World Academy of Science, Engineering and Technology
International Journal of Agricultural and Biosystems Engineering
Vol:8, No:1, 2014

Beekeeping in Libya

M. Keshlaf

***Abstract*—**Honey bees are the most important insects because of their ecologic and economic impacts. They pollinate more than 200 flowering crop plants resulting in an increased yield. Also, honey bees provide multiple products such as honey, royal jelly, wax, venom, pollen and propolis. Beekeeping has been practiced by Africans in all parts of the continent for many thousands of years. However, there is a little scientific information published worldwide about beekeeping in Libya. This review article aims to shed light on the history and current status of honey bee keeping in Libya.

Keywords*—Apis mellifera*, Libya, beekeeping.

I. Introduction

LIBYA extends over 1,759,540 km^2, making it the 17th largest nation in the world by size. The Libyan Desert which covers much of Libya (up to 90%) is one of the most arid places on earth. Oases can be found scattered throughout Libya, the most important of which are Ghadames and El-Kufrah, where water can be found by digging to a few feet in depth. Libya's coastline (1,770 km^2) is the longest of any African country bordering the Mediterranean [1]. The climate is mostly dry and desert-like in nature. However, the northern regions enjoy a milder Mediterranean climate [2]. Most of commercial beekeepers are located in an agricultural belt that extends to about 30 km from the coast.

A. History of Keeping Bees in Libya

Honey bees are endemic to Africa, where the relationship between man and honey bees took several forms, commencing with harvesting honey comb from wild honey bee nests in hollow trees and rock crevices to modern beekeeping [3]. Historically, honey hunting has been practiced in many countries. However, much less is known about honey hunting in the Mediterranean region. Graphic depictions of honey hunting can be found at numerous sites throughout Africa. Paintings showing bees, hunters, and their primitive tools such as ladders, torches, and honey containers required to carry out the raids have been found on rock walls in Libya as well as many other countries [3]. However, few beekeeping records have been found for areas of North Africa west of Egypt. The earliest likely one concerns Libya which adjoins Egypt. Herodotus (485-425 BC) wrote: "Next to the Maxyes of Libya are the Zaueces, whose women act as their drivers when they take their chariots into war. Next to these are the Gyzantes, a people where their bees produce a great deal of honey, but, it is said, craftsmen make much more' (IV, 193-4). Perhaps "their bees" were in hives, and the craftsmen made a sweet "honey" from dates or other fruits. Herodotus wrote later (VII, 31) that men in Lydia in Asia Minor "make honey out of the fruit of tamarisk" [3].

Beekeeping in Libya has been practiced traditionally since early times [4]. Almost all traditional hives in North Africa were horizontal cylinders made of mud, clay or other materials that could be opened at either end [3]. Olive Brittan [5], a beekeeper to the king of Libya, Idris El-Senussi, reported that Libyan beekeepers in Cyrenaica collected swarms which they had learnt to put into heavy wooden boxes, long, wide and shallow, capable of holding 15 combs. Two or three forked juniper sticks were jammed as pillars from floor to roof in the center or towards the front of the box to support the heavy brood combs. They used to honey combs were able to be cut from the back and front entrances without killing bees. These boxes, Brittan estimated, yielded about 18 kg of honey each year [5]. She reported that she had heard that these boxes were in use for more than 200 years, even before the Turkish era. Brittan mentioned that most families kept one or two hives but there were beekeepers with apiaries of up to 100 hives which they located in caves [5].

Until the 1950s, Libya was the 3rd poorest country in the world. After the discovery of oil reserves in 1959, the Libyan economy has changed dramatically [6]. Modern beekeeping has in Libya has developed only in the recent decades with the adoption of modern beekeeping techniques using hives with removable frames [5]. The successful introduction of modern hives to the east of Libya occurred after the ravages of the Second World War, and was supported by Olive Brittan in 1952 [7]. Until today, beekeepers in the eastern region of Libya still use Langstroth hives, whereas in the western region Dadant hives are used and are believed to have been imported by the Italians during the occupation (1911-1932). Then, early in the 1960s, European-evolved races of honey bees, primarily the Italian, *A. mellifera ligustica*, formed the basis of a honey producing industry. Currently, there are more than 3,000 beekeepers, managing approximately 50,000 colonies [8]. Although many of these bees are maintained in the one location (i.e. not migrated), they still produce an average of 500,000 kg per annum. Because of increasing management difficulties, associated with limited floral resources and bee diseases, some beekeepers have had to reduce their operations. While a number of beekeepers manage 200 or more colonies; the majority manage 50 or a few more colonies in their apiary to harvest respectable amounts of honey. Keeping bees as a second income is very common in Libya. As a result, increased competition from adjacent apiaries appears to have reduced nectar availability.

B. Subspecies of Libya Honey Bee

Because Libya was historically so isolated, its local bees had no outside contact with other bees. The native bees have

Marwan. M. Keshlaf is with the Department of Plant Protection, University of Tripoli, Tripoli, Libya (phone: 208-91479-4142; e-mail: marwan_keshlaf@yahoo.com).

been described as predominantly of the Taillan race, *A. mellifera intermissa* [9]. Brittan [10] wrote in one article, "the race itself seems to be the purest one found this side of the Iron Curtain. [the Libyan bee] is gentle apart from a natural intense fierceness during the great heat of the day, or when very strong through a long period of honey flows". Brother Adam [11], after a visit to Libya, stated that honey bee colonies there were considerably more aggressive than all those he had encountered in the USA.

El Banby [12] concluded that bees from northeast Libya belong neither to *A. m. intermissa* nor to *A. m. lamarckii*. However, Ruttner [13] subsequently alleged, based on morphometric analyses of adjacent countries, that the Libyan honey bees belong to *A. m. intermissa*, in spite Shaibi et al. [14] investigated honey bee populations of *A. mellifera* in Saharan and coastal locations in Libya to fill the North Africa gap of biogeography and distribution of honey bees. They found that Libyan honey bees are different, morphologically and genetically, from adjacent subspecies; and majority of Libyan bees (92%) belong to oriental evolutionary lineage (O). As well as, they found local impacts of imported European honey bees. They suggested naming Libyan bees as a separate subspecies [15]. In another study, Shaibi and Moritz compared the non-fragmented coastal population with those of the oases of Brak and El Kufrah using 15 polymorphic microsatellite loci assessing the mating frequency, colony density, gene diversity, and population differentiation. They found that the honey bee population of the remote oasis of El Kufrah was well isolated whereas those of the oasis of Brak and the coastal regions showed genetic foot prints of introgression by commercial beekeeping [16]. The isolated El Kufrah population showed no indications of inbreeding suggesting that the endemic population size is sufficient to ensure sustainable local survival [17].

Although honey bee queens have been frequently imported into Libya from Italy and Australia generally they last only for one season, and most requeened colonies rapidly lose their gentle character through subsequent crossing with the native bees. There are probably enough hygienic colonies in Libya to provide genetic stock for rearing more hygienic queens, but there is at the present no queen rearing unit in Libya.

C. Bee Plants

Like most other African countries, pollination servicing is not practiced [18] in Libya. Therefore, honey is considered to be the major if not the sole income for beekeepers. There is no large scale of orchards or other horticultural crops. Sometimes, beekeepers are requested to provide honey to farmers as a rental fee for access to a flowering crop. As a result, beekeepers largely rely on non-crop wild plants, different species of which occur in different regions of the country. Migratory beekeeping is commonly practiced for honey production [19].

The main honey plants in Libya including; *Eucalyptus* spp., *Acacia* spp., *Citrus* spp., *Pinus* spp., *Cupressus* spp., *Thymus vulgaris*, *Lantana camara*, *Hisbiscus rosa-sinensis*, *Medicago sativa* and many wild plants [19]-[25]. Of those types, *Eucalyptus* honey, from *Eucalyptus* spp., is one of the main honeys produced and consumed in Libya especially in the north where there are extensive areas of trees which flower in November and December. Because of the consecutive blooming of the different *Eucalyptus* species, it is regarded as the most important source of nectar and pollen to colonies in drought periods [22], [23].

In the western region of Libya, there are three main honey flows, the heaviest from spring flowering plants in late March and April. Many beekeepers move their colonies to hilly country located east of Tripoli for the second flow from wild flowers of Sider, *Zizaphus Spina*, from May to June, then for the third flow from thyme, *T. vulgaris*, in June to July. In desert areas, tamarisk, *Tamarix nilotica*, of provides exceptional honey flow [25]. In the eastern region there are other bee plants such as schamiry, *Arbtus pavarii*, [20] and carob, *Ceratonia siliqua* [10].

Libyans use honey primarily for medicinal purposes, but also for many handmade sweets, especially Baklava, a popular Middle Eastern dessert. Brittan [10] praised Libyan honeys including shibrook honey from the carob tree, min honey from the shaiee tree, and hanoon honey from schamiry tree. High standards of Libyan honeys were confirmed by Owayss [23] who assessed the physicochemical characteristics of Libyan *Eucalyptus* honey.

TABLE I
MAIN BEE PLANTS IN LIBYA, AND ITS FLOWERING PERIOD

Common name	Scientific name	Flowering season
Orange tree	*Citrus spp.*	March – April
African rue (harmal)	*Peganum harmala*	April – May
Sedr	*Zizaphus Spina Christi*	May – June
Thyme (Za'atar)	*Thymus capitatus* L.	June – July
Tamarix	*Tamarix Africana*	July – August
Carob tree	*Ceratonia siliqua*	August- October
Schamiry	*Arbtus pavarii*	December – January

The Libyan honey market is rich in unifloral honeys. Locally produced honeys bring a premium price, ranging from 20 to 40 Libyan diners (LD) (about US $17 to 30) per kg, with the exception of hanon "bitter" honey which fetches 70 LD per kg. Most of the honey produced by the commercial beekeepers is sold directly to customers, often, along roadsides in a great variety of glass jars. There is very little marketing undertaken, because honey is generally sold as soon as the beekeeper produces it. Imported honey sells in grocery stores for approximately US $7 per kg, but despite its lower price, consumers prefer the local honey because of its quality and authenticity. Crystallized honey is widely misinterpreted as an indication of foul play by the producer, so buyers are happy to obtain honey directly from trustful beekeepers as soon as it has been extracted.

Honey yields are generally low, about 10-15 kg per hive per annum [21], due to limited bee flora, inadequate winter feeding, the common practice of splitting colonies just before honey flow, and the debilitating effects of pesticides and diseases. As a result, demand for both honey and bee packages is always greater than supply. There is continuous demand for

bees, with swarms selling for about 200 LD, which provides beekeepers with additional income. Normally, the beekeeping season commences earlier in the eastern region. However, the use of different types of hives makes it difficult to supply bee packages from the eastern to western region. Capturing swarms in bait hives (particularly in spring) is a procedure being used by many beekeepers to increase colony numbers. Beekeepers usually do not requeen such colonies. However, this procedure eventually could pose problems as beekeepers are unintentionally selecting for bees that are more prone to swarming.

Although there is an increasing demand for royal jelly and other bee products to be used mainly for traditional medication, the lack of knowledge and availability of modern equipment for processing these alternative bee products mean these beekeepers are foregoing this source of income. The only other bee product is bee wax, which is used to a very limited extent for manufacture of foundation comb.

D.Pest and Diseases

Control of bee diseases has been always considered as an important part of good beekeeping. Beekeepers must learn to recognize signs of bee diseases and know the correct actions for each one. Most of the cosmopolitan honey bee pests and disease are present in Libya [26]. The honey bee ecto-parasite mite, *Varroa destructor*, is a serious threat to beekeeping in Africa as well as many other parts of the world, was reported to be present in Libya in 1976 [27]. Mites were introduced with infested bee packages imported from Bulgaria [28] to Algabal Elakder which then spread rapidly throughout the country. Hopefully, the barrier created by Sahara will prevent its spread into the sub-Saharan African honey bee populations. Shibi reported that oasis of Al Kufrah, in the Libyan desert, [16] and Australia are the only varroa-free regions worldwide [29]. Infested European bee colonies die within two years if left untreated [30], but Libyan bees seem to have a good hygienic behavior since colonies can survive more than five years without medication. Kefuss [31] found that *A. m. intermissa* colonies from Tunisia, which also occur in Libya, had the highest level of hygienic behavior of several subspecies of *A. mellifera* (*A. m. mellifera, A. m. ligustica, A. m. carnica, A. m. caucasica*) that he tested from France, Tunisia and Chile.

The presence of the bee louse, *Braula coeca*, in Africa was reported in Tunisia in 1978 [32]. AS a result of trade activities, the parasite spread to Egypt, in the areas of the Nile Delta, then into Algeria in 1981 [32], and subsequently into Morocco and Libya. Because of their broadly similar appearance, some Libyan beekeepers have difficulty in to differentiating between varroa mite and bee louse.

Libyan beekeepers also have problems with the greater wax moth, *Galleria mellonella*, which causes the most serious damage to stored combs [26]. During summer, they can also infest weakened colonies. Many beekeepers avoid infestations by fumigating stored supers with paradichorobenzene (PDCB). A growing number of beekeepers store their supers in cool rooms to avoid chemical contamination of honey.

Small hive beetle (SHB), *Aethina tumida*, does not pose a threat in sub-Saharan Africa since it is endemic to this region [33] and the native bees have coevolved with it. They only represent minor pests since they infest weakened colonies [34]. In the northern part of Africa, their presence has been reported in Egypt along the Nile river and in Sudan [35], but they do not seem to have established there according to recent large scale surveys that found them to be either absent or very scarce [36]. Like *Varroa* mites, SHB became serious pests when they were exposed to susceptible hosts (European strains of honey bees) in the USA and Australia. Although small hive beetle is not yet reported in Libya, further quarantine action needs to be undertaken to prevent its introduction from Egypt. Restrictions on the importation of hive products or beekeeping equipment from Egypt are regulated by the government. The importation of honeybees is prohibited by the Agricultural Pest legislation. These measures could prevent the introduction of foreign pests and diseases to which Libyan bees are not adapted and to which they could be susceptible.

Several diseases common in temperate beekeeping areas, such as European foulbrood, *Streptococcus pluton*, have been observed occasionally (MK pers. obs.) in early to mid-spring, the period when colonies should be building up to maximum populations. The fungal disease chalk brood, *Ascosphaera apis*, has also been reported [26], and for its management, beekeepers are advised to maintain populous colonies and to select for colonies which show resistance, for future bee package production.

In Africa, American foulbrood, *Paenibacillus larvae larvae*, has not been diagnosed south of the Sahara, except for one unconfirmed observation from the Johannesburg area in South Africa [37]. A survey of Libyan honey did not show any sign of contamination by *P. larvae larvae* spores [38]. It may be that the disease is not present in Libya, or that colonies are tolerant because of their hygienic behavior or low physiological susceptibility. It is well documented that bees with the ability to detect and remove diseased brood can be completely AFB resistant [39].

The bee-eater, *Merops apister*, is a bird that feeds on honey bees and other insects. The first generation of this species is usually observed in April-May, with peak populations in July-August. Keshlaf [19] and Fallah [40] demonstrated that bee-eaters did not affect bee flight activity during their experimental work. Although forager bees can comprise more than 90% of bird's insect diet [40], beekeepers commonly neglect these birds. They would be considered a serious pest if they arrive earlier in the season, especially during mating flights of new virgin queens.

E. Other Issues Influencing Libyan Beekeeping

As with beekeeping throughout the world, swarming is a serious problem that requires beekeepers in Libya to visit their apiaries every 7-10 days during strong nectar flow, to manipulate hives for swarm minimisation.

Habitat loss in Libya is likely to be the most significant factor affecting honey bee populations in the future. Although the population in Libya doubled in size between 1970 and

2000 the major impacts were on the cities and other settlements. The decrease in forested areas through land exploitation has a greater impact. Indeed, beekeepers move their honey bee colonies to these areas during drought and deforestation could affect them drastically.

REFERENCES

[1] Anon. "Demographic Yearbook (3) Pop., Rate of Pop. Increase, Surface Area & Density". United Nations Statistics Division. Retrieved 5 February 2013.
[2] Anon. "Weather and Climate in Libya". Southtravels.com. Retrieved 23 December 2012
[3] E. Crane "The World History of Beekeeping and Honey Hunting". Taylor & Francis. 1999.
[4] M. H. Hussein "A review of beekeeping in Africa: i- North-east and West African countries", Apiacta, vol. 36, pp. 32-48, 2001.
[5] O. Brittan "Introduction of modern beekeeping to Cyrenacia (Libya)". Bee Craft, vol. 37, pp. 145-146, 1956.
[6] Anon "World proven crude oil reserves by country, 1980–2004". Opec.org. Retrieved 5 February 2013
[7] K. Showler "Beekeeper to the king of Libya". Bee World, vol. 88, pp. 37, 2011.
[8] A. S. El-Mabrook "Beekeeping in Libya". 1st International Arab Apicultural Congress, Beirut, August; pp. 29-31. 1996.
[9] H. R. Hepburn, S. E. Radloff "Africa races of honeybees". Proc. XXV international Apiculture. Congress, Grenoble, 172, 1998.
[10] O. Brittan "Introduction of modern beekeeping to Cyrenacia (Libya)". Bee Craft, vol. 38, pp. 4-5, 1956.
[11] A. Brother "In Search of the Best Strains of Bees. Second Journey". Bee World, vol 35, pp. 133-245. 1954.
[12] M. A. El Banby "Biometrical studies on the local honeybee of the Libyan Arab People's Socialist Jamahiriya". *Proceedings of International Beekeeping Congress*, vol. 26, pp. 269, 1977.
[13] F., Ruttner "Biogeography and Taxonomy of Bees**".** Springer-Verlag, Berlin. 1988.
[14] T. Shaibi, S. Fuchs, R. Moritz "Morphological study of honeybees (*Apis mellifera*) from Libya". Apidologie, vol. 40, pp. 97–105, 2009.
[15] T. Shaibi, R. Muñoz Dall'Olio, M. Lodesani, P. De La Rúa, R. Moritz "*Apis mellifera* evolutionary lineages in northern Africa: Libya, where orient meets occident". Insectes Soc, vol. 56, pp. 293–300, 2009.
[16] T. Shaibi, R. Moritz "10,000 years in isolation? Honeybees (*Apis mellifera*) in Saharan oases". Conservation Genetics, vol. 11, pp. 2085-2089, 2010.
[17] T. Shaibi "The honeybees (*Apis mellifera* L) of Libya". Egypt. Acad. J. Biolog. Sci., vol. 6, pp. 39 – 47, 2013.
[18] J. Corner "Bees as a development resource in sub-Saharan Africa". In D.L. Hawksworth Advancing agricultural production in Africa: proceedings of CAB's First Scientific Conference, Arusha, Tanzania, 12-18 February1984.
[19] M. Keshlaf "Thyme *Thymus capitatus* L. as a melliferous plant". Dissertation, University of Tripoli, 2002.
[20] H. G. Keith "A preliminary check list of Libyan flora". Ministry of Agriculture and Agrarian Reform, pp. 528, 1970.
[21] M. H. Hussein "A review of beekeeping in Arab countries", *Bee World*, vol. 81, pp. 56- 71, 2000.
[22] S. H. Rateb, M. H. Hussein "Pollen spectrum of some Libyan honeys" Journal of Applied Sciences Research, vol. 8, pp. 2659-2663, 2012.
[23] A. Owayss "Physicochemical Analysis for Standardizing Quality Criteria of Libyan Eucalyptus (Eucalyptus sp.) Honey". Egypt J. of Appl. Sci., vol. 20 pp. 247-255, 2005.
[24] M. A. Mohaned, A. A. Ahmed, M. M. Mazid "Studies on Libyan honeys". *Journal of Food Quality*, vol. 4, pp. 185-201, 1981
[25] A. Zboray "Flora and Fauna of the Libyan Desert". Fliegel Jezerniczky Expeditions. Retrieved 5 February 2013.
[26] A. Ghalio "Pests and disease of Honeybees in Libya". Dissertation, University of Tripoli, 1997.
[27] E. Crane "Fresh news on the varroa mite". Bee World, vol. 60, pp. 8, 1979.
[28] H. Fallah "Control of Varroa Mite". Dissertation, University of Tripoli, 2000.
[29] M**.** Holland "Varroa mites could devastate our honeybee industry"., The Sydney Morning Herald. June 26, 2012.
[30] A. Gregorc , I. Planinc "The control of *Varroa destructor* using oxalic acid". Vet. J., vol. 163, pp. 306-310, 2002.
[31] J. A. Kefuss "Honey bee hygienic behavior: France, Tunisia and Chile". *Apidologie* , vol. 26, pp. 325–327, 1995.
[32] I. B. Smith, D. M. Caron "Distribution of the bee louse *Braula coeca*, in Maryland and worldwide", *Am. Bee J.*, vol. 125, pp. 294-96, 1985.
[33] El-Niweiri T., El-Sarrag M.S., Neumann P. (2008) Filling the Sudan gap: the Northernmost natural distribution limit of small hive beetles, J. Apic. Res. 47, 183–184.
[34] Neumann P., Elzen P.J. (2004) The biology of the small hive beetle (*Aethina tumida*, Coleoptera: Nitidulidae): Gaps in our knowledge of an invasive species, Apidologie 35, 229–247.
[35] Mostafa A.M., Williams R.N. (2000) New record of the small hive beetle in Egypt and notes on its distribution and control, *Bee World* 83, 99–108.
[36] Hassan A.R., Neumann P. (2008) A survey for the small hive beetle in Egypt, *Journal of Apicultural Research* 47, 185–186.
[37] Govan, D. Leat, V. Allsopp, M. H. (1999) Bee diseases in South Africa I: EFB, AFB, chalkbrood and bee viruses. *South African Bee Journal* 71: 84-87.
[38] I Fries, S. Wei, C. J. Coleman, S Raina "Is American foulbrood (*Paenibacillus larvae larvae*) absent in honey bee colonies in sub-Saharan Africa? ", Proceedings of the 37th International Apicultural Congress, Durban, South Africa, 28 October – 1 November 2001.
[39] Spivak M., Gilliam M. (1998) Hygienic behaviour of honey bees and its application for control of brood diseases and varroa. Part I. Hygienic behaviour and resistance to American foulbrood. *Bee World* 79, 124-134
[40] H. Alfallah, M. Alfituri, M. Hmuda "The impact of bee eater *Merops apiaster* on the behavior of honey bee *Apis mellifera L*. during foraging" *J. Plant Prot. and Path., Mansoura Univ., Vol. 1, pp. 1023 - 1034, 2010.*