MELLIFERA REVIEW ARTICLE

Beekeeping Activities in Turkey and Algeria

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A B S T R A C T

The present review consists of highlighting the different aspects of one of the most important sectors of agriculture, beekeeping, of two countries; Turkey and Algeria.

We gave a historical overview about beekeeping of both countries and also the flora and fauna (more especially on honey bee species) components of the two countries and their impacts on the beekeeping. In addition, position of the beekeeping in each country's economy and its possibilities as well as the most important problems that face the beekeepers have also been cited.

Keywords: Beekeeping, Turkey, Algeria

Introduction

Beekeeping, which means rearing bees, has been practiced since antiquity and still widely widespread in the world. Practiced on all continents, this activity differs according to the climate, flora, the variety of bees and the level of economic development.

Turkey forms a bridge between Europe and Asia, surrounded by the Black Sea in the north, the Aegean in the west, and the Mediterranean in the south. It is bounded by the Caucasus mountains in the north-east, and the Middle East in the south-east. Turkey is a mountainous country and it has many rivers, lakes and dams. The climate ranges from subtropical to arid upland steppe. Turkey is endowed with a diverse and rich flora [1]. It has about 10.000 plant species and 3.506 of them are endemic to this country. About 500 of them provide large amount of nectar and pollen for bees [2]. Beekeeping is conducted in all the provinces of Turkey. On the Mediterranean coast: from the end of autumn until spring, *Erica*, *Eriobotrya japonica*, *Prunus amygdalus*, *Citrus*; In spring in mountains and arcs: *Trifolium*, *Thymus*, *Astragalus* and *Salvia officinalis*; in the Thrace region: *Helianthus annuus*; in the South (Southeast and East) regions: *Gossypium*, are seen as the most important source of nectar and pollen for bees. Besides that, in the southwestern region they grow an important source of nectar which are the pine trees. In addition, in nature there are trees such as *Acacia*, *Tilia*, *Rhodendron*, *Castanea sativa* which grow wildly and contribute importantly to beekeeping [3]. In addition, almond trees (*Amigdalus*), *Castanea sativa*, *Castanea vulgaris*, *Salix alba*, *Robinia pseudoacacia* and *Erica* are the most important plants contributing in the enrichment of the beekeeping in Turkey with an interesting pollen yields [4, 2].

Algeria is located in North Africa and with an area of 2.4 million km^2 it is the largest

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country in the African continent. It includes 4000 plant species. There are three geographical regions: the tell in the north, the steppe and the Sahara. The tell covering 5% of the territory spreads on 1600 km of the coast and includes towards the interior many plains and the different mountains of the Tellian atlas. It is a region under the influence of the Mediterranean climate and presents the most diversified flora of the country with 2500 species of which 10% are endemic. Citing as an example: the species *Erysimum cheiri* of the *Brassicaceae*'s family and *Hypochaeris saldensis* of the *Asteraceae*'s family, two endemics of Gouraya National Park in the area of Bejaia [5].

Many trees, cultivated crops and wild plants, like eucalypt (*Eucalyptus camaldulensis* and *E. globulus*), orange trees (*Citrus* spp.), sunflower (*Helianthus annuus*), clover (*Trifolium* species), French honeysuckle (*Hedysarum coronarium*), Rosemary (*Rosmarinus officinalis*) and thyme (thymus sp.), provide nectar and pollen for the bees. Also, natural forests, including pine trees, are good sources for the bees and it is possible to obtain honey all year round [6, 7]. After passing the south side of the Tellian atlas, it is the steppe. It covers about 15% of the territory and includes the highlands whose attitude varies between 600-1200 m. It is under an arid Mediterranean climate and has a less rich flora than the tell with about 1100 species with few endemics.

As an example, *Saccocalyx satureioides* (steppic thyme). When we pass the southern side of the Saharan Atlas it is the Sahara. It covers 80% of the territory. It is under the influence of an extremely arid climate and thus presents the less rich flora with only 600 species and less favourable for beekeeping. On the other hand, the rate of endemics is high; 25%. From the most well known we can cite the Saharan Myrtle (*Myrtus nivellei*) and *Olea europea* subsp. *lapperrinei*. [5].

Beside this richness in flora of the two countries, we can observe a great diversity of the honeybees *Apis mellifera* breeds. In Turkey, the presence of at least five different races of *Apis mellifera* has been investigated: *A. m. anatoliaca, A. m. caucasica, A. m. meda, A. m. syriaca, A. m. carnica* [8, 9] and the recently found to be existed in the Greek border region *A. m. macedonica* [10]. While in Algeria, there are two races: Tellian *A. m. intermissa* and the Saharan *A. m. sahariensis*.

With these two most indispensable components, an abundant and varied flora and the bee, the beekeeping becomes a necessity to be cared out. That, not only because it is a very important activity in the development of agriculture for its various productions, noting that the bee is a source of incomparable wealth for the whole world. Honey, pollen, royal jelly, venom, larvae and the bee itself are used in dietetics and pharmacy, but also, since a third of what we eat would not exist if the bees disappeared. Beekeeping is involved, through the pollination process, as an element of integration in the development of fruit growing, not to neglect the fact that it intervenes in the process of income formation of farmers located in agro-zones ecologically difficult (mountain areas and foothills, oases, steppes) [11].

By the aim of this review, further information about history, general structure and position of the beekeeping in each of the two countries' economy and the most important studies done in this field have been underlined.

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I. Brief history of beekeeping

I. 1. Turkey

"Turkey is on the intersection of three continents and also located on two important trade routes of the past, namely the Spice and Silk Roads. Thus, it played a very important role bridging Asia, Europe and Africa. Indeed, Turkey was also the place where very important civilizations such as the Roman, Hittite, Byzantine, Ottoman and finally the modern Turkish Republic became established. Covering all of these civilizations, beekeeping can be divides into three main periods, supported by archaeological findings, the written laws of Ottomans and the present period of the new Republic. The history of beekeeping in Turkey is well documented in many books and articles (Crane, 1983; Crane and Graham, 1985; Kandemir, 2003; Akkaya and Alkan, 2007)." [12].

According to Kandemir, 2018 the three periods of Turkey's beekeeping history are:

Before Ottoman Empire

They have been found in central Anatolia, Boğazköy (Çorum) and Hattusa, many beekeeping remains like hives, bees, bees wax and some laws tablets showing how the honeybee thief was punished, going back to the period of Hittite Kingdom ([13]; [14]).

Furthermore, in Çatalhöyük, located in the Northeast of Konya and represent from the most important archaeological sites in Turkey and in the world, they have been observed, in a form of wall paintings and motifs on objects such as rugs, the presence of honey, beeswax, bee figures as well as the domestication of many animals and the daily life in this city which its presence goes back to B.C. 80007000 [15, 16].

In addition, dating back to the period of the Hellenistic and Romans, bee figures on different objects such as coins have been found in the excavations in Ephesus and Torbalı [17].

Moreover, about the beekeeping history in this period, about 2500 years ago, an intoxication incident has been reported while a group of soldiers during their passage by the villages of Trabzon consumed honey from hives. This was due to the "mad honey" in which till the present time is the cause of a lot of intoxications in these regions [12].

Ottoman Empire Period

The Ottoman Empire recorded an important plus for the history of beekeeping in Turkey.

"Many Ottoman Sultans used honey as a sweetener. During the period of Ottoman Sultan "Fatih Sultan Mehmet", more than 3 tons of honey was consumed in Topkapı Palace according to the records. In the Ottoman Empire period, beekeepers had to pay tax for their hives (Öşr-ü- kovan meaning hive tax) and honey (Öşr-ü asel meaning honey tax), until the end of 18th century, all sweets were made from grape molasses and honey.

Beeswax was also used in Ottoman Empire for document seals and also candles as light sources. At the end of the Ottoman period (the beginning of 1900's) beekeeping books and leaflets were published and the first modern beekeeping book was translated but not published for a long time. [12].

Modernization Period

In this period the beekeeping stayed stable for some time.

After 1923, the government put an important step in order to develop the activity of beekeeping by teaching it in schools. In the other hand, the use of

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primitive hives was still dominant. In addition, the production of honey was also law. However, this period has been considered as a transition period from using the primitive beekeeping to the modern beekeeping.

The modern beekeeping started to be developed significantly after the establishment of the Development Foundation (TKV) in 1969 and far away in 2003, the foundation of the Turkish Beekeeping Association. The aim is to relate the beekeepers to the government and to solve their problems.

For the same aim, many institutes (Ardahan İnstitute and Ordu Institute) and nongovernmental organizations (like Al Nihat Gökyiğit [ANG] foundation) were established, as well as the contributions of universities are not neglectable [12].

I. 2. Algeria

The ancient Algeria passed by many dynasties and empires such as the ancient Numidians, Phoenicians, vandals, Carthaginians, Byzantines, Abbasids, Umayyads, Idridis, Rustamis, Aghlabid, Ziris, Fatimids, Hammadids, Almohads, Ottomans,

Almoravids and the French colonisation empire. In the period of French occupation, many archaeological sites have been destroyed to build new cities or establish prisons, as it has also burned or hidden many state archives.

Beekeeping is an ancestral practice in Algeria. However, its origin is lost in the mists of time. Furthermore, data are very few.

According to [18], the history of Algerian beekeeping can be divided into two important stages:

During French colonisation

Traditional beekeeping was important, but modern beekeeping was largely at the hands of settlers without knowledge transfer to indigenous peoples.

[19] site the statistical data of 1891, there were 27,885 beekeepers including 260861 Algerians owning together 231,329 traditional hives. The 1000 French beekeepers operated about 10,000 hives with frames. - Before the national liberation war, the French authorities estimated at 150,000 traditional hives in Algeria but other information estimates the double 300,000 traditional hives and 20,000 hives to frame.

In 1954 came the national liberation war which contributed to the destruction of a large part whose situation was critical to independence [20- 22].

During the war of liberation, a large part of the traditional hives was destroyed by the French army which considered that each hive could serve as a hiding place for weapons.

After independence

During this period, the State looked into the problem of the beekeeping sector by implementing development programs. It has focused on the growth of livestock, moving towards the importation of foreign bees and also to build a hive called Algerian [18, 23] and the creation of beekeeping cooperatives.

II. Current beekeeping situation of the two countries

II. 1. Turkish beekeeping

Turkey has a great natural potential for beekeeping; various and economically

precious bee breeds, richness in floral resources and the appropriate climate conditions [1]. As it showed a remarkable progress in recent years, in which almost in all cities of Turkey, beekeeping unions have been founded and gathered under one main union (Central Turkish Beekeeping Association [TAB]). In addition, each beekeeper has an identification number in order to be able to control all what concerns the production and the problems that may happen [10].

The number of beekeepers in Turkey increased from 40.000 [24] to 83.210 in 2017 (Statistical İnstitute of Turkey [TÜİK]). One from the important development images of the Turkish beekeeping as well is in term of number of beehives. Turkey is considered among the countries having a high number of beehives in the world [25].

The country's colony presence was 4,2 million between 2000-2002, it reached 6,6 million in 2013 [26].

In an agriculture fair held on 27. 09. 2017 in Samsun, the Ministry of Food, Agriculture and Livestock Deputy Undersecretary Hasan Özlü, in his speech: "As of 2017, there are 7,9 million of beehive units" said.

Langstroth type hives are the most applied in the beekeeping of Turkey and only about 4,2 % as traditional hives are still used [25].

Honeybee races

In turkey there are at least five different races of the honeybee *Apis mellifera*:

Apis mellifera anatoliaca (central Anatolia) it has large spread in lot of regions in Anatolia. They are generally small bees and have a light brown colour. The most important characteristic of these bees that they are vey adapted to the geography and climate of Anatolia. They are more resistant to winter conditions and diseases [27, 28]. Thus, they have many ecotypes adapted to different regions of Turkey, in which the most common are Muğla, Thrace and Central Anatolian ecotypes [29, 30].

A. m. caucasica (North east of Turkey) The second important honeybee in Turkey. They are seen in the eastern Anatolian plateau and in the border regions of Caucasus. They are adapted to highlands and temperate climates. They are dark grey in colour and have the longest tongue between the other bee races. They give stronger colonies during the summer. They use lot of propolis and the honey yield that can produce is far superior than that of the Anatolian honeybee. It is found that they are sensitive to Nosema disease [25; 27].

A. m. carnica (Black Sea region) called as well grey bees, they are slim and have a long tongue. They are the calmest bee breeds. Their giving puppies' yield is very good and they use less propolis. Besides that, in harsh climatic conditions they have a very good wintering skill. It is observed that they are not sensitive to puppies' diseases [27].

A. m. meda (southeastern of Anatolia) and *A. m. syriaca* (southwestern of Anatolia) It was observed that they are characterized by less honey storage and their aggressivity comparing to the other bee races and ecotypes of Turkey [31].

Bee products

The most important beehive product in Turkey is honey. Honey production has increased from 81.115 in 2010, 107.665 in 2015 to 114.471 ton in 2017. Yearly honey production is reported as 14 kg per colony in the years 2012-2015 [10, 32]. Turkey offers a great diversity of honey types with different taste, colour and aroma [2].

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"As unifloral honey there are produced numerous kinds of honey including 'yonca' (alfalfa), 'Anzer', 'kestane' (chestnut), 'deli' (crazy), 'okaliptus' (eucalyptus), 'ihlamur' (linden), 'nane' (mint), 'portakal' (orange), 'çam' (pine),'kuşdili/biberiye' (rosemary), 'ayçiçeği' (sunflower), 'kekik' (thyme) honey." [33].

Anzer honey is the most expensive honey in Turkey and it is produced in Anzer highland located in Rize [34].

Deli honey is produced by taking nectar from Rhododendron plants which contains high level of grayanatocin which makes the honey poisonous [33].

Also, the honeydew produced in Turkey represent 85 % of it in the world [35].

The average consumption of honey in Turkey estimated 1,2 kg, in which almost all the honey produced in the country per year in consumed locally [36].

"In 2014, Turkey exported approximatively 5.000 MT (20 million $) honey mostly to Germany, United States, Jordan, Hungary, Iraq, Saudi Arabia, Austria, Northern Cyprus, Belgium and Spain". [36]

In the other hand, "Turkey has no import ban on honey, the Turkish Ministry of Economy implemented a high custom tariff on imports, thus making it difficult for Turkish business to import honey". [36]

Beeswax, pollen, propolis, royal jelly, bee venom, bee swarm, package bee, queen bee and bee hives are also a part the beekeeping economy of Turkey [37].

Beeswax production is 4750 ton in 2015 [38], which is not enough to cover the demand. In consequence, in the last years it was obliged to import the wax.

There is no sufficient data about the yearly production of pollen, royal jelly, propolis and bee venom [10].

Queen production is about 100.000 which is reported that it is less sufficient.

Furthermore, because of the huge importance of bee pollination, it has a crucial role for any country's economy. "In Turkey, the added value to agriculture from honeybee pollination is over $ 2.3 billion annually" [39].

Most faced problems

The most serious problem is presence of honeybee diseases;

Marketing, trading and quality of the products;

Environmental factors (like climate);

Education of beekeepers;

"Beekeepers have to pay fees to the farmers instead of being paid for pollination services"; - "Beekeepers can not enter to some places in Turkey with scientifically unknown reasons"; in addition to the underestimated pollination [25].

Uncontrolled use of pesticides in agricultural areas affects so badly the productivity of bees and the yield of colonies [40].

Resistance and residue problem as a result of overusing the chemical treatments [41].

Migratory beekeeping

Migratory beekeeping is widespread in Turkey, in which, the beekeepers transport their hives from one place to another in order to reach a sufficient and the desired level of honey production [39]. The transfer is generally done to citrus and thyme areas in spring, to the fire forests in June, to cotton areas in summer, clover and

sunflowers areas in August and to pine forests in September and October [42]. It is first started about 35-40 years ago from the Black Sea region [1].

80 % of total honey production in Turkey is operated by the main of migratory beekeeping [43], and around 75 % of total Turkish honeybee colonies are concerned in this practice. It provides the country with an important revenue. The average honey yield resulted after a long distance migratory beekeeping can reach 30 Kg per colony [44]. However, it has been reported that the migratory beekeeping is a main cause of lot of beekeeping problems. It affects seriously the natural genetic diversity of bee races in Turkey. Moreover, it causes the distribution of resistant varroa mites and other diseases to the other colonies in areas visited, which results huge colony losses [10].

II. 2. Algerian Beekeeping

Algeria has within its possibilities that conditions the success of this sector the mild climate, especially in the north, and the diversity of honey resources well adapted to the three levels of climate present in the country.

With the National Plan of Agrarian Development (N.P.A.D.) that the State set up in 2000, beekeeping in Algeria has undergone a certain development in which the evolution of the beekeeping continues to increase.

During the period 2000-2008, the beekeeping sector underwent a major improvement thanks to this plan, such as, the apiarian livestock increased from 360.000 in 2000 to nearly one million colonies in 2008. Thus, the production of honey has been tripled; it has changed from 10.500 quintals in 2000 to 33.000 quintals in 2008 [45].

In addition, a very large number of traditional hives have been replaced by modern hives; 95.000 was the number of traditional hives in 2000 and it became 25.000 in 2008 [45].

The Agricultural and Rural Renewal (ARR) strategy applied in the country has contributed as well to the development of the beekeeping sector. The number of colonies has increased by more than 30 % to reach 1.3 million between 2008- 2014. In the same period, the production of honey was estimated around 600.000 tons, as it was noted a diversification of bee products (pollen, royal jelly, propolis, beeswax) [45].

Moreover, in the framework of the country's Human Capacity Building and Technical Assistance Program (HCBTA), more than 40.800 beekeeping trainings, provided by different institutions, have been launched. This resulted the presence of more than 40.000 beekeepers distributed in 43 wilayas from 48 (present in different geoclimatic and agricultural zones: mountains forests, steppe and Saharan areas) [45, 46].

The Langstroth hive type is the most modern hive used in Algeria. This type of bee hive has undergone some modifications in order to protect the bees from winds and hot weather (especially in the warmer regions) and to promote a better production of honey. In the desert areas of Algeria where temperatures are very high and winds are violent, traditional hives made of stone and clay have also been found [11].

Honeybee races

Algeria has two main breeds of bees. *Apis mellifera intermissa* and *A. m. sahariensis*.

a. *A. m. intermissa* (Tellian bees) Called Tellian bee relative to the Tellian Atlas Mountains and named by some the

"Phoenician bee" compared to the ancient Phoenicians who settled on the coasts of North Africa, spreads in the northern regions of

Algeria, Morocco and Tunisia. It's a medium sized bee compared with the other bee breeds and its colour is black [47].

"Generally, more than 100 queen cells are built during the swarming period and several virgin queens can coexist until the fertilization of one of them, an observation that is made in other Mediterranean breeds. The colonies swarm lot, sometimes seven times in a season. They are nervous bees and have a strong defensive character. Moreover, they propolis a lot" [48] and it is characterized by a good production of honey [49].

A. m. intermissa is very sensitive to brood diseases but resists well to that of adults [50].

b. *A. m. sahariensis* (Saharan bee) It is the most threatened bee breed because of its low interest in the Algerian economy. Its pollinating activity is not negligible and its scientific interest lies mainly in its ability to adapt to the desert climate of the Sahara [47]. "This bee spreads in the oases of southern Morocco and western Algeria. In the oases of the Eastern Algerian Sahara, the presence of *A. m. intermissa* was registered. It can survive in extreme weather conditions, with temperatures ranging from -8 ° to 50 °. The colonies are not very populous. *A. m. sahariensis* is smaller than *A. m. intermissa*. It seldom swarms, makes few royal cells and virgin queens are eliminated during swarming. Moreover, the colony propolis little and is not very defensive although a little nervous" [48]. Its colour is yellow and its production of honey is good.

"Many foreign breeds have been introduced to Algeria, such as common bees of Europe, Italian, Caucasian, etc…" [47].

Bee products

In Algeria, as well, honey is found to be the most important and the most consumed compared to other hive products. According to one from the beekeepers of the city of Constantin, there are 10-12 kinds of honey in Algeria; the most famous are: eucalyptus honey, orange honey (the cheapest honey in Algeria), wild carrots honey, white clover honey, lavender honey, wild strawberry honey, mountains honey, various flowers honey…

However, there are those who confirm that there are more than that number; referred to the Sahara beekeepers, they produce about eight other types of honey like, thyme honey, absinthe honey (*Artemisia* sp.), desert wild chamomile (*Anacyclus valentinus*) honey, *Thapsia garganica* honey, *Euphorbia helioscopia* honey, *Peganum harmala* honey, *Aristida pungens* honey besides the cedar honey which raises the number to more than 20 kinds of honey.

Cedar honey is the most expensive and famous honey in Algeria. This is due to the spread of cedar trees more in the desert, which requires the beekeepers to move their hives for long distances which cost them lot of expenses, especially transportation and renting lands of farmers, in addition to its various health benefits [51].

Although the production of honey in Algeria has undergone a remarkable evolution in recent years, the consumption of honey by the Algerian remains insignificant, because it is generally only used for the needs of a remedy. The annual consumption has been estimated around 90 g [52].

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Moreover, the country fails to achieve selfsufficiency for this product where it has to rely on imports. This latter of honey reached the 150 thousand tons in recent years. Hence the main supplier countries are: Saudi Arabia, Thailand, Turkey, USA, Germany, Bulgaria and Hungary [53].

In addition to honey, there are also other bee products such as wax, pollen, propolis and royal jelly, hence their production is very law, because many beekeepers either do not produce them or provide them in small quantities and use them for their own needs.

Algeria also imports wax, beehive wood, beespecific veterinary products and biological materials (queens, swarms).

All raw materials (either imported or supplied by beekeepers) are sent to the cooperatives which transform them into final products for producers (embossed wax, beehives, etc).

Most faced problems

Despite the efforts to improve the beekeeping sector in Algeria, the latter still suffers from problems related mostly to organizational issues, plus to climatic conditions characterized by fluctuation.

One of the most important problems among beekeepers in Algeria is due to the problem of marketing for local products, which is due to various reasons: Lack of coordination between beekeepers, including cooperatives, Dumping local markets with foreign products, Lack of publicity to local products, Problem of packing in which the beekeeper still cannot expose his products in a way that satisfies the consumer. Colony losses due mainly to honeybee diseases; Problem of coordination between farmers ad beekeepers at the time of use of pesticides [51]. Lack of accredited honey analysis laboratories [45].

Migratory beekeeping

In order to increase their productions, beekeepers have adopted the practice of migratory beekeeping, which means transporting hives to areas where flowering occurs at different times.

The development of the sector in recent years as a result of governmental programs and the efforts of beekeepers has led to increased production and diversification of hive products; beekeepers crisscross approximatively the entire national territory and do up to eight migrations per year [54].

However, this practice remains expensive (despite the quality of products offered by this possibility), limited (lack of resources and professionalism) and poorly organized (overload on the same sites) [45].

Türkiye ve Cezayir'deki Arıcılık Aktiviteleri

Öz: Bu derleme, Türkiye ve Cezayir'deki en önemli tarımsal sektörlerden biri olan arıcılığın farklı yönlerinin vurgulanması amacıyla oluşturulmuştur.

İki ülkenin arıcılığı hakkında tarihi bir bakış açısı sunulmuş, ayrıca iki ülkenin flora ve fauna (daha özel olarak bal arısı türleri üzerinde) bileşenleri ve bunların arıcılık üzerindeki etkileri hakkında bilgi verilmiştir. Ayrıca, arıcılığın her ülkenin ekonomisindeki konumu ve olanakları ile arıcıların karşılaştığı en önemli sorunlardan bahsedilmiştir.

Anahtar Kelimeler: Arıcılık, Türkiye, Cezayir

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