetation in order to produce honey. Apiculture provides (Figure 1) in order to secure genetic diversity, resistant individual and presence of population, there should be an effective and natural pollination. Bees are the most important actors in pollination. 85–90 % of the pollination in nature is done by the honey bees (Belen 2010, Anonymous 2013c). It is estimated that there are

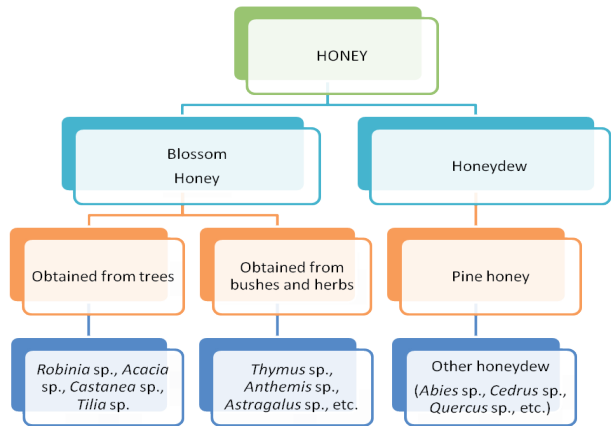


Fig. 1. Types of honey (Anonymous 2009).

25,000 bee species in the world and approximately 2000 species in Turkey (Mere 2010, Anonymous 2013c).

One fourth of all the honey produced in Turkey is pine honey. This particular honey is solely produced by an aphid called *Marchalina helenica* (Gennadius 1883) (Syn. *Monophlebus hellenicus* – bug of Basra, Honeydew) (Figure 2) living on *Pinus brutia* Ten., *Pinus nigra* Arn., *Pinus pinea* L., *Pinus halepensis* Mill. Cochineal makes a living by tapping the tree's sap water. The bug drinks this sap water and after the digestion it gets extracted from its rear end as a sweetened secretion. This sweet substance, which the bugs secrete from October to July is highly favored by honeybee for making honey. To



Fig. 2. Adult female of *Marchalina helenica* (left) and secretion of honey (right).

produce honey, sweet leftover of the bug are collected by the bees. The most important peculiarity of pine honey is its consistency, preserved for many years. 1000 m² forest land produces approximately 20–25 kg pine honey (Mere 2010). Major producer of pine honey is Turkey – about 92 % of the global production, followed by Greece with roughly 8 %. Germany, Austria and Spain have also very low production rates (Anonymous 2009, Belen 2010). About 25 % of all the honey produced in Turkey is pine based through forest (Anonymous 2013c). The provinces of İzmir, Aydın, Kusadasi, Dilek Peninsula, Milas, Bodrum, Mugla, Marmaris, Datca, Fethiye, Kas, Balıkesir, Manisa and Canakkale in Mediterranean and Aegean regions are major pine honey areas. 80 % of all pine honey in Turkey comes from *Pinus brutia* in the province of Mugla. Half of the nation's all honey producers comes from this site, which coincides with 4 % of all the global honey producers (Mere 2010).

Beekeepers generally function in forest or vicinity of forests. 85 % of all honey production occurs in or near open areas inside forest land. Since the production is so involved within the forestry, it can be very well considered as part of forestry activities (Anonymous 2009, 2013c).

Since Turkey has various climatic regions and soil diversity and it is situated in the crossing of Europe-Siberian, Iran-Turan

and Mediterranean plant regions, its plant diversity is very unique and one of a kind. 75 % of all honeyed plant species in the world exist in Turkey. Although in terms of the number who are engaged in beekeeping (150,000 household) and the number of beehives in the country, Turkey is among the leading countries, it lays behind many of the other producers in terms of the other bee related products (Anonymous 2009, 2013c). 10 % of all beekeepers in Turkey make their living entirely on this and 30 % makes it as a contributor to their living. The vast majority of the rest is hobby type of beekeeping (Anonymous 2013c).

In terms of the number of total beehives and the production capacity (Table 1), Turkey ranks (Figure 3) the 3rd, and the 2nd making one of the major players in this field (TUIK 2012). Although Turkey is in the top three based on the total number of beehives, honey production per hive, which is around 16–17 kg, is below the world average of 20–22 kg. However, the fact that Turkey is placed at 10, based on the global honey trade, is not suitable with its hive wealth and honey production (Anonymous 2013c).

China and Argentina are the top two honey exporters, and EU is the top importer in the world (Anonymous 2009, 2010).

Annual average commercial honey production in Turkey is about 80,000–

Table 1. Honey and wax production in Turkey (TUIK 2012).

Apiculture	2011		2012		Change, %
	Amount, t	Share, %	Amount, t	Share, %	
Honey Production	94,245	100.0	89,162	100.0	–5.4
Wax Production	4,235	100.0	4,222	100.0	–0.3
Number of Hives (Unit)	6,011,332	100.0	6,348,009	100.0	5.6
Old Type	149,020	2.5	156,777	2.5	5.2
New Type	5,862,312	97.5	6,191,232	97.5	5.6

90,000 tons (TUIK 2012), the approximate market value of this production is \$ 300,000,000. One fourth of this production comes directly from forests in the form of pine based honey. Forest trees like *Castanea* sp., *Robinia* sp., *Tilia* sp., *Rhododendron* sp., *Pyrus* sp., forest shrubs, small tree-like plants and flowers constitute about 85 % of this production, and such trees and adjoining plant life are predominantly found in state's forests (Mere 2010, Anonymous 2013c).

Traditional agricultural practices and widespread use of pesticides adversely affected the nectar sources, which honey bees prefer. In this case, instead of stationary honey production, bee keepers have started embracing a nomadic life style. Recently, biological combat against forest damaging insects keep the forested areas free of chemical agents so honey produced off forest areas is rather healthier regarding food safety. This case validated the thinking that forests can be very well managed considering honey production. In this context, General Directorate of Forestry in Turkey established 205 honey forests in about 20,000 ha forest land to support beekeeping and increase honey production by each beehive. Establishing honey forests are an ongoing and important project for the General Directorate of Forestry (Anonymous 2013e). In the scope of this study, basic rehabilitation and improvement strategies are pointed

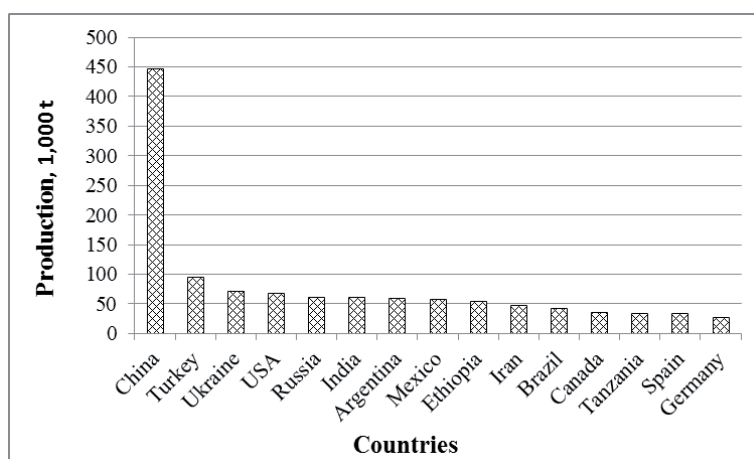


Fig. 3. Honey production and total beehive number according to some producer countries (Anonymous 2013d).

out to contribute to the “Action Plan and Targets” set by General Directorate of Forestry.

Methodology of the Study

In terms of beekeeping, honey plants are grouped in two categories: 1) Secretion producing; 2) Nectar producing. This study tabulates only some features of the “woody taxa” contributing to honey production via secretion and nectar (flowering as to season, secretion/nectar production potential, honey production potential, species’ distribution and habitat, etc.). General rehabilitation strategies are suggested in order to increase the honey production.

Results

Table 2 includes the list of exotic species, small tree and shrubs in Turkey’s natural forest vegetation, which contribute to honey

Table 2. Production potential of pollen, excretion and nectar in some characteristics of woody species in Turkey (Webster and Hill 1991; Turna 1992; Belen 2010; Anonymous 2013c, 2013f; TUBIVES 2013).

Latin name	Flowering period	Production potential of			Altitude / Turkey distribution	General distribution
		Pollen	Nectar	Honey		
A. Nectar, secretion, pollen producing plants in late autumn and winter seasons						
<i>Amygdalus communis</i> L.	January–March	Minor	Minor	1–2	150–1800 m /Anatolia	NW. and Central Asia
<i>Cornus mas</i> L.	February–March	Dominant	Dominant	-	20–1500 m /N. and S. Anatolia	Central and SE. Europe, Crimea, South Russia, Caucasias, N. and NW. Iran, Lebanon
<i>Eucalyptus camaldulensis</i> Dehnh.	November–May	Dominant	Dominant	3	Adana, Antalya, Hatay, İçel, İstanbul, İzmir	Australia, S. Europe
<i>Arbutus unedo</i> L.	March–May	Secondary	Dominant	2–3	0–300 m /Antalya, Balıkesir, Bursa, Çanakkale, İçel, İstanbul, İzmir, Kocaeli, Muğla, Sakarya, Samsun, Sinop, Zonguldak	Atlantic Europe (N. and W. Ireland), Mediterranean Basin
B. Nectar, secretion, pollen producing plants in spring season						
<i>Aesculus hippocastanatum</i> L.	April–May	Minor	Trace amounts	-	Turkey	Native of the Balkan peninsula; other species in the family are found in S. and E. Asia and the Americas
<i>Cistus</i> spp.	May–June	Dominant	-	-	0–1200 m /Turkey	Crimea, Georgia, Caucasian, Europe, Cyprus, Mediterranean Basin, N. Iran
<i>Cotoneaster horizontalis</i> Decne	April–July	Secondary	Secondary	-	1250–2300 m /Turkey	Native of W. China
<i>Fagus orientalis</i> Lipsky	April–May	Trace amounts	-	-	30–2000 m /N. Turkey, W. and S. Anatolia	E. Balkan peninsula (Bulgaria, Romania, Greece), Crimea, Caucasian, N. Iran
<i>Juglans regia</i> L.	May	Minor	-	-	0–1550 m /Turkey	Balkans, Lebanon, Caucasian, N. Iraq, Iran, Afghanistan, Central Asia, China
<i>Morus alba</i> L.	May	Trace amounts	-	-	Turkey	China and the Far East
<i>Laurus nobilis</i> L.	March–May	Secondary	Trace amounts	3–4	0–1200 m /Antalya, Aydın, Balıkesir, Bursa, Çanakkale, İçel, İstanbul, İzmir, Kastamonu, Kahramanmaraş, Muğla, Rize, Samsun, Sinop, Trabzon, Zonguldak	SE. Europe, NW. Africa, Syria, Crimea, Mediterranean region
<i>Acer campestre</i> L.	April–May	Secondary	Minor	3–4	0–1200 m /Ankara, Artvin, Balıkesir, Bolu, Bursa, Çanakkale, Giresun, İstanbul, Samsun, Sinop, Tokat, Trabzon, Yozgat	Europe, Caucasias, N. Iran, NW. Africa
<i>Acer negundo</i> L.	March–April	Secondary	Minor	3–4	As ornamental plants /İstanbul, Samsun	N. America
<i>Acer pseudoplatanus</i> L.	March–May	Secondary	Minor	3–4	0–1200 m /Amasya, Antalya, Artvin, Balıkesir, Bitlis, Bolu, Bursa, Denizli, Kars, Kayseri, Kırklareli, Kütahya, Kahramanmaraş, Trabzon	Europe, E. and W. Caucasias
<i>Salix</i> spp.	February–May	Dominant	Dominant	4	0–2000 m /Turkey	NW. Africa, Europe, Central Asia, Siberia
<i>Acacia karroo</i> Hayne	May–June	Minor	Secondary	4–5	0–500 m /İçel	S. Africa, Mediterranean region
<i>Robinia pseudoacacia</i> L.	April–June	Trace amounts	Dominant	6	0–2500 m /Artvin, İstanbul, Sakarya	North America
<i>Pyrus elaeagnifolia</i> Pall.	April–May	Secondary	Dominant	2	0–1700 m /Amasya, Ankara, Antalya, Bolu, Eskişehir, Gümüşhane, İçel, İstanbul, Kars, Kastamonu, Kayseri, Konya, Kütahya, Kahramanmaraş, Muş, Niğde, Sinop, Van	Crimea
<i>Malus sylvestris</i> Mill.	March–April	Secondary	Secondary	-	150–2000 m / Northeast Anatolia	Europe
<i>Pyracantha coccinea</i> Roemer	April–June	Secondary	Trace amounts	-	30–1800 m /N. Turkey, Central and S. Anatolia	S. Europe, Crimea, Caucasian, NW. Iran
<i>Rosa canina</i> L.	April–August	Minor	Trace amounts	-	30–1700 m /Turkey	Temperate Europe, NW. Africa
<i>Cercis siliquastrum</i> L.	April–May	Trace amounts	Trace amounts	3	0–1370 m /Adana, Amasya, Antalya, Balıkesir, Bursa, Çanakkale, İstanbul, Kocaeli, Mardin, Muğla, Şanlıurfa	Central Europe
<i>Tamarix</i> spp.	April–August	Minor	Minor	3–4	0–1300 m /Turkey	Asia, Africa, Greece, Aegean islands, Palestine, Turkestan, Russia, Mediterranean region
<i>Pistacia lentiscus</i> L.	April–May	Secondary	-	3–4	0–200 m /N., W., Central and S. Anatolia	Mediterranean Basin
<i>Pistacia terebinthus</i> L.	March–May (June)	Secondary	-	3–4	0 m /N. and W. Anatolia	NW. Africa, S. Europe
<i>Tilia</i> spp.	June–July	Secondary	Dominant	6	0–1500 m /Artvin, Bolu, Çanakkale, Giresun, Gümüşhane, İzmir, Kars, Kastamonu, Samsun, Zonguldak, W. Anatolia, N. Anatolia	Europe, Balkans, Crimea, Caucasian, N. Iran
<i>Eleaegnus angustifolia</i> L.	April–June	Trace amounts	Minor	4	0–3000 m /Turkey	Caucasian, Syria, Iran, Afghanistan, Pakistan
<i>Arbutus andrachne</i> L.	March–May	Secondary	Dominant	2–3	0–800 m /Amasya, Antalya, Artvin, Aydın, Bursa, İzmir, Çanakkale, İçel, Muğla, Sinop, Trabzon, Zonguldak	Mediterranean region, Crimea and E. Black Sea coast, Cyprus
<i>Crataegus monogyna</i> Jacq.	April–June	Minor	Secondary	-	0–1800 m /Adana, Adıyaman, Amasya, Ankara, Antalya, Aydın, Bitlis, Bursa, Erzincan, İçel, İstanbul, İzmir, Konya, Kütahya, Mardin, Muğla, Samsun, Tekirdağ, Şanlıurfa, Karaman	Syria, Lebanon
<i>Crataegus orientalis</i> Pallas ex Bieb.	May–July	Minor	Secondary	-	750–2240 m /Anatolia (except W. and SE.)	Europe, Cyprus, Syria, N. Iraq
<i>Crataegus microphylla</i> C. Koch.	April–June	Minor	Secondary	-	20–450 m /N. and Central Anatolia	S. Europe, Crimea, Caucasian
						Crimea, Georgia, Caucasian, N. Iran

<i>Laurocerasus officinalis</i> L.	April–June	Secondary	Trace amounts	-	20–2000 m /Balıkesir, Bolu, Hatay, İstanbul, Kastamonu, Ordu, Rize, Samsun, Trabzon, Zonguldak	Bulgaria, Serbia, Croatia, Bosnia, Slovenia, Macedonia, Montenegro, Kosovo
<i>Prunus spinosa</i> L. subsp. <i>dasyphylla</i> (Schur) Domin	March–April	Secondary	Minor	-	0–1700 m /Adana, Amasya, Ankara, Balıkesir, Çanakkale, Edirne, Kars, Kocaeli, Kütahya, Manisa, Sinop, Sivas, Zonguldak	Caucasian, N. Iran, Europe, N.W. Africa, Caucasian, NW. Iran
<i>Cupressus sempervirens</i> L.	May–June	Trace amounts	-	-	900–1200 m /Antalya, Içel	E. Mediterranean, N. Iran
<i>Erica arborea</i> L.	March–July	Dominant	Dominant	-	0–900 m /Balıkesir, İstanbul, İzmir, Muğla, Sinop, Trabzon	Tibet, E. Africa and Yemen
<i>Fraxinus excelsior</i> L.	March–April	Trace amounts	Trace amounts	-	900–2100 m /Bolu, Giresun, Hatay, Kars, Kastamonu, Samsun, Sinop, Sakarya	N. and S. Europe, Caucasian
<i>Ligustrum vulgare</i> L.	May–June	Minor	Trace amounts	-	0–1500 m /Afyon, Ankara, Artvin, Bilecik, Çorum, Edirne, İstanbul, Kastamonu, Ordu, Rize, Tekirdağ, Trabzon, Zonguldak	Morocco, W., S. and C. from Europe to the Caucasus and N. Iran
<i>Phillyrea latifolia</i> L.	March–May	Minor	-	-	10–1350 m /Aydın, Çanakkale, Balıkesir, Isparta, Içel, İstanbul, Muğla, Sakarya, Sinop, Tekirdağ, Tokat, Trabzon, Zonguldak	Mediterranean Basin
C. Nectar, secretion, pollen producing plants in summer season						
<i>Castanea sativa</i> Mill.	June–July	Dominant	Dominant	2–3	30–1500 m /Artvin, Balıkesir, Bursa, İstanbul, İzmir, Kastamonu, Kütahya, Ordu, Sinop, Tekirdağ, Trabzon, Van	Europe, Caucasian
<i>Crataegus tanacetifolia</i> (Lam.) Pers.	June	Minor	Secondary	-	1800 m /Ankara, Bolu, Erzincan, Eskişehir, Kastamonu, Malatya, Samsun, Sivas	Turkey
<i>Diospyros lotus</i> L.	May–June	Dominant	Secondary	-	50–1100 m /Artvin, Bursa, Erzincan, Erzurum, Giresun, Kastamonu, Kahramanmaraş, Rize, Samsun, Trabzon, Zonguldak	Caucasian, China, Japan
<i>Diospyros kaki</i> L. Fil.	June, September	Dominant	Dominant	-	Antalya, Hatay, Içel, İstanbul, Trabzon	China, Japan
<i>Sophora japonica</i> L.	July–August	-	-	-	Eastern Anatolia	SW. and E. Asia
<i>Vaccinium</i> spp.	May–July (August)	Minor	Secondary	-	0–1830 m /North of Turkey	SE. Bulgaria, Caucasians, Georgia, N. Iran
<i>Paliurus spina-chritii</i> Mill.	May–July	Minor	Dominant	4–5	0–1400 m /Turkey	S. Europe, Crimea, Caucasian, and Syria, N. and SW. Iran, N. Iraq
<i>Rhododendron ponticum</i> L. subsp. <i>ponticum</i> L.	March (May)–June (August)	Minor	Dominant	3–4	0–2100 m /N. Turkey	E. Balkans, Caucasian, Georgia, Lebanon
<i>Quercus robur</i> L.	August–September	Dominant	-	-	100–1800 m /Amasya, Bingöl, Bitlis, Bursa, Erzincan, Hakkâri, Içel, İstanbul, Konya, Muş, Niğde, Sivas, Tekirdağ, Tunceli, Van	Europe, Caucasian
D. Nectar, secretion, pollen producing plants in autumn season						
<i>Pinus brutia</i> Ten.	June (excretion period in September–October)	-	-	6	0–1200 m /Adana, Antalya, Aydın, Bilecik, Kütahya, Malatya, Muğla, Sinop, Zonguldak	S. Italy, S. Aegean, Crimea, Cyprus, N. Iraq, W. Syria, Caucasian
<i>Ceratonia siliqua</i> L.	September–November	Secondary	Dominant	4–5	0–300 m /Antalya, Içel, İstanbul, Muğla	S. Europe, Cyprus, Syria
<i>Calluna vulgaris</i> L. Hull	August–October	Minor	Dominant	3–4	150–1000 m /NW. Turkey, NE. Anatolia	Europe, N. Morocco, Açores, West Asia, North America
<i>Erica manipulliflora</i> Salisb.	July, October	Dominant	Secondary	3–4	0–1530 m /W. Turkey, S. Anatolia	Mediterranean, from Italy to the east and Lebanon, Latakia
<i>Eriobotrya japonica</i> (Thunb.) Lindl.	October–January (March)	Trace amounts	Dominant	-	0 m /W. and S. Anatolia	China, Japan

production via secretion or nectar. Besides, within the context of General Directorate of Forestry's 2013–2017 Honey Action Plan, 7 million of the lowest income generating portion of the overall population, forest villagers, are directly or indirectly supported considering the following:

- Within the afforestation done under Burned Forest Rehabilitation and Establishment of Fire Resistant Forest Projects, honey production oriented trees and shrubs are prioritized.

- Unless an imperativeness is on, species which are important in terms of biodiversity and beekeeping like *Castanea*

sp., *Tilia* sp., *Rhododendron* sp. will be protected while wood production.

- While producing non-wood forest products, flowering and blooming times (when honey and pollen productivity are at the maximum level) must be paid attention and no harm should be done to the following year's flower buds.

- During afforestation, rehabilitation, erosion control, range rehabilitation and forest maintenance, available flora/vegetation elements structure should be protected as is and in the same context and convenient vegetation for beekeeping must be established.

- During afforestation, rehabilitation, artificial regeneration, road side planting, service roads and fire suppression roads by taking the natural growth conditions into account, it is aimed to mix *Acacia dealbata* Link, *Acer* sp., *Tilia* sp., *Castanea* sp., *Rhododendron* sp., *Eucalyptus* sp., *Ceratonia siliqua* L., *Casuarina equisetifolia* L., *Robinia pseudoacacia* L., *Catalpa* sp., *Sophora* sp., *Thymus* sp., *Arbutus andrachne* L., *A. unedo* L., *Cornus* sp., *Pyrus* sp., *Salix* sp., *Myrtus communis* L., *Crataegus* sp., *Cotoneaster* sp., *Vitex agnus-castus* L., *Ziziphus jujuba* Mill.

- In national parks, natural protection areas, special environment conservation areas and other protected areas, within afforestation, rehabilitation, forest management and silvicultural planning stages, and production stages, and production/logging phase, demands coming from honey producers and sectoral representatives will be considered depending on forests and planning principles (Anonymous 2008).

- Starting in 1997, General Directorate of Forestry's "Multipurpose Functional Planning in Forests", "Honey Production from Forests" was included in a plan. Firstly, some parts of *Pinus brutia* forests within the Mugla Regional Directorate of Forestry was left (13,204.5 ha) for pine honey production.

- It is decided that no payment will be required for the beehives placed in state forests with the commitment of not harming the forest (Anonymous 2009, 2010, 2013c; Kılıç 2013; Mere 2010).

Conclusion and Suggestions

In Turkey, forest villagers are one of the most poor people group. In the for-

est area, about 7.8 million people live in Turkey. Agroforestry is very strategic tool for supporting this people. That's why in recent years the General Directorate of Forestry in Turkey has given very much importance to establish "Honey Forests". Apiculture can be acknowledged as a sub-system of agroforestry. There are numerous factors affecting the establishment of honey forests: highly productive bee races, knowledge and experience in bee-keeping, suitability of natural conditions, necessary tools and equipment. There should be planning with clone and genotype selection and rehabilitation in order to establish better honey forests other than choosing tree species. As a general approach, when designing agroforestry systems, the use of a range of tree and shrubs species flowering at different times can provide better forage for bees, therefore enhancing both honey and tree and annual crop production. Establishing honey forests all around Turkey, which started around 2010, is fairly new and we still did not receive any concrete results yet. Also we still need to work on informing/educating forest villagers about these establishments because they have number of reservations to place their beehives in the forest. As of today we have 205 honey forest establishments all around Turkey.

The following conclusions can be drawn from this study: 1) The first step of technical assistance for the families who deal with beekeeping; "phenology flowering maps" according to altitude and region need to be created. 2) More research, especially on exotic species like *Acacia*, *Robinia* etc., needs to be formulated to extend the flowering time by planting and growing the early, normal and late flowering varieties of the above species and clones. 3) Studies should concentrate on primary species, which have

high potential of pollen and nectar and rehabilitate by doing massive and individual selection in certain regions. 4) Also, for the species with high productivity, clone banks and seed origin plantations needed to be established with the individuals which were selected carefully. 5) Besides the experiments done for the selection improvement, further studies should be done for improving hybrid in genotype and clone/species which has long and high flowering characteristics. 6) Conferences/meetings have to be organized in order to acknowledge forest villagers that beekeeping in honey forests is more productive and free. 7) Turkey's honey production takes 3rd place in the world, with the help of "honey action plan" and General Directorate of Forestry it could be in a higher position. 8) In order to increase the income for forest villagers/beekeepers, we should have brand name organic and certificated honey.

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