MedBEESinessHubs

A3.1.2 Regional studies on the economic value of networking around the honeybee products

Project Title	C_A.1.2_0035 - MedBEESinessHubs
Programme	ENI CBC Mediterranean Sea Basin
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Contents

Chapter 1: The beekeeping unique characteristics in the region

Egypt has the longest recorded history of honeybee use among the ancient civilizations, it may be said. King Menes, the founder of the First Dynasty of Egyptian Kings, was known as the "Beekeeper" (- 4445 B.C.), and subsequent successors were sometimes referred to as the "Bee King." Egypt's earliest paintings and engravings on tombs, sarcophagi, temples, and obelisks reveal that beekeeping was an integral part of society. Ancient Egyptian beekeeping was distinguished by the use of cylindrical hives and the production of enormous quantities of honey.

Ancient Egyptians utilized honey not only as a meal, but also as a medicine and cosmetic. In addition, it was employed to preserve the tissues of mummies during embalming. In addition, it was used to treat baldness. Additionally, it was utilized in contraceptive medications. However, the Germans used fish oil to treat wounds, burns, fistulas, and their healing. With the addition of egg yolk and flour, it was employed as a cream thickener. It was prominently mentioned in the Holy Quran and the other sacred texts.

Currently, honey is an essential nutritional item containing sugars, most of which are mono. Additionally, it contains yeast, amino acids, vitamins, and minerals. Honey is made from the nectar of flowers, which is collected by bees from various flowers and spread throughout the pasture surrounding the apiary. After nectar undergoes partial digestion and moisture reduction to become sugar, it is stored in the hexagonal cells of the apiary under wax coverings. The objective of its storage is to supply nourishment for the hive and brood over the winter. Wild Honey is the common name for the honey produced by bees living in the wild.

FAO includes this honey on its list of non-wood forest products. When there are no flowers in the fields close to the apiary, bees are compelled to collect honey from the secretions of insects with similar wing structures, such as honeydew and crustaceans. Moreover, most people recognize honey as an essential meal for the human body and health. Additionally, contemporary science acknowledges that honey from bees is a natural antibiotic that strengthens the human body (strengthens the immune system, which is resistant to all diseases that attack it).

In addition, this honey has been shown to be effective in treating burns, wounds, and numerous other ailments.1918 marked the beginning of modern beekeeping in Egypt, when a group of amateurs began using wooden Langstroth frames and in 1920 created the first society of beekeepers in 1920. Since then and continuing up until the present day, , this group has released periodical bulletins to enhance beekeeping techniques in Egypt and share ideas. After

the introduction of Langstroth frames, there has been a gradual transition from traditional to contemporary beekeeping techniques, such that today 99 percent of beekeepers in Egypt adopt modern methodologies.

Egypt has three pollination seasons, which are distinguished by their citrus, clover, and cotton characteristics. Apis mellifera, the western honeybee, is native to Europe, the Middle East, and Africa and has been subdivided into 20 subspecies. In 1906, it was determined that Lamarck's honeybee (A. m. lamarckii) originated in the Nile Valley and Sudan. This subspecies is thought to be identical to the one that existed during the reign of the Pharaohs. It is said that Lamarck's bee is a good housekeeper but a mediocre honey producer. This indigenous subspecies has been supplanted or hybridized with mostly A. m. carnica and other imported types. The remote Siwa Oasis is home to pure A. m. lamarckii populations that are raised in traditional hives. The relevance of apiculture (beekeeping) to the agricultural sector in Egypt continues to grow each year. Most beekeepers derive the majority of their income from honeybee colonies' products. Because the establishment of honeybee colonies requires healthy flora, the majority of apicultural operations exist in close proximity to cultivated Nile River areas. It is common knowledge that nectar and pollen gathered from flowering plants are the primary food sources for honeybees. It may be claimed that citrus, clover, and cotton are the three most important blooming plants for beekeeping in Egypt. These plants are not native to all Egyptian governorates; thus, beekeepers travel their colonies from area to region to follow the blossoming season. This practise is known as "Migratory Beekeeping." In addition to these primary plants, honeybee colonies should be located near cultivated plants to meet their nutritional needs. Placing honeybee colonies on barren soil could result in their demise. Recently, Egypt's desert has being intensively reclaimed. It is likely that apicultural activities will be prevalent in these places.

Egypt has 15,924,179 cultivated feddan, comprising 1620308 feddan of fruit orchards, 117073 feddan of palms, 1867875 feddan of vegetables, and 12318923 feddan of crops, as reported by the Central Agency for Public Mobilization and Statistics in February 2021. Clover (1953281 feddan), medicinal and aromatic plants (110112 feddan), and citrus orchids (414588 feddan) are the governorates' principal honeybee-supporting plants.

Several factors affect honeybee colonies, including temperature, precipitation, soil cover, and distance from plants. These elements are of particular importance to honeybees since they can significantly affect all honeybee colony operations. For example, temperature plays a crucial role in brood raising, development, and foraging behavior. As in many other regions of the world, many beekeepers in Egypt experience colony loss during the winter months.

Beekeeping is a promising sector for reducing unemployment in rural areas, since beekeepers suggest it as a source of revenue rise and urge others to work in it, as the majority of beekeepers employ people to assist them with daily tasks. Unfortunately, there is no apitourism culture in Egypt, but it can be promoted by constructing new apiaries in tourist destinations.

The diversity of agriculture and its continued growth, Egypt's geographical location and climatic conditions, and the availability of the necessary expertise are major strengths of Egypt's production, whereas the absence of certified treatments and market control, as well as high production costs, are the primary challenges beekeepers face. Additionally, the scarcity of pure queens and lack of marketing skills contribute significantly to the decline in beekeeper profit.

Honey is the most popular commercial product produced by Egyptian beekeepers, followed by the creation of bee packaging (Live bees that are exported or sold locally). Thirdly, royal jelly and pollen are produced economically, followed by the manufacturing of bee wax. Bee venom and propolis have the lowest production rates, therefore some beekeepers produce protein alternatives for use in their own winter hives. In the absence of pollen, the Protein replacements are protein-based food to sustain bees.

Chapter 2: The flora and the ecosystem that support the bees

Egyptian beekeepers rely primarily on three flowering plants (citrus, clover and cotton) , although there are other plants that support bees, such as Beans, Bananas, Eucalyptus, Sidr, Tamarisk, Sesame, Canola, Bee Bread, and a variety of aromatic and medicinal plants, such as Anise, Thyme, Fennel, nigella, and others.The following tables depict, according to the Central Agency for Public Mobilization and Statistics in February 2021, the key plant groupings that support bees in each governorate. In Egypt, there are 15924179 farmed feddans; Sharkia has the highest number of cultivated feddans (1641325 feddan), with around 82percent of it grown with crops and just 7percent cultivated with fruits; it is also the leading governorate for farming perennial clover. El-wadi El-Gadid scored first in terms of area of planted alfalfa, while Beni-Suief had the highest area of cultivated clover (for seed production) and Behera is the leading governorate in terms of cultivation of Tahreesh clover. The governorate of Fayoum has the most land devoted to growing aromatic and medicinal plants (annexes Table 1). The oranges region of Behera and the Mandirine region of Ismailia scored first among governorates (annexes Table 2). It was observed that the rate of change in the cultivated area of Clover from 2018 to 2019 was +15.5percent, Alfalfa +0.2percent, and Medical and Aromatic Plants +4.5percent, while Citrus declined with a ratio of -1.5:10.5percent (annexes Table 3).

Table 1. Total area of cultivated plants group (feddan) in each governorate

Governorate	Fruits	Palms	Vegetables	Crops	Total
Total	1620308	117073	1867875	12318923	15924179
Cairo	18791	770	592	772	20925
Alexandria	9517	402	114057	199262	323238
Port Said	356	0	2169	292862	295387
Suez	27551	144	8103	26811	62609
Damietta	8544	12	25631	171055	205242
Dakahlia	16942	784	111738	1165615	1295079
Sharkia	116974	191	176403	1347757	1641325
Qalyoubia	38278	452	27286	203057	269073
Kafr-El shikh	6625	6146	97833	970928	1081532
Gharbia	27160	356	57083	623729	708328
Menoufia	36436	103	102525	496374	635438
Behera	168600	5937	267529	1155115	1597181
Ismailia	214935	1206	83098	169292	468531
Giza	38497	20814	108640	166472	334423
Beni- Suief	18300	47	40116	531163	589626
Fayoum	35739	1188	39794	658646	735367
Menia	36312	686	75510	758518	871026
Assuit	43512	400	16130	624781	684823
Suhag	7355	753	20618	609706	638432
Qena	9374	1395	12313	354279	377361
Aswan	19676	24403	8703	218205	270987
Luxor	12292	680	17330	176164	206466
Red- Sea	47	135	0	522	704
El- wadi El- Gadid	29407	25936	52351	693255	800949
Marsa Matruh	121389	10328	47527	63604	242848
North Sinai	18182	6823	2864	589	28458
South Sinai	24480	0	326	2047	26853

Central Agency for Public Mobilization and Statistics, 2021

Table 2. The area (Feddan) and production (Tons) of Clover crop according to governorates

Governorate	Clover Type							
	Alfalfa		Clover (for seed production)		Tahreesh Clover		Permanent Clover	
	Production	Area	Production	Area	Production	Area	Production	Area
Cairo	0	0	0	0	0	0	0	0
Alexandria	660	33	102	434	16754	1411	752652	31622
Port Said	0	0	0	0	0	0	814440	40722
Suez	28916	498	0	0	0	0	63020	2768
Damietta	0	0	41	720	19915	2550	1192075	57723
Dakahlia	0	0	0	0	217019	26235	3215087	159676
Sharkia	8000	230	2699	7410	117751	10301	6197613	200648
Qalyoubia	0	0	0	0	66591	5779	937258	35269
Kafr-El shikh	0	0	0	0	514225	25138	4915964	107685
Gharbia	0	0	3122	7126	114521	8015	2900420	97028
Menoufia	0	0	1652	5295	46593	3747	3350553	88701
Behera	0	0	1922	6777	647499	71883	4967530	142185
Ismailia	17600	449	0	0	28152	2792	614426	22152
Giza	22180	1620	1307	5166	57952	5538	830691	28595
Beni- Suief	4500	450	1855	9101	0	0	2801216	67950
Fayoum	0	0	1054	5652	112706	12204	999536	56518
Menia	86196	2646	791	3490	11965	758	3308800	90645
Assuit	19818	1017	1687	6213	30916	2458	1648917	56760
Suhag	0	0	2763	6650	54887	2446	2670764	74907
Qena	142377	3404	541	1456	0	0	476250	17480
Aswan	97865	6731	0	0	0	0	76627	4252
Luxor	137765	5598	0	0	0	0	147301	8935
El- wadi El- Gadid	2307613	41612	0	0	0	0	1463398	53086
Marsa Matruh	72000	3000	0	0	0	0	933164	23130
North Sinai	224	56	0	0	0	0	86	12
South Sinai	2500	125	0	0	0	0	185	18

Central Agency for Public Mobilization and Statistics, 2021

Climate of Egypt and Its Parameter Variations

Climate change is currently the greatest obstacle to apiculture, as it can directly or indirectly affect honeybee colonies by affecting flowering plants. It is crucial for decision-makers to anticipate the potential effects of climate change on the suitability of land for apiculture in order to take the appropriate steps at the appropriate times.

Climate is one of the primary soil formation elements, which has a significant impact on the growth of soil profile. In general, the climate of Egypt is characterized by arid and semiarid conditions with limited precipitation throughout the winter months. Meteorological data were acquired from the NASA Prediction of Worldwide Energy Resource (POWER)—Climatology Resource for Agroclimatology website (http://power.larc.nasa.gov/) in order to quantify the primary Egyptian climatic factors. The data was tabulated and evaluated in order to characterize the climate of contemporary Egypt. Specifically, data was collected for the governorates that comprise the entire Egyptian area. Included in the collected meteorological data are the mean, minimum, and maximum air temperatures (°C). Variation in the mean air temperature.

Due to its position, Egypt has a unique climate, which is Mediterranean for the Egyptian coastal regions in the winter and arid for the deserts, which can reach temperatures of more than 40 °C in the summer. The main Egyptian cities located in the deserts (i.e., Luxor, Aswan, Asyut, Siwa, or Sohag) are hotter in the summer, whilst the higher altitudes (e.g., certain mountainous in Sinai, such as Saint Catherine) are cooler. Egypt's climate could be explained by the country's geological zones, which include the Nile valley and delta (approximately 4 percent of the country's total area), the Eastern desert (22 percent), the Western desert (68 percent), and the Sinai Peninsula (6 percent). The yield of crops is highly sensitive to climate change. In the future, this will result in significant adjustments in crop distribution due to climate change. Moreover, climate change is projected to diminish crop yields and/or cause crop damage in certain regions of the world in the twenty-first century.

Therefore, global warming is one of the repercussions of climate change on agriculture. It may be determined that climate change is the primary cause of global warming, that Arctic Sea Ice would melt, that rising sea levels would impact coastal areas, and that extreme events (hurricanes, floods, and droughts) would occur more frequently. Several properties and functions of the soil will change as a result of climate change, including: (1) increased CO2 may enhance the production of biomass, (2) these climate changes may lead to enhancement in decomposition of soil organic matter, (3) climate changes will increase the evapotranspiration process, (4)

climate changes could increase the salinization of many soils, (5) climate changes could alter the composition and the functions of soil microorganisms, and (6) the rising in temperature may lead to permafrost thawing.

Egypt is practically devoid of precipitation. Egypt's climate is generally moderate, ranging from semiarid to very arid conditions with distinct arid zone characteristics. Egypt has three distinct climates, including a desert climate (in the interior), a Mediterranean climate (in the northern coastal districts), and a climate along the coast of the Red Sea. Limitation of water resources and climate change are among Egypt's greatest obstacles.

Climate change is a significant issue in a number of nations, particularly in the agricultural and water sectors. Climate change in Egypt includes the possibility of a rising sea level, a rise in temperature, and a decline in crop yield. Such consequences may also include the rise in water needs of crops, the distribution rate of plant diseases and pests, the decrease in precipitation rates or drought, the alteration of land usage, and the secondary salinization caused by the incursion of seawater. Consequently, there is an immediate need to comprehend the possible implications of climate change and to establish adaptation strategies and measures to mitigate future climate change risks. Further research should be conducted in Egypt regarding the effects of climate change on the agricultural, energy, and water sectors, as well as human health.

These studies are required for the following issues: a new crop pattern suitable for the available water, the selection of new varieties and strains of various crops that tolerate drought, salinity, and diseases, and the establishment of a well-coordinated information system to aid decision-makers in water resources management in the context of global climate change.It is evident from the examination of the temperature findings for the five zones that divide the Arab Republic of Egypt, namely the east, west, north, and central regions.

There is a detrimental influence of climatic changes, particularly temperatures, and this effect is clearly seen in the maximum and minimum temperatures during the ten years preceding 2010-202, where the following may be observed:

a) <u>Maximum temperature</u>

The highest rate of maximum temperature decline was found in the country's northern areas, followed by the central region, the west, the east, and finally the south.

b) Minimum temperature

The south region experienced the greatest fall in minimum temperature over the previous ten years, followed by the east and central regions, then the north and west.

Impact of temperature changes on the territories

1. Northern area

Even while the maximum temperature in the north is decreasing, there is still a large difference between day and night temperatures that affects all creatures with distinct thermal needs throughout the year. This period has the greatest temperature difference between night and day, followed by the central areas, the west, the east, and finally the south, which has the smallest temperature difference between night and day.

2. The Middle region

It resembles the northern section in many ways.

3. Southern area

It is observed that the rate of drop in maximum and minimum temperatures is nearly same over time, which maintains the temperature difference between them despite the propensity for both to decrease. This also has repercussions for the thermal impacts on living organisms.

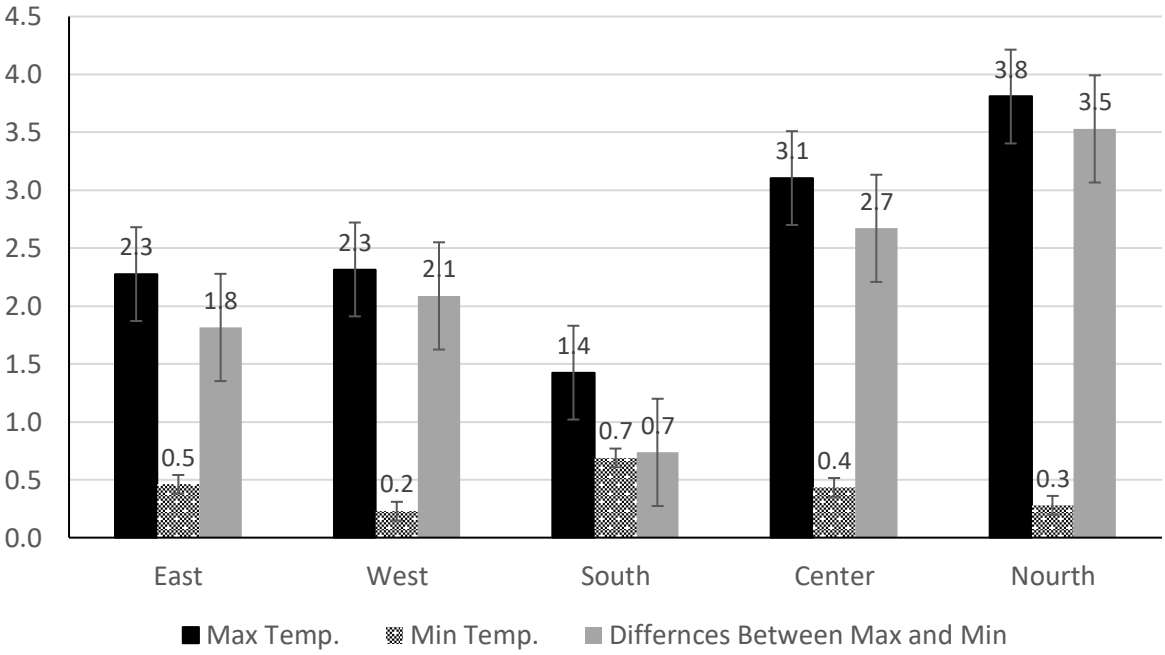
4. Western and Eastern regions

Especially in the east, the maximum temperatures are falling rapidly and at a rapid rate towards the minimum temperature.

The review of these thermal changes leads us to the conclusion that beekeepers must take preventative measures to protect bees in different regions from thermal conditions that could lead to bee extinction over the next century (barring sudden sharp changes or natural disasters) and provide appropriate means of protection from the sun's rays in the south, east, and west regions. The considerable temperature differential between the north and centre regions is where bees originate. In addition, climate change caused the oriental hornet (a pest that feeds on honeybees) to become active early and cause enormous losses in North Sinai.

This necessitates the search for methods of protecting bees that can adapt to different temperature changes so that they can continue their role as a pollinating insect that plays an important role in increasing the national income and pollinating more than 85 percent of the crops grown in the country, whether for field crops, vegetables, or fruit orchards, and increasing their productivity.

Figure 1. Decrease in Egypt Temperature during 2010-2020



Chapter 3: The beekeeping sector of the region in numbers

Egypt is regarded as one of the most significant countries for beekeeping in Africa and the Arab world. The Egyptian Ministry of Agriculture recently revealed that exports of bee products had reached $300 million, with 30 thousand tons of honey produced and 3,200 tons exported. In 2021, Egypt ranked top globally in exporting bee packages.

The Food and Agriculture Organization (FAO) statistics on data collected for beehives in Egypt from 1960 to 2016 indicate that the number of beehives increased from 1961 to 1990, reaching a peak of 1.7 million beehives, dropped thereafter and declined steeply between 2005 (1.5 million) and 2015 (800 thousand), and then tended to increase gradually until 2019; however, this trend is expected to reverse in 2019. (820 thousand). The variation in the number of beehives in Egypt between 1960 and 2016 may have been caused by a number of variables.

The first may be associated with the ten percent rise in total cropped area between 1970 and 1990, which indicates the creation of new land plots and rising cultivation, which supplied more crops and cultivated areas where bees could graze and thrive. In 1970, the five most important crops in Egypt, based on area, occupied around 77percent of the cultivated land. Some crops may not necessitate animal pollination, although they benefit substantially from it. In Egypt, these crops include three significant ones: berseem, also known as Egyptian clover (Trifolium alexandrinum L.), cotton, and citrus. In addition, the area devoted to fruits expanded by around 165percent in 1989, while the areas devoted to winter and summer vegetables increased by approximately 94percent and 32percent, respectively.

The correlation between the growth in the area devoted to fruits and vegetables and the negligible influence of honeybee parasites and pathogens observed during this period of time is noteworthy, as these parameters correlate with the rise in the number of beehives. The drop in the number of beehives in Egypt from 1990 to 2016 can be linked to a number of factors such as;

(1) The destructive effects of the *Varroa* mite, which represents the major ectoparasite of honeybees in Egypt and worldwide and was first observed in Egypt in 1983
(2) The loss of agricultural land in Egypt due to urbanization that led to decreasing trends in cultivated crops that depend on honeybee pollination
(3) The extension and overuse of pesticides against different crop pests, which negatively affect bees
(4) Adverse effects of in-hive chemicals used to protect and treat honeybees against pathogens and parasites

(5) The introduction of alien species.

From 1961 to the mid-1980s, the average productivity per hive in Egypt increased from 3 kg to 10 kg, resulting in a boom in Egyptian honey production. From the mid-1980s to the 1990s, a significant reduction to 6 kg/hive was seen, followed by a slow stabilization at 5–6 kg/hive.Egypt ranks second in the Arab world in terms of honey output in 2018, behind Algeria. The Arab Union for Beekeepers estimates that Egypt currently cultivates 2.5 million beehives, which are the primary source of income for 25.000 to 30.000 Egyptian beekeeping households. In 2018, Egypt exported over 1,2 million bee packages and 115 Tons of bee wax, making it the leading exporter of both items in the Mediterranean region. Recent years have seen a decline in the honey production and revenue of beekeepers due to a number of issues, including the rise in production expenses and the challenges beekeepers have in migrating to fruit orchids as their primary source of income in other countries.

The problem is exemplified by the fall in Egypt's production of bee honey, despite the availability of a suitable climate, fruit fields, alfalfa, and flower orchards, as well as mountainous and desert regions for the production of mountain honey, which is imported using foreign currency. In addition to increasing honey production, it is necessary to build bee product projects that, via the pollination process carried out by bees, boost the yield of agricultural crops and provide economic value to the project's owner.

The Status of Honeybee in Egypt:

Evidently, Figures (3,4) depicts honey and wax products in Egypt over the period (2002 - 2019). Figure 2 clearly demonstrates that the number of hives falls throughout the course of the study period, reaching around 1447 thousand hives in 2002, of which 1,443 thousand are foreign hives and only 4,000 are local hives. In 2018, there were around 796 thousand hives, of which 795 thousand were foreign and 1,000 were local. In addition, wax production reached approximately 84 tons in 2002 and 115 tons in 2018. Moreover, wax production peaked in 2011 when it reached approximately 180 tons. According to the equation of the general temporal trend of honey production in Figure (2), the trend of a statistically significant drop amounted to approximately 0.313,000 tons. In addition to honey, pollen, wax, bee venom, royal jelly, and propolis, bees generate honey, pollen, wax, bee venom, and royal jelly. In Egypt, bee production is considered the most essential investment in the field of beekeeping. According to the Central Agency for Public Mobilization and Statistics, Egypt exported approximately 511 thousand bee packages (bees are packaged in kilograms) to Saudi Arabia and approximately 304,000

packages to the UAE and 35,000 packages to Kuwait in the first nine months of 2021 for a total of approximately 861,000 bee packages valued at $19,846,000. However, exports to these countries were conducted for less than 24 dollars per pack, although international pricing for the same package of bees were between 100 and 130 dollars.

Honey is not a primary product in Egypt; people rarely consume honey and frequently utilize it for therapeutic purposes, as annual honey consumption declined from 0.13 kilograms per person in 2002 to 0.05 kg per person in 2013.

Apiculture is predominantly conducted by beekeepers of middle age (59 percent) with small apiaries (>50 hives). 41 percent of Egyptian beekeepers had between 10 and 20 years of experience, while the remainder had between less than 5 and more than 20 years. Approximately 53percent of beekeepers rent land for apiary establishment, particularly during migratory apiculture, which is required by 79percent of Egyptian beekeepers.

Ninety percent of beekeepers believed that beekeeping increases income and recommended it to others, indicating that beekeeping is a promising enterprise for reducing rural unemployment.

Beekeeping is not a solitary profession, as 86 percent of beekeepers require workers to assist them. The majority of workers are not untrained and assist only in the transport of hives (95 percent). 29 to 47 percent of the workers are involved in hive repair, cleaning, feeding, and observation. Ninety-two percent of beekeepers do not have any access to training services in their regions. For 75% of beekeepers , the knowledge of honeybee keeping in transferred by relatives and friends rather than recognized academic sources.

Approximately 89 percent of beekeepers stated that beekeeping associations (individual non-governmental association of beekeepers that provides scientific, technical, social and economic apicultural support and that collaborates with universities and commercial academies working in this sector) play no active role in their regions, and they rely solely on themselves. Still, forty percent of beekeepers are members of beekeeping associations, and thirty-four percent of beekeepers play an active role in the association.

The most popular product produced by Egyptian beekeepers is honey (96 percent of beekeepers produce hone), followed by the production of bee packages at a rate of 57 percent. 51 percent of beekeepers produce royal jelly and pollen professionally, followed by the production of bee wax (49 percent). While bee venom and propolis had the lowest production rates (35

percent and 15 percent, respectively), some beekeepers also produce protein replacements (21 percent) for use in their own winter hives.

41 percent of beekeepers lack knowledge of value-added products because they only sell their products as raw material. Even the remaining 59 percent of beekeepers are lacking in information, as only 2 percent of them produce honey candies and only 7percent of beekeepers in Egypt are involved in the production of bee wax products. The rest of them use labels, distingue jars and make honey mixtures

Propolis cannot be used as raw material and must be refined; just nine percent of beekeepers purify propolis, while eleven percent dissolve collected bee venom in solution. Regarding diseases and pests' control, 68 percent of beekeepers claimed that they can diagnose the origin of hive disease and treat it properly, which requires further investigation as the majority of beekeepers (73 percent) utilize preventative treatments without observable symptoms.

In addition, the lack of technical knowledge among beekeepers has resulted in the adoption of many treatments for the same cause. For instance, 28 percent of beekeepers use chemicals to treat Varroa, while 87 percent utilize natural alternatives. The same pattern was discovered in Nosema and poultry diseases, indicating that they employ both sorts of therapy (45 percent, 73 percent and 37 percent ,76 percent, respectively). Given the paucity of authorized treatments, the interactions between different treatments are extremely significant and hazardous. There are several causes for colony extinction, which can be either natural or induced by external factors. Sixty-nine percent of beekeepers lost approximately 20 percent of their colonies owing to ineffective queens, while 17 percent of beekeepers lost between 20 and 30 percent of their honeybee colonies and 14 percent lost more than 30 percent of their colonies. 92 percent of beekeepers attribute less than 20 percent of honeybee colony losses to starvation. 89 percent of beekeepers said that chemicals are responsible for 20 percent of colony losses. The most relevant findings are that beekeepers cannot always identify the reason of colonies losses, in the last winter season 64 percent of beekeepers lost about 20 percent of their colonies, 14 percent of beekeepers lost between 20 and 30 percent of their colonies while 22 percent of beekeepers lost more than 30 percent of their colonies for unknown reasons, requiring further investigation and research.

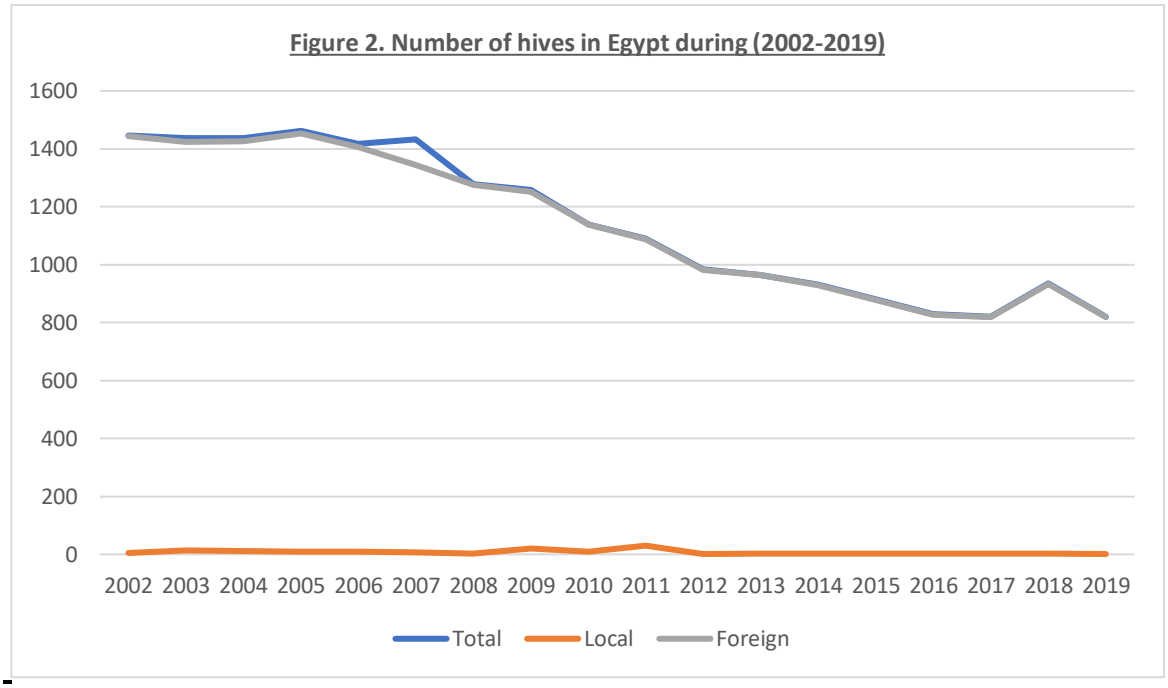
Climate change is a growing problem worldwide, and 65 percent of Egyptian beekeepers consider it to be the most significant problem confronting beekeeping in Egypt, requiring more attention to solve. The winterization and ventilation of hives must be enhanced, and new hive designs must be developed. Regarding diseases, 64 percent of beekeepers concurred that it is

a major issue. According to 53 percent of beekeepers, the rise in production costs is the third major issue, and marketing comes in last with a 39 percent approval rate.

Regional concentration

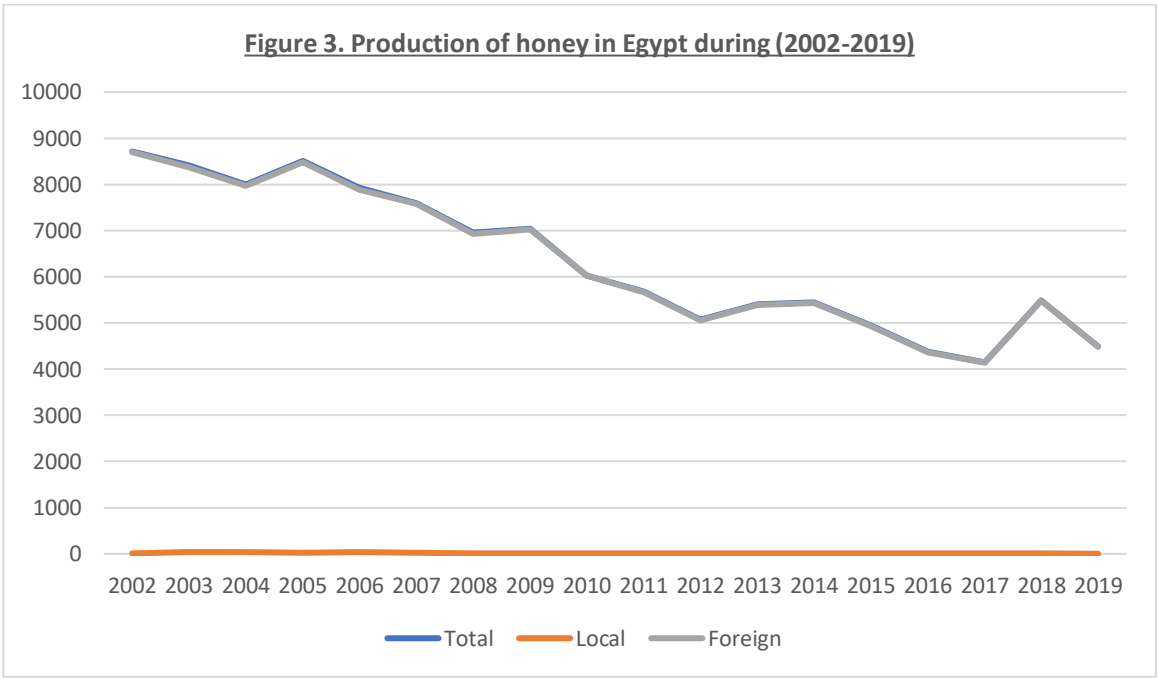
There are certain regions in Egypt where the majority of beehives are located. According to the governorates, Table 3 displayed the number of hives and production of honey and wax (tons). Asyout governorate had the biggest number of hives in 2018 (225573), representing 24 percent of all hives in Egypt, followed by Behera governorate with 128809 hives (14 percent), and Gharbia governorate with 110656 hives (12 percent of bee hives).

Regarding the concentrations of honey production, the similar tendency was observed for the same governorates, as the Asyout, Behera, and Gharbia governorates produced 1802, 694, and 525 tons of honey, representing 33.13 and 10percent of the total honey production. .As for wax production, the governorates of Gharbia, Asyout, and Sharkia occupied the top three positions with 55.23 and 13 tons, representing 46.19 and 11.0percent of the total production, respectively.



*Source: Central Agency for Public Mobilization and Statistics - Annual Book of Statistics, 2021

FAO data based on imputation methodology



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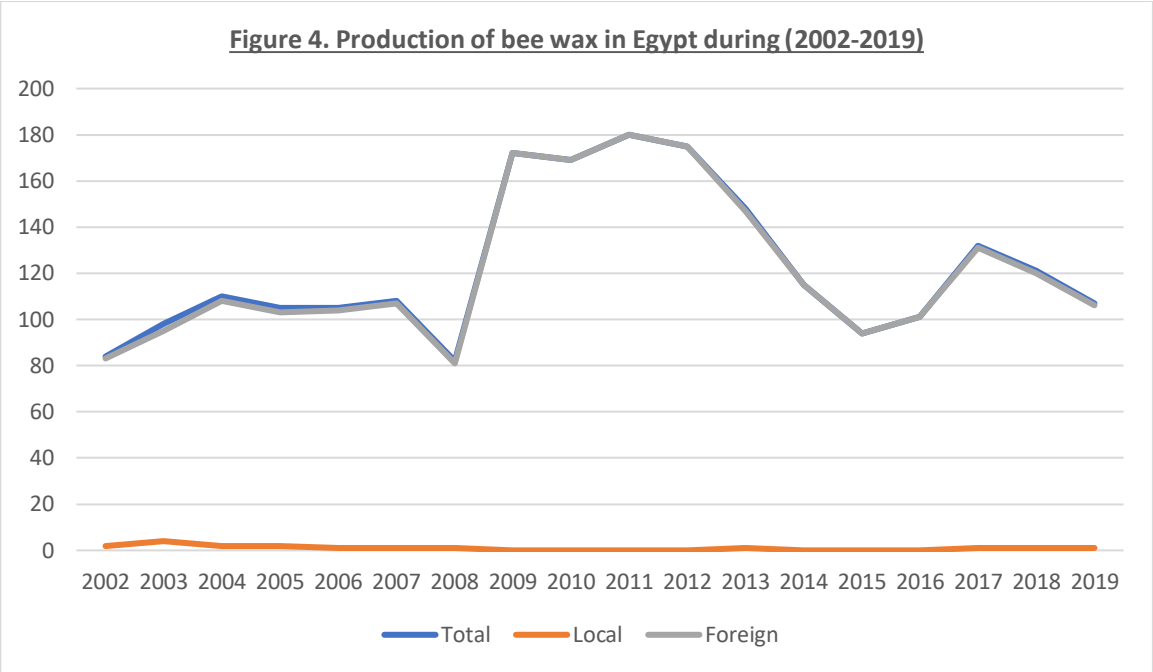

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FAO data based on imputation methodology

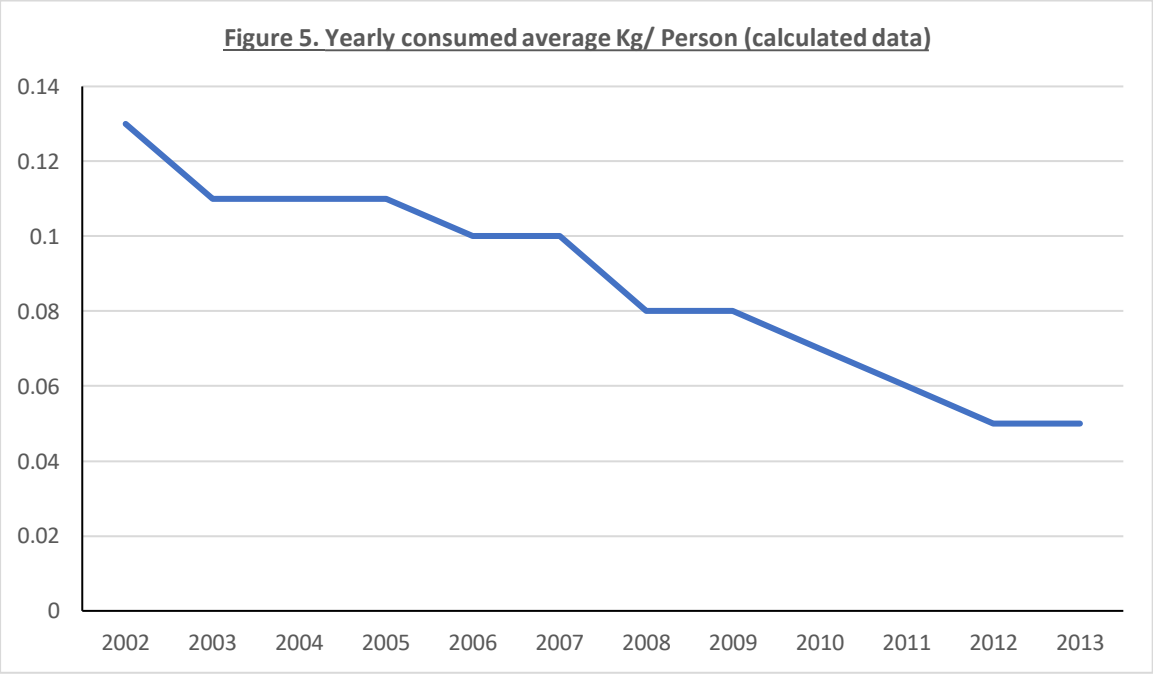


Table 3. Number of Beehives (local and foreign) and production of Honey and Wax (Tons) According to Governorates 2018

Governorate	Total			Foreign			Local		
	Wax	Honey	Bee hives	Wax	Honey	Bee hives	Wax	Honey	Bee hives
Alexandria	0	195.75	3536	0	195.75	3536	0	0	0
Suez	0	4.51	751	0	4.51	751	0	0	0
Damietta	0.87	99.89	21088	0.87	99.89	21088	0	0	0
Dakahlia	0	222.03	46093	0	222.03	46093	0	0	0
Sharkia	12.81	326.18	64037	12.81	326.18	64037	0	0	0
Ismailia	0	75.85	8428	0	75.85	8428	0	0	0
Qalyoubia	4.37	109.16	21957	4.36	109.08	21937	0	0.08	20
Kafr El-Shikh	1.82	173.59	34766	1.82	173.59	34766	0	0	0
Gharbia	55.33	525.23	110656	55.33	525.23	110656	0	0	0
Menoufia	4.2	125.91	41969	4.2	125.91	41969	0	0	0
Behera	12.07	693.72	128889	12.07	693.72	128889	0	0	0
Giza	0.59	24.07	4590	0.02	22.37	4075	0.57	1.7	515
Beni- Suif	2	199.85	44550	2	199.85	44550	0	0	0
Fayoum	0.74	321.04	82957	0.74	321.04	82957	0	0	0
Menia	3.68	169.97	36780	3.68	169.97	36780	0	0	0
Asyout	22.68	1802.39	225736	22.5	1800.29	225036	0.18	2.1	700
Suhag	0	111.95	17640	0	111.95	17640	0	0	0
Qena	0	164.18	17958	0	164.18	17958	0	0	0
Aswan	0	3.99	798	0	3.99	798	0	0	0
Luxor	0	46.89	4689	0	46.89	4689	0	0	0
El Wadi El Gadid	0	91.89	15653	0	91.89	15653	0	0	0
North Saini	0	0.95	283	0	0.95	283	0	0	0
South Saini	0.13	2.27	713	0.07	1.27	363	0.06	1	350

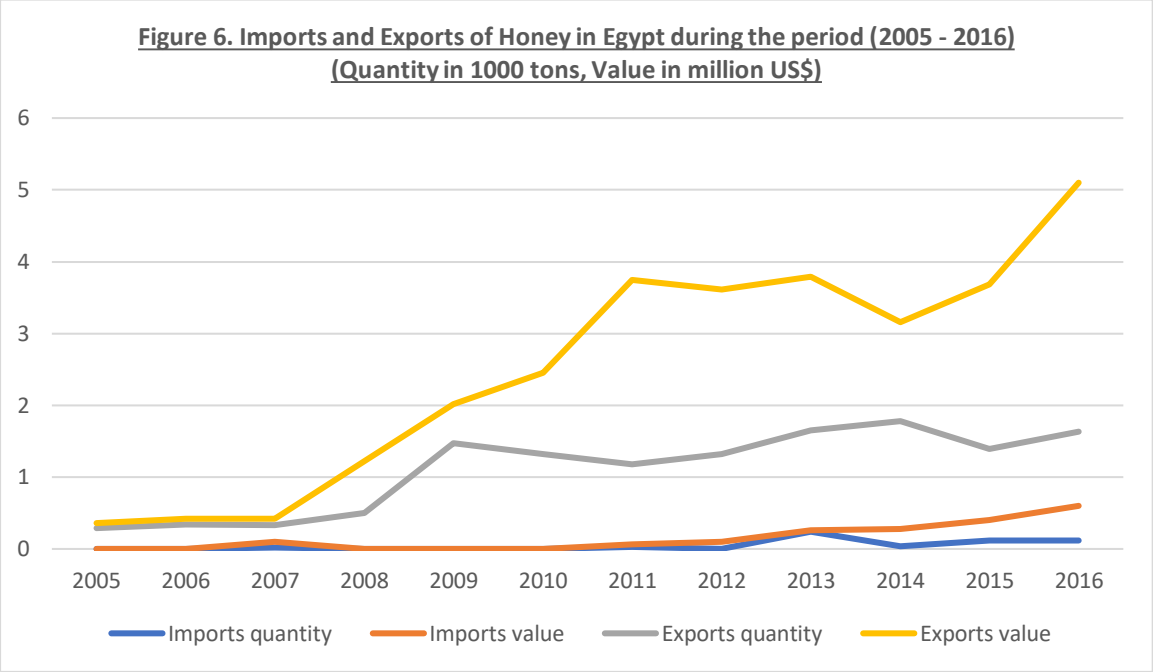
*Source: Central Agency for Public Mobilization and Statistics - Annual Bulletin of Statistics livestock, 2020

Chapter 4: Beekeeping economic figures and employment in rural regions (macroeconomic impact)

The Arab Union for Beekeepers estimates that Egypt currently cultivates 2.5 million beehives, which are the primary source of income for 25.000 to 30.000 Egyptian beekeeping households. In 2018, Egypt exported over 1,2 million bee packages and 115 Tons of bee wax, making it the leading exporter of both items in the Mediterranean region. Recent years have seen a decline in the honey production and the revenue of beekeepers due to a number of reasons, including the rise in production expenses and the challenges beekeepers have in the migration to fruit orchids as the main source of income in other countries is the pollination services, while in Egypt the beekeepers have to pay money to the farmers to establish their apiaries near the orchids. This results in more expenses for the beekeepers and low income.

Egyptian export revenues were low due to the low quality of Egyptian bee packages in comparison to the Australian and Argentine counterparts. This is regrettable as despite of the seven-thousand-year history of Egyptian beekeepers there are not pure certified race of bee in Egypt which has a major effect on the revenues. In addition, Egypt is the only country capable of producing bees and queens the year-round and by an ease of mobility of bees. These factors make Egypt qualified to be an international center for beekeeping with excellent investment and employment opportunities for Egyptian youth.

Egypt did not import honey until 2011 (Figure 6), with the exception of a minor quantity of approximately 0.02 thousand tons in 2007, which peaked at approximately 0.24 thousand tons in 2014, decreased to approximately 0.12 thousand tons in 2016, and was valued at approximately $0.6 million. In addition, Figure (6) reveals that honey exports ranged between the two lowest levels of 0.29 thousand tons valued at approximately $0.36 million in 2005 and the highest level of 1.78 thousand tons valued at approximately $3.16 million in 2014.Egypt's primary exports of bee goods are beehives and bee wax, as the country's favourable climate permits the production of bee packages and bee queens for the majority of the year. According to FAO data based on imputation methods, over 1.5 million bee packages were shipped from Egypt in 2016; this number reduced to 1.2 million in 2018, as reported by the Arab Bee Union. Concerning bee wax, Egypt had exported 55 tons of bee wax in 2018. According to Arab Organization for Agricultural Development - Annual Book of Statistics - Miscellaneous Editions and Trade map organisation, the following tables and figure display the export and import volumes and values of bee products.



Source: Arab Organization for Agricultural Development - Annual Book of Statistics - Miscellaneous Editions - Trade map organization

Table 4. The quantity and value of exported beehives during 1990-2016

Year	Quantity	Source	Value in 1000 US$	
1990	457	Official data	1822	Official data
1991	170	Unofficial figure	1480	Unofficial figure
1992	114	Official data	1205	Official data
1993	145	Official data	1553	Official data
1994	155	Official data	1799	Official data
1995	242	Official data	2556	Official data
1996	242	FAO estimate	2556	FAO estimate
1997	296	Official data	3223	Official data
1998	324	Official data	3533	Official data
1999	335	Official data	3489	Official data
2000	213	Official data	2572	Official data
2001	380	Official data	4214	Official data
2002	498	Official data	4567	Official data
2003	495	Official data	4116	Official data
2004	624	Official data	3726	Official data

2005	0	Unofficial figure	4368	Official data
2006	0	FAO estimate	3339	Official data
2007	0	FAO estimate	4126	Official data
2008	0	FAO estimate	4126	FAO estimate
2009	0	FAO estimate	4126	FAO estimate
2010	0	FAO estimate	4126	FAO estimate
2011	0	FAO estimate	0	Unofficial figure
2012	0	FAO estimate	0	FAO estimate
2013	0	FAO estimate	0	FAO estimate
2014	779977	FAO data based on imputation methodology	16438	Estimated data using trading partners database
2015	964826	FAO data based on imputation methodology	15995	Estimated data using trading partners database
2016	1576542	FAO data based on imputation methodology	19874	Estimated data using trading partners database

Source: Arab Organization for Agricultural Development - Annual Book of Statistics - Miscellaneous Editions - Trade map organization

Table 5. The quantity and value of imported bee wax during 1990-2018

Year	Quantity tons	Source	Value 1000 US$	Source
1990	2	Official data	10	Official data
1991	1	Official data	10	Official data
1992	6	Official data	27	Official data
1993	0	Unofficial figure	0	Unofficial figure
1994	4	Official data	27	Official data
1995	5	Official data	29	Official data
1996	17	Official data	46	Official data
1997	13	Official data	27	Official data
1998	12	Official data	72	Official data
1999	25	Official data	82	Official data

2000	40	Official data	57	Official data
2001	12	Unofficial figure	49	Official data
2002	21	Unofficial figure	52	Official data
2003	60	Official data	99	Official data
2004	34	Unofficial figure	92	Official data
2005	13	Official data	39	Official data
2006	20	Official data	62	Official data
2007	20	Unofficial figure	81	Official data
2008	5	Estimated data using trading partners database	65	Estimated data using trading partners database
2009	8	Official data	68	Official data
2010	14	Estimated data using trading partners database	125	Estimated data using trading partners database
2011	152	Official data	384	Official data
2012	31	Estimated data using trading partners database	326	Estimated data using trading partners database
2013	48	Official data	308	Official data
2014	38	Estimated data using trading partners database	395	Estimated data using trading partners database
2015	25	Estimated data using trading partners database	272	Estimated data using trading partners database
2016	23	Estimated data using trading partners database	196	Estimated data using trading partners database
2017	30	FAO data based on imputation methodology	341	Official data
2018	39	FAO data based on imputation methodology	400	Official data

Source: Arab Organization for Agricultural Development - Annual Book of Statistics-Miscellaneous Editions - Trade map organization

Table 6. The quantity and value of Exported bee wax during 1990-2018

Year	Quantity tons	Source	Value 1000 US$	Source
1990	18	Official data	35	Official data
1991	0	Unofficial figure	0	Unofficial figure
1992	3	Official data	7	Official data
1993	1	Official data	1	Official data
1994	3	Unofficial figure	3	Official data
1995	0	Unofficial figure	0	Unofficial figure
1996	2	Official data	1	Official data
1997	27	Official data	24	Official data
1998	6	Official data	8	Official data
1999	3	Official data	3	Official data
2000	1	Official data	1	Official data
2001	1	Official data	1	Official data
2002	1	Official data	1	Official data
2003	5	Official data	2	Official data
2004	2	Unofficial figure	1	Official data
2005	47	Official data	41	Official data
2006	21	Official data	37	Official data
2007	39	Official data	42	Official data
2008	3	Estimated data using trading partners database	8	Estimated data using trading partners database
2009	600	Official data	858	Official data
2010	13	Estimated data using trading partners database	22	Estimated data using trading partners database
2011	172	Official data	491	Official data
2012	51	Estimated data using trading partners database	121	Estimated data using trading partners database
2013	81	Official data	178	Official data
2014	57	Estimated data using trading partners database	179	Estimated data using trading partners database
2015	29	Estimated data using trading partners database	119	Estimated data using trading partners database
2016	28	Estimated data using trading partners database	35	Estimated data using trading partners database
2017	112	FAO data based on imputation methodology	754	Official data
2018	55	FAO data based on imputation methodology	305	Official data

Source: Arab Organization for Agricultural Development - Annual Book of Statistics-Miscellaneous Editions - Trade map organization

According to the results of our questionnaire apiculture is considered a family business for over 75 percent of beekeepers, and over 86.1 percent of beekeepers work in the apiaries with their families (about 79 percent of beekeepers' family size ranges from 4-6 persons), and they employ others to help them with ordinary apiary labour. The remainder of beekeepers who did not acquire beekeeping through their family (25 percent) typically learned beekeeping because it is a widespread occupation in their region in addition to their primary occupation; nonetheless, the majority of them have limited experience and lack the required understanding. They can manipulate beehives and extract honey, but they lack the precision required to manage beehives. 90 percent of beekeepers believed that beekeeping increases income and recommended it to others, indicating that beekeeping is a potential venture for reducing rural unemployment. Local apiculture businesses focus primarily on the processing, marketing, and exportation of bee products. They are also involved in the collection and exporting of bee packages.

Local businesses are regarded as beekeeping brokers, as they serve as collection points for all beekeepers who are typically unable to process or market their products, and their importance is increasing due to their capacity to store and market bee products on the long term, which is unavailable to beekeepers. Without their contribution to the market, the majority of beekeepers would have lost their jobs as a result of their inability to sell their goods.

The lowest unemployment rate (1.9percent) was observed in the governorate of Menia, which is regarded a suitable place for beekeeping. This percentage soared to 27.5percent in South Sinai, which has no substantial beekeeping industry. Depending on the income from beekeeping, the existence of beekeeping in a region encourages the community to undertake a second, low-paying employment (Table 8). According to Table 8, the average weekly wage in Menia is over 60 percent of the average wage in South Sinai because the majority of beekeepers in Menia also work a second job. Only 40.3percent of beekeepers are members of beekeeping associations, whereas 34percent of beekeepers play an active role in these organisations. In addition, the cost of apiary land rental is a significant concern, since around 52.8percent of beekeepers pay rental fees for apiaries, particularly during migratory apiculture, which is required for 78.9percent of Egyptian beekeepers.

Approximately 88.9 percent of beekeepers stated that beekeeping associations have no role in their locations, and that they rely solely on themselves.

According to beekeepers, the most significant issues affecting beekeepers in Egypt are climate change (65.3percent), bee pests and pathogens (63.9percent), price inflation (52.8percent), and marketing (38.9 percent)

Table 7. Unemployment rate (15 years & more) by governorate (2017-2020) percent

Governorate	2020	2019	2018	2017
Total	7.9	7.9	9.9	11.8
Cairo	12.7	11.4	12.6	15.1
Alexandria	14.8	10.9	10.8	13.6
Port-Said	16.5	12.7	9.7	16.7
Suez	11.5	15	18.6	22.3
Damietta	20.8	21.1	16.6	9.6
Dakahlia	4.8	5.5	11	10.9
Sharkia	6.8	10.2	8.4	14
Kalyoubia	8.2	8.9	11.4	12.6
Kafr-El-Sheikh	2.7	6.4	5.2	8.4
Gharbia	7.8	6.5	10.7	12.7
Menoufia	4.2	5.2	5.7	6.9
Behera	7.4	7	9.5	11.8
Ismailia	5	8.7	10.8	11.8
Giza	10.3	7.9	11	12.5
Beni-Suef	5.9	5.2	5.7	7.9
Fayoum	4.5	3.5	4.1	7.2
Menia	1.9	4.6	6.1	10.1
Asyout	3	5.8	11.6	9.7
Suhag	7.8	5.1	6.4	9.4
Qena	3.6	4.8	6.3	9.3
Aswan	2.3	10.5	24.1	18.1
Luxor	14.9	5.5	7.5	16.3
Red Sea	18.1	14.8	23.5	18.5
El Wadi El Gadid	2.3	7.3	4.3	8
Marsa Matrouh	4	8.1	8.6	9.1
North Sinai	14.4	15.6	48.2	15.2
South Sinai	27.5	0	5.6	0.5

*Source: Central Agency for Public Mobilization and Statistics - Statistical Year book 2020

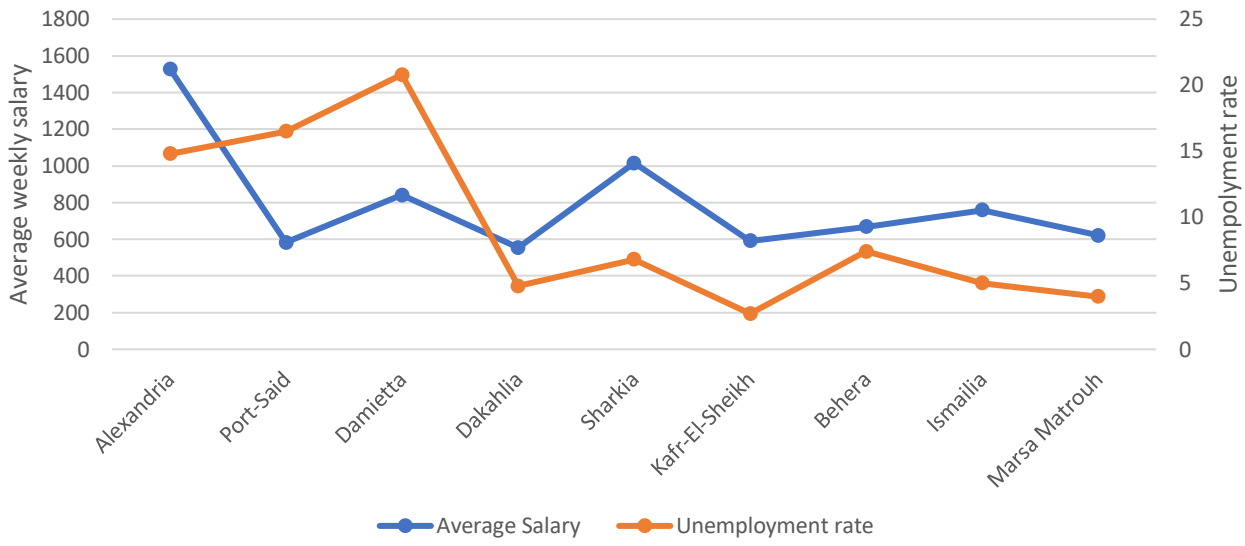
Table 8. Number of employees with weekly work hours and weekly salary

Governorate	Total employees		
	Number	Average Salary	Average working hours
Total	21374229	915	54
Cairo	5733301	946	51
Alexandria	1754517	1528	56
Port-Said	192331	582	58
Suez	94145	996	57
Damietta	230654	840	56
Dakahlia	886872	554	56
Sharkia	1272588	1015	57
Kalyoubia	943485	620	55
Kafr-El-Sheikh	274372	591	66
Gharbia	454230	568	44
Menoufia	355698	514	55
Behera	759152	667	58
Ismailia	208588	759	47
Giza	6121461	1021	54
Beni-Suef	325598	376	67
Fayoum	209289	619	63
Menia	320199	486	54
Asyout	236791	527	50
Suhag	235739	507	53
Qena	75678	753	58
Aswan	155175	947	54
Luxor	126699	428	53
Red Sea	107898	744	58
El Wadi El Gadid	53363	376	35
Marsa Matrouh	205548	621	58
North Sinai	3943	1421	49
South Sinai	36916	818	59

*Source: Central Agency for Public Mobilization and Statistics - Statistical Year book 2020

Using data from Tables 7 and 8, Fig. 7 depicts the relationship between the unemployment rate and the average weekly pay in the regions of interest. This number indicated that, in the majority of cases, the unemployment rate was reduced when the average pay was decreased due to the presence of beekeeping. In the instance of Port Said, we must consider that beekeeping is not prevalent there.

Figure7 Relationship between the unemployment rate and average weekly salary in targeted regions



Chapter 5: SWOT analysis of the beekeeping sector in the region

To create greater revenue for farmers, agriculture must diversify. The beekeeping industry plays an important role in increasing crop productivity through pollination and creating jobs opportunities among rural people. The government is implementing numerous programmes to significantly promote the industry, such as the MSMEs agency, which supports MSMEs in many industry sectors in order to establish sustainable competitive advantages and identify major obstacles to the sector's future development. Using SWOT analysis, the purpose of this study is to identify the primary obstacles to the sustainable development of the beekeeping business in Egypt.

Sample description in the research method

To conduct this study, a group of individuals ranging in age from 23 to 61, with an average age of 44, was gathered. Regardless of age, the outcome demonstrated that beekeeping is an active practise in society. Strengths and weaknesses as well as opportunities and threats for beekeeping development are identified using SWOT analysis method. This method is among the most popular in scientific literature, which is used to set strategic objectives and choose a strategy for the development of the organization. SWOT analysis technology requires knowledge of all specific factors that have a direct and indirect impact on the business organization in order to analyze them in detail so that the organization can easily adapt to its requirements. It is the subject of discussions by the beekeepers in specially designed focus groups. As a result of derived focus groups, the discussion has been stimulated in order to extract internal and external environmental factors that affect the beekeeping sector, which are able to either enhance or weaken its resilience to many threats.

The results are organized in the form of SWOT matrix (Table 1), identify strengths, weaknesses (i.e. internal factors controlled by sector operators and can try to change or manage them), opportunities and threats (i.e. external factors derived from the environmental, market or regulatory context and therefore do not depend on beekeeper decisions).

The main topics that appeared in the brainstorming session were used to fill the SWOT matrix, identifying internal and external factors affecting the beekeeping sector.

Results

The SWOT analysis depicts the internal and external environment of beekeeping according to the consensus of discussion groups.

Strengths	Weakness
1. Diversity in agricultural crops and continues blooming. 2. Egypt's geographical location and climatic conditions are suitable for production. 3. Limited land area needed for apiary construction. 4. The Egyptian beekeeper has good competitive skills, and beekeeping is an inherited profession and well-known. 5. The availability of the necessary expertise, which facilitates the management and follow-up process, proper planning and the ability to expand in the future. 6. The early, low-cost production of bee packaging results in a distinctive, in-demand product on the international market. 7. Availability access to raw materials in suitable time. 8. Diversity of the honey types and the spread of complementary and supportive industries. 9. The availability of improved and new beekeeping practices. 10. Sufficient investment in beekeeping 11. The widespread of beekeeping associations in Egypt.	1. Exported bee packages death because of airlines negligence. 2. Lack of control over products and contamination of some products with chemicals. 3. Lack of approved treatments for bee diseases. 4. High production costs. 5. Weak cooperation between the private and governmental sectors. 6. Non effective agricultural advisory, training and poor communication with research centers. 7. Lack of experience in applying for structural funding and inability to handle administrative documents. 8. Difficulty marketing bee products. 9. The average size of apiaries is small. 10. Lack of pure and certified bee queens. 11. Lack of scientific knowledge for beekeepers.
Opportunities	**Threats**
1. Producing early bee packages makes us competitive. 2. Opening new markets, and diversity of the products that honey enters into its components. 3. Most of rural population considering beekeeping as a good income job. 4. Working with strategic partners in the industry environment. 5. The government financial policies support exportation. 6. Training workshops for beekeepers. 7. Honey has social acceptance as a food and pharmaceutical product. 8. Small apiaries are the backbone of the rural economy.	1. Random use of agricultural pesticides. 2. Raw materials increasing prices. 3. Market monopoly by companies. 4. New competitors and the ferocity of competition. 5. Negative changes in currency prices leading to higher import or selling prices and therefore less buying. 6. Governments apply certain policies that restrict investors or require them to pay high taxes. 7. Problems of climate change. 8. Insufficient risk management skills. 9. Import cheap honey from other countries and have a demand on adulterated honey in the local market. 10. Different export specifications of countries.

Strengths

1. **Diversity in agriculture and continues blooming**

   Egypt has a wide variety of crops and plants that are dispersed across the area according to temperature and soil conditions. The majority of these plants are appealing to bees, allowing bee colonies to collect nectar, pollinate these plants, and contribute to the conservation of biodiversity. Excellent pollinators, bees can increase crop yields by up to 200 percent in some places.

2. **Egypt's geographical location and Climatic conditions are suitable for production.**

   Egypt's climate is ideal for beekeeping for a number of reasons, including the moderate atmosphere throughout the year and the variety of agricultural seasons and their succession, which leads to a succession of flowering plants that produce nectar and pollen. Beekeeping is of high economic importance and high nutritional value due to its nutrients, which include sugars, enzymes, organic acids, and minerals, among other products. Recently, it was revealed that bee venom can be used to treat a variety of diseases.

3. **Limited land area needed for apiary construction.**

   The area of land needed for beekeeping is very limited; beekeepers who do not have their own land can do this project, as the majority of beekeepers rent space between farmed areas, particularly during migratory activity.

   The Egyptian beekeeper has good competitive skills, and beekeeping is an inherited profession and well-known.

   Honey producers supply production with their own labour force, a requirement for higher quality work on the farm.

4. **The availability of the necessary expertise, which facilitates the management and follow-up process, proper planning and the ability to expand in the future.**

   Due to small production scale, apiaries adapt more quickly to market conditions. The smaller volume of production facilitates effective control over apiary activities and facilitates apiary decision-making. About 62.3% of beekeepers tend to expand their production but one of the main factors limiting production specialization is the owner's experience and market requirements. This is, of course, a greater motivation for the owner to control income and expenses in order to achieve higher profitability during the year. The combination of owner, businessman and beekeeper (owner) is a key factor in determining his motivation for developing his apiary.

5. **Unique production with good demand in the international market.**
   Diversity of crops and plants spread all over Egypt land according to the climate and soil properties and the moderation of the atmosphere throughout the year and the variety of agricultural seasons are responsible for producing many honey types and different bee products especially bee packages that are the main source of income nowadays.

6. **Availability access to raw materials in suitable time.**
   That allowed a wide range of specific equipment's and tools to improve beekeepers' activity and bee colony productivity (migratory beekeeping, honey harvest, etc.).

7. **The diversity of honey types, and the spread of complementary and supportive industries.**
   On small beekeeping farms there is a clear desire to add value to the products produced. Therefore, efforts are focused on providing high value to the consumer. Beekeeping farms track the strategy of increasing production since the main intensive factor is employment. The expansion of production volume is achieved through good production practices and control of production quality. There is a clear desire to produce high quality products. The wide variety of manufactured products is a key tool for stabilizing operating revenues and reducing market risk.

8. **The availability of improved and new beekeeping practices.**
   Scientific findings in beekeeping techniques aim to **a.** protect and preserve local genetic and biological materials, **b.** improve production performance and behavior, **c.** develop standard methods for evaluating and selecting bee colonies, **d.** improve the methods and techniques of beekeeping and effective pollination, **e.** improve the nutrition of bee colonies on the basis of balanced supplements, **f.** study the environment of insect prophecies and their vaccination needs.

   An integrated beekeeping program has been developed and the best areas for picking have been identified, and new techniques have been developed to maintain and exploit bee communities, in order to obtain well-resistant bee queens against diseases, in order to sustainability manage the beekeeping.

9. **Sufficient investment in beekeeping.**
   The initial investment required to start beekeeping is one of the critical factors that farmers are motivated to adopt, honey producers state that financial support for their apiaries activity depends mainly on their own money. But it gives a high degree of safety to beekeepers, which is of paramount importance to him because his activity often

contributes significantly to the comfort of the family. This project is characterized by the low cost required to build and operate them and do not require high technical expertise and skills.

10. **The spread of beekeeping associations in Egypt.**

    The presence of beekeepers' associations and honey brands is a motivation to create new brands and promote beekeeping along the product chain. To enhance the position of beekeeping in negotiating the prices of production materials as well as bee products, government should mark beekeeping as tax free industry and support beekeepers with financial loans.

Weakness

1. **Exported bee packages death because of airlines negligence.**

   As bee packages are the primary bee product produced from Egypt, beekeepers have difficulties with exporting them. The primary issue is the death of bee packages during the exportation procedure. This process's effectiveness is mostly dependent on the airlines, as packages may remain at airports for days instead of hours if poor ventilation and incompetent package handling lead to the death of bees and enormous losses for exporters.

2. **Lack of control over products and contamination of some products with chemicals.**

   Honey dilution leads to honey falsification, as a few beekeepers make low-quality honey by utilising sucrose or glucose syrup inside the hive and mixing it with natural honey in order to boost their income. The contamination of products with chemicals is caused by both beekeepers who use unapproved pesticides and plants that may have been treated against certain pests, with the transferred chemicals contaminating the products.

3. **Lack of approved treatments for bee diseases.**

   The health of honeybee colonies is crucial to their growth and honey output. Therefore, it is necessary to understand diseases caused by bacteria, viruses, fungi, and parasites, as well as physiological problems, deformities, and poisoning. Treatment must be administered immediately based on pathogens, however it is difficult to inform all beekeepers about bee diseases. Since there are no bee doctors available everywhere for prevention or therapy, the epidemic can quickly wipe out the entire beehive.

4. **High production costs.**

   Despite the small size of the apiary, beekeepers believe they have failed to plan and control their costs effectively and their ability to compete in terms of market prices. High

row material costs, treatment costs due to small scale and lake of suitable information in the suitable time do not allow the small producers to decrease their expenses. Also, the difficulties in producing same quality honey batches, increase the costs of packaging and labeling,

5. **Weak cooperation with the private and governmental sectors.**
   Honey producers don't want to cooperate - 70% of focus group participants indicate that they are not and do not want to be a part of bee associations as they do not have sufficient trust in it and prefer to make their own decisions alone.

6. **Non effective agricultural advisory, training and poor communication with research centers.**
   Through Regulation 1698/2005, the European Union requires direct links of cooperation between universities, producers, and consumers to promote technology transfer, as beekeepers seek opportunities to increase their competitiveness and the introduction of innovations is hindered by the small size of apiaries, inadequate investment, and inadequate guidance and communication roles in research centres.

7. **Lack of experience in applying for structural funding and inability to handle administrative documents.** In general, farmers lack experience in managing administrative documents associated with their activity. 70.2% of them mentioned this as a fact accompanying their activity.
8. **Difficulty marketing bee products.**
   As a result of lack of marketing structure: Due to the lack of marketing facilities and transport options, beekeepers must rely on intermediaries to sell their products on the market, causing significant losses. Lack of awareness of market conditions is the main reason for reducing beekeeper's ability to respond quickly and appropriately to market trends.

9. **The average size of apiaries is small.**
   The main weakness of beekeepers is their weak impact on the purchase price of bee products. The small volume of production does not allow large batches of high-quality products to be formed, losing competitive advantage in serving the market. In general, the marketing function (or at least partially implemented) is not performed by the owner and completely delegates the problem of marketing products to the companies. According to beekeepers, direct sales to the end consumer have a small share of total sales have little impact on their income. Strong individualism in sales is a critical factor in hindering co-

marketing and is one of the opportunities for honey producers to gain more power in negotiating purchase prices.

10. **Lack of pure and certified bee queens.**

    The number of queen producer in Egypt is lower than the needs (37.5% of the beekeepers) and there are not certified queens producers. The Egyptian Ministry of Agriculture has prevented the importation of queens since1960 to control honeybee diseases till 2019 as the importation of Carniolian and Italian queens was allowed but the high price still a major problem. Egyptian beekeepers requeen every year by purchasing virgin queens and let them to natural mating or by rearing virgins from the existing colonies. Queens are reared mostly using grafting method and queens are held in caged with few workers and sold either as virgin or mated queens. Generally, certified queens' producers in Egypt are highly required as there are not pure races nowadays in Egypt and all of colonies are hybrids

11. **Lack of scientific knowledge of beekeepers.**

    Most beekeepers in Egypt have not studied anything about honeybees but they keep bees by their own experience and practice. Beekeeping in Egypt is a profession that passes from one generation to another and it is very hard to change their conviction of something they have learned in the past.

Opportunities

1. **Producing early bee packages makes us competitive**

   The good climate of Egypt helps to produce bee packages early, and available throughout the year. Early bee package production is one of the main opportunities to increase the income of beekeeper.

2. **Opening new markets and the diversity of products that honey enters into its components**

   That will achieve more direct sales, establish local bee products brands, and improve the quality of manufactured products. Also, creating more jobs, creating preconditions for the development of related industries, achieving balanced prices and increasing household access to local bee products.

3. **Most of rural population considering beekeeping as a good job.**

Farmers with fewer financial means or administrative experience can practise small enterprises, so contributing to the expansion of the state's business sector and increasing their income. Agriculture-based industries provide farmers with an outstanding opportunity for local entrepreneurship and job creation, thereby enhancing their social and economic conditions and encouraging their adoption of beekeeping, as entrepreneurship encourages increased honey production, pollination, and employment supplements. Sustainable rural development seeks to enhance the quality of life through resource-focused development, innovation, and intergenerational equity. Beekeeping can provide rural residents with the ability to earn additional revenue from honey and other products and improve their standard of living.

4. **Working with strategic partners in the industry environment.**
   Having models of beekeepers' associations and honey brands that the traditions defined in production in different rural areas of the country are the basis for forcing local bee products brands into the market. In this way, beekeeping farms can use their main competitive advantage, namely, the production of high-quality bee products and easy adaptation to market requirements in the local market. For the most part, these products are intended for export.

5. **The government financial policies support exportation.**
   Financial support from the government for the development of small and micro producers, including the beekeeping sector, is a key factor in increasing the competitiveness of small and large producers in this sector. .

6. **Training workshops for beekeepers.**
   Training workshops for beekeepers has a positive impact on their knowledge and skills and helps them to be good managers of bees and marketers of their products

7. **Honey is socially accepted as a nutritional and pharmaceutical product.**
   A large demand on honey is exist from the athletics sector as it is a healthy and enjoyable with no side effects like white sugar and considered a tradition therapy in Egypt

8. **Small apiaries are the backbone of the rural economy.**
   Beekeeping is one of the main sources of income in some rural areas and one of the main barriers to increased regional unemployment.

Threats

1. **Random use of agricultural pesticides.**

   The use of pesticides and other chemicals in agriculture affects honey production and the health of bee colonies. The random use of pesticide especially neonicotinoid pesticides leading to real disasters with regard to bee colonies, and more specifically the so-called "Colony Collapse Disorder" which practically means the disappearance of bees. If bees die, life will disappear because vegetables and fruits are the result of pollination. For this reason, it is important to avoid intensive use of chemicals in agriculture.

2. **Raw materials increasing prices.**

   Increasing the price of inputs is also a challenge and a threat to beekeepers, whose income depends on honey production and quality, and on climatic conditions that have a profound impact on honey production. The bee expert should ensure corresponding inputs at the requirement level to develop a good deal. The most expensive input in beekeeping are prices of basic production resources as they have increased significantly in recent years, the construction costs of small apiaries and the cost of controlling diseases.

3. **Market monopoly by companies.**

   Price of beekeeping products varies from time to time, and the presence of brokers in the chain acts as cherries on the cake, because this makes farmers sell their products at very low prices to brokers, who in turn sell the same product at a very high price in the market, for huge gains. The low purchase price offered by wholesalers and processors in both the local and external market is also a threat, as if production costs are not covered by income, or if the income is equal to production expenses, beekeeper will have nothing to earn.

4. **New competitors and the ferocity of competition.**

   Increasing competition between honey producers and exporters, is important to increase honey production and quality to maintain actual beneficiaries and expand its market at the local and international level. There is also strong market power for supermarkets and distributors. Beekeepers take most of the risk in producing bee products, who instead get the lowest profit in the product chain. Bee product distributors have stronger market power because there is no real competition in this unit in the supply chain. Beekeepers inability to assemble product clusters on the market through collaboration puts them at a disadvantage in trade negotiations.

5. **Negative changes in currency prices leading to higher import or selling prices and therefore less buying.**

The bee products market is determined by high price dynamics for a relatively short period of time. This is the main reason why revenues from bee product sales are difficult to manage. The main reason for low income and unwillingness to increase production volume for small farms is unstable market prices.

6. **Governments apply certain policies that restrict investors or require them to pay high taxes.**

   Unstable regulations and frequently changing regulations limit the investment activity of beekeeping industry. On the other hand, they cause an increase in the administrative costs of bee products companies and the complexity of their management.

7. **Problems of climate change.**

   Our country is in the risk zone associated with climate changes. The trend of global warming will lead to a change in the specialization of apiaries dueto increase production costs and increase losses in bee colonies, thereby bee products production would decrease and so as related industries.

8. **Insufficient risk management skills.**

   Beekeepers see risk management as not a top priority in managing their apiaries. That's the main reason they don't develop skills and gain experience in this area. Although small producers operate at higher levels of risk, they are hesitant to apply risk management. This is because of distrust of insurance institutions. High insurance costs, which cannot be easily covered by their property. In addition, there is a lack of awareness of risk management mechanisms and a lack of tradition in their implementation.

9. **Import cheap honey from other countries, and there is a demand for adulterated honey in the local market.**

   The adulterated and diluted honey is critically harm good beekeepers with high quality products as it is much cheaper than the natural honey and very had to distingue without laboratory analysis

10. **Different export specifications of countries.**

    Countries have different export standard standards; each country has its own export standard specification. Small apiaries, which serve as the backbone of the industry, are plagued by a lack of supervision and quality control. In addition, the constant alteration of these specifications exacerbates the situation. As a result, it is exceedingly difficult for businesses to export bee products of acceptable quality to any country.

Chapter 6: The region's product portfolio on honeybee products and the honey types available

Economic importance of the honey bee colony

The economic significance of bees is evident in both beekeepers and the national economy. This significance is exemplified by the production of honey, wax, royal jelly, bee venom, pollen, and propolis, all of which have proven to be vital nutritional supplements. In addition to these items, there are others, such as the manufacture of Queen bees and bee packages, which are sold or used to increase the number of apiary colonies for people or their recovery from several diseases.

1 . Honey:

The first sugary substance known to man (before sugar cane) and bees produce it from the nectar of flowers which is collected by bees from the nectar glands in flowers. It is used as a food substance in the pharmaceutical industries, traditional treatments and in Cosmetic products.

2 . Bee wax:

It is the substance secreted by bees to build wax combs and cover the cells of honey and brood, it is secreted from 4 pairs of glands on the lower surface of the abdomen of workers aged 12-18 days old. Honey is the main ingredient in its production. Wax is used in the manufacture of cosmetics and foundations and are also used as a therapeutic substance.

3 . Royal jelly:

Glandular milky secretion from the worker's head, whose age ranges between 6-12 days, and is used to feed young larvae and queens. This substance is important to humans, as it activates the body's immune system. It also activates memory, as it contains antioxidants and helps reduce cholesterol and blood sugar.

4 . Bee venom:

It is a mixture of proteins and peptides that workers secrete as a means of self-defense. Its is a substance used by humans at the present time as a therapeutic substance for many diseases.

5 . Pollen:

They are the male gametes of flowering plants that bees collect as a protein source to feed the members of the hive and also plays a key role in the production of royal jelly. Pollen are an important treatment for humans.

6 . Propolis:

A resinous substance collected by bees from the leaf buds or bark secretions of some trees, where they mix it with saliva. This substance is mainly used by bees to sterilize the hexagonal cells from the inside, closing the abnormal cracks in the hive. As for humans, it is used

as a stimulant to increase immunity and as an anti-cancer agent in addition to being anti-bacterial, viral and fungal.

Honey

Honey is the primary and most common product of all apiaries in Egypt, whereas the other items are considered byproducts.

According to the Egyptian General Organization for Standardization and Quality, honey is a nectar collected by honey bee workers that ranges in colour from colourless to dark brown and has a sweet flavour. Apis mellifera from the flowers and secretions of plants, transforming it into a ripe, aromatic, fragrant liquid within waxy combs that contains primarily sugars, primarily glucose and fructose, and a small percentage of sucrose and maltose, as well as amino acids, organic acids, enzymes, mineral salts, and pollen. Depending on the type of plant source, the taste and odour components vary.

Basic requirements

1- It shall be free of any sweeteners, whether natural or industrial, other than those produced or assembled by beekeepers.
2- It shall be free from preservatives, coloring, aromatic scents or any other food additives
3- It does not contain any strange taste that is different from the sweet and natural taste, except for the naturally acquired taste.
4- shall be free from fermentation
5- It is not permissible to adjust the acidity of honey artificially
6- It shall be free from organic and inorganic materials such as insects or their parts or sand grains.
7- Free from pathogenic and non-pathogenic microbes and fungi and their toxins.
8- free of toxins resulting from plants in any proportion that cause harm to health
9- Residues of pesticides and medicines shall be according to the permissible healthy percentages.
10- The polarized light is shifted to the left, or the ratio of fructose to glucose in it is (106-119):100.
11- That the proportions of the components of bee honey be according to what is shown in the following table

Table 9. Components of honeybee

Components	Ratio
Apparent reduced sugars nectar honeydew	65 60 45
Humidity max	20
Apparent sucrose up to Cotton, Egyptian clover, medicinal plants The honeydew- lavender - Citrus – Alfalfa clover- Eucalyptus	5 10
Solid substances that are insoluble in water (max)	0.1
Ash	0.6
Acidity (maximum)	50 milligrams acid equivalent (per 1000 grams)
Estimated diastase enzyme activity after preparation and mixing according to Guth scale (minimum)	3
Hydroxy methyl furfural (maximum)	80 ppm

Honey seasons:

The beekeeping seasons begin in March and last in November, while the winter season lasts from December to March. Egypt has three primary seasons: citrus season in the first two weeks of April, clover season from May to the first week of June, and cotton season in August and September. The annual yield per colony is approximately 9 to 15 kg (all three pastures). Egypt exports honey to several nations. Egypt also exports beekeeping tools and swarms to many Arab and African countries.

Main types of honey:

Honey varies according to the variety of the nectar source. As a result, honey's hue, aroma, flavour, crystallisation, density, alkalinity, and even some of its constituents fluctuate by a small proportion. In addition, soil type and climate play a significant role in determining the qualities of honey. The following natural honey types are found in Egypt:

1- Clover Honey: Alfalfa honey is characterized by its yellow color and contains a volatile oil; which is flavone flakes and gums.
2- Sunflowers Honey: The color of sunflower honey is golden yellow. If it was crystallized, it would transform into a light green. Its aroma is light and tastes bitter delicious. Besides, the hectare of each plant gives 50 kg of honey.
3- Hijazi Honey Alfalfa: The freshness of it has different colors from colorless to umber color. It crystallizes quickly and turns into a white mass such as butter. It has a good smell and a special taste. It contains 40% fructose, 37% dextrose. Besides each one hectare of flowering Hijazi Alfalfa produces 380 kg of honey. Benefits: Keep the rate of blood sugar. Besides it is diuretic and diarrhea.
4- Citrus Honey: It has an excellent aroma like orange blossom and lemon. Besides, it has an excellent taste and it is used for rubbing the face to remove the freckles.
5- Cotton Honey: it is light and has a distinctive smell and an accurate taste. It freezes quickly and turns to a white color as snow. It may be yellow; containing 36% dextrose and 39% fructose. Besides, the cotton leaves give nectar that is not different from the nectar of flowers and the hectare of cotton produces from 100-300 kg of honey.
6- Sidr Honey: contains carotenoids, which are one of the most important substances to strengthen eyesight and protect eye cells from damage and protect them from many diseases such as cataract.. Sidr honey is widely used as a medication to treat liver diseases, ulcers of the stomach, lung infections, malnutrition consequences, digestion problems, constipation, infections of eyes, infections following burns, wounds and surgery, and general health and vitality. Sidr honey is known to have a strong antioxidant and antibacterial activities
7- Black seed Honey (multifloral): this is a good source of honey. It comes from various aromatic plants that bloom in the same time. Its honey has a distinguished scent and its color is dark. It has anti-inflammatory, antimicrobial and immune-enhancing properties.

Bee wax

Bees require wax to construct their honeycomb nests. The construction material and energy source for this activity is honey. It is secreted by the wax glands at the bottom of the abdominal segments; it is a liquid that solidifies when exposed to air.

Raw wax sources

Bee wax is the second product after honey in terms of obtaining and marketing, and is secondary to the production of honey for beekeepers, and there are several sources for obtaining it:

1- Traditional hives

2- Scraping wax

3- Waxy appendages

4- Old wax combs

Methods for extracting bee wax

There are many ways to extract bee wax, either by melting the wax or by chemical extraction. Bee wax is melted, whether for wax caps or for old combs and waxy appendages, in order to separate the impurities from them, and reuse them for industrial or medical purposes.

Extraction methods depend on raising the temperature using either hot water, steam, taking advantage of the sun's heat or using electrical energy, taking into account that the temperature should not rise to more than 100 ° C, as the temperature rises above that average, would lead to a change in the characteristics of the resulting wax, and reduces its quality so it is preferable to use hot water for this purpose so that the temperature does not rise above 100°C.

Basic requirements

According to the Egyptian General Organization for Standardization and Quality

1- It shall be free of impurities and manifestations of insect infestation.
2- It shall be free from the growth of fungi and yeasts or their toxins.
3- It shall be free of pathogenic microorganisms and their toxins.
4- It shall be free from paraffin wax and other waxes.
5- Pesticide residues in the product shall not exceed the established limits stated in the legislation issued in this regard.
6- Bee wax is insoluble in water or cold alcohol.
7- Bee wax dissolves in ether, chloroform, carbon tetrachloride and some oils .
8- Partially soluble bee wax in hot gasoline and carbon disulfide.
9- Wax is saponified with alkalis, but does not dissolve in them.
10- The color ranges from white to yellow to brown and has an aromatic or floral smell (like the smell of honey bees
11- The percentage of lead shall not exceed 0 .5 parts per million.
12- The percentage of copper does not exceed o ne part per million.
13- Do not exceed one part per million of arsenic.

Descriptive criteria

1- Bee wax is fragile, easy to break at low temperatures, 15.5°C, and bendable at 49°C
2- Melting point of bee wax is 64°C
3- Degree of ductility is 60°C
4- Acidity number in the range of 18.5
5- Saponification number is around 91
6- The ester number is within 73
7- Iodine number ranges from 4 to 13
8- The specific density ranges from 0.95: 0.97 g/cm^3.
9- Humidity is within 5% estimated under discharge at 40 °C.

Royal jelly

Glandular milky secretion from the worker's head, whose age ranges between 6-12 days, and is used to feed young larvae and queens. This substance is important to humans, as it activates the body's immune system. It also activates memory, as it contains antioxidants and helps reduce cholesterol and blood sugar.

The bee milk for the queen is the most nutrient rich and is therefore called royal jelly. The queen also gets much more than the workers. This is partly why the queen becomes much bigger and stronger than the workers. She can live for a few years, and thus much longer than the 4 weeks to 6 months, depending on the season, that the worker bees live. The composition of bee milk depends partly on the bee bread and thus the pollen. It is rich in vitamins B1, B2, B6, folic acid, inositol, pantothenic acid, vitamin C and vitamin E (tocopherol). Royal jelly also contains peptides, lipids, sterols, aromatic oils, carbohydrates, enzymes, anthocyanins, carotenoids, flavenoids, ferulic acids, as well as minerals and spore elements from the bee bread.

About half of the fat fraction in royal jelly is made up of 10-hydroxy-2- decanoic acid (10-HDA), which plays a role in growth, the hormonal system and the immune system. Fresh royal jelly contains 2-15% 10- HDA, which determines its quality (>5% is preferred).

Basic requirements

According to the Egyptian General Organization for Standardization and Quality

1. It shall be free from any natural or artificial sweeteners other than those produced in its original formula
2. It shall be free from preservatives and colorings

3. have a sour, sour taste
4. It shall be free from signs of fermentation and spoilage
5. specifications of raw royal jelly
    a) Moisture content does not exceed 66%
    b) The protein content shall not be less than 12%
    c) The proportion of 10hydroxyacid-decenoic acid shall not be less than 2% 0%
    d) Fat percentage not less than 5.5%
    e) Carbohydrate content shall not be less than 12%
    f) Ash percentage shall not exceed 0.8% 0
6. Specifications of dry royal jelly
    a) Moisture content should not be more than 5%
    b) The percentage of protein is not less than 32%
    c) The proportion of 10hydroxyacid-decenoic acid shall not be less than 6% 0 **%**
7. The total count of non-pathogenic bacteria does not exceed 10,000 cells/g 0
8. shall be free of pathogenic microbes
9. The product shall be free from the growth of fungi and yeasts, their spores and their toxins.
10. The product shall be free of anaerobic bacteria.
11. The percentage of lead shall not exceed 0.5 ppm
12. The percentage of copper does not exceed 1 ppm
13. The percentage of arsenic does not exceed 1 ppm
14. Pesticide residues in the product shall not exceed the established limits stated in the legislation issued in this regard.

Descriptive criteria

1- It shall retain its distinctive color
2- It is suspended in water and fixed for a long time due to its colloidal nature
3- PH ranges between 3-4
4- Royal food contains the following substances in different proportions: water - protein - fats - invert sugars - vitamins, minerals and their salts and other important compounds, which are (acetylcholine, adenosine diphosphate, adenosine triphosphate) and some hormones
5- The proportions of these ingredients vary according to:
    a) The age of the worker bees in terms of the quantity and type of protein source that the worker bees feed on
    b) Protein quality of flowering plants from which nectar and pollen were collected

c) Quality of pollen substitutes and supplements provided to bees 0
d) Weather conditions

Pollen

They are the male gametes of flowering plants that bees collect as a protein source to feed the members of the hive and also plays a key role in the production of royal jelly. Pollen are an important treatment for humans.

Honey bees collect pollen from the stamens of flowers. The pollen sticks to the bee's hairs while the bee is sucking nectar. The bee removes the pollen from its hairs using its forelegs and adds some saliva to help roll it into a ball. The bee flies with these loads in the pollen baskets on its hind legs to the beehive. Nurse bees push these loads with their heads into the honeycomb cells, together with a small amount of honey and saliva. The bees then process this mixture and it ripens into bee bread.

Pollen grains have a tough outer wall "the exine". This sometimes has barbs that allow it to stick well to the bee's hairs. This outer wall is covered in a layer of wax, which makes the pollen very difficult to digest and is also the reason pollen can become fossilised and remain intact in the soil for millions of years. Despite this hard outer wall bees make it slowly more digestible and eventually after several weeks make bee milk or royal jelly out of it for the young larvae.

Pollen contains lipids, essential oils, vitamin E (tocopherol), carbohydrates, peptides, short proteins or oligopeptides, amino acids, pantothenic acid, anthocyanins, carotenoids, flavonoids, ferulic acids and enzymes as well as many minerals such as iron, manganese, zinc and spore elements

Basic requirements

According to the Egyptian General Organization for Standardization and Quality

1- It shall be free of wax worms and honeybee parts
2- It shall be free from the growth of fungi and yeasts or their toxins.
3- It shall be free from microorganisms and their toxins.
4- It shall be free from pollen substitutes such as ground chickpeas and ground soybeans
5- Pesticide residues in the product shall not exceed the established limits stated in the legislation issued in this regard.
6- It shall be free from added coloring matter
7- Moisture content should not be more than 17 %
8- The protein content should not be less than 5%.

9- The percentage of reducing sugars shall not be less than 19%.
10- The percentage of starch should not exceed 11%
11- The percentage of ether extract that contains fats, vitamins, pigments and some hormones is not less in the product about 1.2 %
12- The percentage of ash shall not exceed 4%.
13- The percentage of lead shall not exceed 5 parts per million
14- The proportion of copper does not exceed one part per million
15- Do not exceed one part per million of arsenic

Descriptive criteria

1- The pollen grains are in the form of a homogeneous and non-adherent
2- The color of the pollen is homogeneous according to the source of the plant
3- The pollen grains retain their natural properties so that they do not stick together and do not crumble by pressing them.
4- The percentage of non-reducing sugars should not exceed 9%

Propolis

A resinous substance collected by bees from the leaf buds or bark secretions of some trees, where they mix it with saliva. This substance is mainly used by bees to sterilize the hexagonal cells from the inside, closing the abnormal cracks in the hive. As for humans, it is used as a stimulant to increase immunity and as an anti-cancer agent in addition to being anti-bacterial, viral and fungal.

Basic requirements

According to the Egyptian General Organization for Standardization and Quality

1- It shall be free from impurities such as the remains of insects or other organisms.
2- It has a distinct aromatic odor.
3- Pesticide residues in the product shall not exceed the established limits stated in the legislation issued in this regard
4- It is relatively soluble in water and strongly in other organic solvents (especially ethanol).
5- The percentage of lead shall not exceed 0.5 parts per million.
6- The percentage of copper does not exceed one part per million.
7- The percentage of arsenic does not exceed one part per million

Descriptive criteria

1- The color varies from yellow to dark brown according to the plant source, geographical area and storage period
2- It is different, it is a fine powder or a sticky lumpy substance
3- Consists of 55% aromatic resins, 10% essential oils, 5% pollen, 30% wax, 5% Fatty acids - terpenes - secretions of the salivary glands of bees and non-essential components.
4- Melting point 64oC.
5- Degree of softness at 38°C .
6- Moisture content in the range of 0.5

Bee venom

The bee venom is made in the venom gland and is stored in a venom sac at the base of the stinger. Young bees have little venom. Their venom sac is not filled until their 18th to 21st day. The spring bees that are raised with a lot of pollen have the most and most effective venom. Bee venom dissolves in water but not in oil. Alcohol is harmful to bee venom.

It is a mixture of proteins and peptides that workers secrete as a means of self-defense. Its is a substance used by humans at the present time as a therapeutic substance for many diseases.

Unfortunately, the Egyptian General Organization for Standardization and Quality does not has a standard specification for bee venom beside the number of producers is very low.

Chemical composition of bee venom

The chemical composition of bee venom is very complex, as it contains chemically and pharmacologically active substances. The general composition, among many other substances, mellitin (40-60%), phospholipase A (10-12%), apamine (2-3%), MCD-peptide (2%), histamine (1%). The exact composition is differed between individual colonies or races of bee species and could be presented in the following groups.

First- Protein Ingredients:

1. Hyaluronidase Enzyme: Hyaluronidase

The percentage of this enzyme in bee venom is 1.3%.

2. Phospholipase A

The percentage of this enzyme in bee venom is 10-12%.

3. Mellitin

It is the basic protein of bee venom, which is generally responsible for the toxicity in the process of stinging, and it is 50% of the dry weight of the venom, and it is composed of 26 amino acids.

Second- Peptide Ingredients: Peptides

1. Apamin

It consists of 18 amino acids, and its percentage in bee venom is 1-3%.

2. MCD Peptide

Similar in structure to apamin - This peptide is a foreign protein for the body and is therefore called Antigen, meaning an antibody, and its proportion in bee venom is 1- 2%.

3. Other peptides:

Such as Secapin, Tertiapin and Procamine and cicapine

Third- Active Amines:

Such as histamine, serotonin, and dopamine.

The levels of histamine in honey bee venom increase with the age of the bee, ranging between 0.5% to 2%, and histamine can cause pain in mammals.

Fourth - Pheromones in bee venom:

There are about 20 volatile compounds in bee venom.

The general pheromone that alerts to danger in bee venom comes from the odor gland or Koschevnikov gland, which is located at the base of the stinging machine. It secretes Alarm pheromone, and 2 Heptanone pheromone is secreted from the glands of mandible , and it has a special effect as a danger stimulant, and the percentage of pheromones in the bee venom is about 4.8% .

Fifth - other components of the poison:

Such as sugars (glucose + fructose) and its proportion is about 2%.

Sixth - other components in the poison: such as phospholipids and amino acids.

Bee swarms and queens

The Arab Union for Beekeepers estimates that 2.5 million beehives are currently cultivated in Egypt being the main sources of income for 25.000-30.000 Egyptian beekeeper-families. Over 1.2 million bee package

had been exported from Egypt in 2018, which make Egypt the top country in exporting in the Mediterranean region. Nearly 84.5% of beekeepers produce bee swarms yearly as it became the main source of beekeeper income (250-500 EGP for package).

Apiculture (beekeeping) has special importance to the agricultural sector in Egypt and is increased actively every year. Most beekeepers depend mainly on the products of honey bee colonies as source of income. Because the development of honey bee colonies requires good vegetation, most apicultural activities is existed close to cultivated areas along the Nile River.

Most beekeepers in Egypt have not studied anything about honeybees but they keep bees by their own experience and practice. Beekeeping in Egypt is a profession that passes from one generation to another. Most hives in Egypt consist of one box only. Beekeepers prefer increasing the number of hives rather than increasing the number of boxes in the same hive due to the migratory beekeeping requirements. All beekeepers in Egypt deal with honeybee colonies without any protective clothes except the veil (face protecting). Also, a lot of beekeepers do not use smokers during hives inspection, despite the aggressiveness of colonies. Bee swarms are sold locally in two types

a. Nueces swarms: The nucleus box, also called a nuc., is a smaller version of a normal beehive, designed to hold fewer frames (5 frames instead for 10). Smaller space makes it easier for the bees to control the temperature and humidity of the colony, which is vital for brood rearing. It usually consist of 3 frames of brood and 2 frames of honey and pollen.
b. Package swarms: in this type the bees are weighted and sold by weight without brood or honey and is being put in package cage and usually used in bees exportation and is preferred to prevent distribution of brood diseases.

In Egypt, there are fewer queen producers than needed (37.5% of beekeepers), and there are no recognised queen producers. Depending on the quality of the queen, honey bee queens cost between 10 and 65 Egyptian pounds. Since 1960, the Egyptian Ministry of Agriculture has prohibited the importation of queens in an effort to manage honeybee diseases. Imports of Carniolian and Italian queens are permitted, although pricing remains a big issue. Egyptian beekeepers requeen their colonies annually by acquiring virgin queens and allowing them to mate naturally, or by growing virgins from existing colonies. The majority of queens are raised through grafting, and queens are kept in cages with few workers and sold either as virgin or mated.

As there are no pure races in Egypt nowadays and all colonies are hybrids, certified queens producers are often in high demand in Egypt.

Chapter 7: Marketing and packaging

7.1 Processing and packaging

Honey

According to our survey, over 96 percent of Egyptian beekeepers produce honey, and the majority of them (93 percent) sell it directly to consumers. They also sell a portion of their production to companies, brokers, and exporters. 'Raw honey can be packed since it retains the aroma of the flowers from which it was gathered. Enzymes and other biologically active components are the highest in raw, unheated honey. Honey can crystallise and solidify. The hue then gradually becomes lighter. It is possible to cream the honey by first warming it slightly and then swirling it. The most delicious creamed honey is created from finely crystallised honey. Within a few days of extraction, place the honey in airtight containers or jars. To conveniently fill small containers and jars, use a container with a valve.

Honey should be stored in glass jars or plastic pails with tight-fitting lids, or in metal containers that have been coated on the inside with liquid paraffin, plastic, or food-safe varnish. Large honey producers heat the honey to maintain its fluidity and avoid its fermentation if the moisture content is excessive. After heating, the honey is filtered and poured into glass jars. This process is also called refining. Through the heating process, however, the honey loses some of its quality. Its fresh character is gone but it does stay clear longer. This is an advantage if the honey is to be sold in stores. The honey can start fermenting during storage if the water content is above 19%. Fermentation can be prevented by heating the honey to a temperature of 55 to 60 °C over a period of 8 hours, followed by rapid cooling. However, heating honey for much longer will diminish its taste, smell, enzyme content and health value.

Pollen

Pollen production is considered popular in Egypt as nearly half of the beekeepers produce it and sell it either alone or mix it with honey. Pollen spoils quickly and can therefore be left in front or under the hive for no longer than a day. It have to be dried immediately after harvesting to prevent moldiness and extend their shelf-life. The moisture content decreases during drying from about 25% (fresh) to an average of

11%. Fresh pollen becomes moldy after just one day, and these molds can produce unhealthy aflatoxins. To keep it longer, fresh pollen can also be added to honey.

Most of Egyptian beekeepers sell pollen in fresh form and only 46% of them dry their production of pollen an the rest store it in freezer.

Pollen has to be stored in a dry, dark place to retain its good properties and to retain its favorable characteristics. Brown glass jars are better for this purpose than clear glass jars but is much expensive.

Nutritional composition and caloric value are given in grams per 100 grams of pollen (or a percentage) after drying. The moisture content decreases during drying from about 25% (fresh) to less than 12%. Other ingredients such as wax capping and debris from the bottom of the hive should not be present. Pollen that is collected from sprayed crops may contain pesticide residues.

Royal Jelly

Royal jelly production is considered a difficult work that needs a lot of experience, although that about 52% of Egyptian beekeepers do produce it for its high price and sell it alone in fresh form or mixed with honey.

Fresh royal jelly can be kept at room temperature for only a few days and, it can be kept longer in the freezer or by adding it to honey, but the concentration must not be more than 3-5% to prevent fermentation. Since the production of royal jelly is very labor-intensive for the beekeeper and the yield is very small this product is very expensive. The active involvement of the beekeeper makes it important to work with calm colonies.

After being freeze-dried, or lyophilized, royal jelly can be kept in powder form at room temperature, but this way of storing is not popular in Egypt. Therefore it is better to freeze it. One of the active and measurable nutrients in royal jelly is 10-HDA (hydroxy-2-decenoid acid), which accounts for 2-11% of its content. The 10-HDA content is indicated on an analysis certificate. Good royal jelly contains more than 5% 10- HDA. Royal jelly should also be free of residues such as antibiotics.

Bee Wax

Bee wax production is essential in beekeeping according to our questionnaire 48.6% of Egyptian beekeepers produce it, but in Egypt most of it is being sold either to wax foundations factories or the exporters and only 8.5% of the producers use it to produce cosmetics and other products.

In the food industry, bee wax is used as a polish and anti-adhesive for candy, such as chewing gum. They are coated with a thin layer of bee wax so that they don't stick to each other. Bee wax is used as an air-tight seal to preserve jams and fruits, and to cover honey that is

separated from the comb through heating and then poured into a jar. Bee wax also has applications in the sport world, such as in archery, and in horticulture, such as in the grafting of trees.

The cosmetic industry uses bee wax as an emulsifier and binding agent in oils and fats because of the high amount of energy required to melt it and its melting trajectory. This makes these cosmetics hard when cold and prevents them from melting too quickly in the sun like solid fats. Moreover, they react perfectly to human skin. Bee wax is therefore frequently added to creams, salves and lotions. Lipstick and mascara, which normally contain more than 30% bee wax, are both quantitatively and qualitatively important uses. Bee wax is also used to remove hair by first pouring it over the skin in liquid form and then pulling it off once it has become solid.

For some uses the wax may have to be bleached, which can be done naturally or with chemicals. For beekeepers, only a natural method is recommended, preferably exposure to the sun. Grate the wax into fine pieces and spread them thinly over a mat or make thin sheets by dipping a wet board in fluid wax and then scraping it off once the wax hardens. If large amounts can be collected and processed, bee wax can be an attractive product for beekeepers in the tropics to trade and even export. Wax produced for the export market has to be cleaned as well as possible. After the cleaning process is completed, the wax can be poured into manageable blocks weighing 20 to 25 kg. To collect enough for a whole shipment, the wax production of many beekeepers can be combined.

Bee wax should be melted at a relatively low temperature (< 80%). If the wax is overheated, it will turn brown and its quality will deteriorate. Simple extraction methods are suitable to retain the quality of the wax. An important quality indicator for bee wax is purity. Bee wax mixed with paraffin, solid fat or oil is not good enough to be sold and certainly not to be exported. The additives can be detected by measuring the melting trajectory of the product

Propolis

Propolis production is not popular in Egypt only 15.3% of Egyptian beekeepers produce it, the main reason of that is the lake of forests in Egypt which the main source of production. The main form of marketing is in row form only 36% of the producers tend to purify propolis and sell it in another form. Imported powder propolis is more popular than local row one for it’s low price and ease of use in honey mixes.

The collected propolis can be stored in plastic buckets but not in cans. As propolis becomes warm, it flows out and eventually forms a hard block. It is then very difficult to get it out of a can. Adding a small amount (10%) of a different powder prevents it from coagulating. For this purpose you can use pollen, sugar, cassava or other type of flour, dextrin-maltose or magnesium stearate.

Propolis scraped from the woodwork in the hive normally contains pieces of bee wax, bees or bee legs, hair, wood shavings and other additives or impurities. These have to be removed if the product is to be consumed right away. After this point, it doesn't matter very much for the quality of the propolis whether or not it is purified, for example through alcohol extraction. Propolis from tropical regions has a low content of active ingredients. This can be less than 10%, whereas purified propolis from moderate climates can contain as much as 50% active ingredients. Other ingredients may include botanical waxes, bee wax and course substances such as wood fibers and hair from plant parts, sheep's wool or particles of paint or varnish. These stick to trees or other objects where sticky substances are collected by the bees.

The concentration of pure propolis in the mixture in moderate regions has to be higher than 50%. Propolis can be ground, such as with an old coffee mill. The propolis should be as cold as possible, straight from a freezer for example, because it is then hard and not sticky. The best results are achieved by first putting the freezing cold propolis through a circular grater until it becomes a rough mixture and then grinding it.

Bee Venom

Bee venom is not a popular product, only 35% of Egyptian beekeepers can produce it and most of them sell it directly in powder form and 20% of the producers transform it to bee venom solutions that could consumed or injected to patients.

Bee venom that is dried on a glass plate and then scraped off looks like a cream to grey-colored gummy powder. The quality of the bee venom is determined among other things by its melittin content. Good quality dried venom contains 40 to 60% of this compound. Purified bee venom is used in apitherapy as an additive to foods or as a nutrient supplement. The status of this product is not clear in every country. In many countries bee venom can only be purified in certified laboratories. Bee venom is poisonous in very small amounts and some people can be allergic to it. Caution and precautionary measures are therefore extremely important in the production and processing of bee venom.

Marketing

Egyptian beekeepers suffer from the lake of marketing locally although they make most of the known steps promote their products which could be a result of low consumption of bee products in Egypt. They often use distinguish jars (made from glass or plastic) with labels (79%).

Moreover, they mix honey with other products like pollen, royal jelly and propolis and sell the mix for higher price (68.9%). Onley about 40% of them could sell sealed honey combs regarding that it is not popular in Egypt and 4.4 % of the beekeepers tend to make candies. Moreover they made bee venom solutions, purify propolis and sell dried pollen.

Honey, pollen, bee bread, brood, whole comb and royal jelly are nutritious primary products from the beehive. They can be eaten fresh or in a processed form. Honey is usually extracted fresh from the comb. Pollen is dried right after harvesting. Whole comb is eaten fresh or made into various dishes. Royal jelly is eaten fresh or is preserved in a frozen or dried form. Bee wax, propolis and bee venom are also primary products, but they are not edible as such. They can be part of edible products or processed into food supplements or therapeutic products. After harvesting (or extraction, in the case of bee wax), these products can be kept for longer periods without preservation. Quantities can be built up, collected from several beekeepers, and stored for several years. Most products are best marketed locally in small packages, while bee wax can also be exported in bulk.

7.2 Local marketing

Quality

The key factors in marketing bee products are quality, continuity, and sustainability. Demand for honey is usually high and therefore not a limiting factor for profitable marketing. Quality is the first requirement. If a product is good, a customer will be more likely to keep coming back.

Each product should be devoid of residues from organic or inorganic compounds, such as antibiotics, acaricides, and insecticides, as well as foreign particles. To prevent such contamination, organic or biological ways of beekeeping are suggested. In addition to the benefit of lacking chemical residues and foreign elements, such as sugar, certified organic products can fetch a higher price in the niche market for organic or bioproducts. Organic bee products fetch a higher premium on the global market because to the ever-increasing demand for eco-friendly products.

Primary products

Honey, pollen, royal jelly, bee wax, propolis, and bee venom are suitable for local marketing. Retail is always the best option as it gives the highest price. The demand is sometimes high compared to production. Wholesale marketing of small packages or semi-bulk to resellers or hotels is the next best option. Because of low export prices, export is usually not a sound option for small-scale producers. With large-scale production that exceeds the local demand, however, surpluses can be traded in bulk or exported.

Local marketing of honey

Usually, a beekeeper produces different honey types. Light and dark-colored honeys can best be separated at harvest time or be extracted separately. Mono-floral honeys can be kept separate to obtain a variety of honeys.

Honey can be sold fluid, creamed, as comb honey, as chunk honey or as crushed honey. Combined packages with three different honey types with contrasting colours are very attractive too. Glass or transparent plastic bottles are another option as the customer can recognize the colour from the outside. A glass bottle can be put into a basket and traditional decorations can be used on the label. Fresh royal jelly can be marketed as a pure product or mixed in honey for preservation.

Derived products

Marketing derived products is another way of diversifying. Adding derived bee products to honey adds value to them. For example, honey with royal jelly or honey mixed with pollen or propolis powder can fetch a better price than the two separate products. Products made with wax, honey, pollen, royal jelly, propolis and bee venom are all good for local marketing, particularly retail.

Advertising

Advertising the products means drawing the attention of wholesale traders, retail shops and customers or consumers to the special properties or quality of one's product. Key issues are identity, diversity, taste, health value, quality, and the price of the products. Information for the customers about the value of the product is a must. A vast range of marketing instruments and ideas for advertising exist, which can be applied specifically to bee products. Nowadays advertises on the social media is considered the main way of advertising in Egypt especially for the small producers as the cost is considered low and it reach massive consumers

Places to sell

Number of selling points could be chosen, the most popular for small producers that they store their products near their apiaries or home and sell directly to the customers, resellers like mini-markets and gas stations with a good turnover can be chosen. In the case of supermarkets or hypermarkets you may have to offer your products on consignment with a minimum quantity of each different product. In this case you may start by offering just one product until it sells well and then expand the assortment. You further need to know the preferred sizes of packages, packing material and the frequency of buying. Excellent places to sell and create a sustainable market are organized honey festivals.

Chapter 8: Regional tourism products and services based on the honeybee

Egypt's economy relies heavily on tourism as one of its primary economic sources. At its peak in 2010, the tourism sector employed approximately 12 percent of Egypt's labour force, served approximately 14.7 million visitors, generated nearly $12.5 billion in revenue, and contributed more than 11 percent to Egypt's Gross Domestic Product (GDP) and 14.4 percent of foreign currency revenues (according to Reuters Africa in 2009, 2014).

In 2010, an all-time high of 14,7 million tourists visited the United States. During the 2018-2019 fiscal year, tourism revenues reached a record high of $12,6 billion. In 2020, tourism-related revenues decreased by around 70percent to $4 billion. According to Tourism and Antiquities Minister Khaled El-Enany, the number of tourists visiting Egypt decreased to 3.5 million in 2020. According to Kristalina Georgieva, managing director of the International Monetary Fund (IMF), Egypt's tourism industry has suffered the most from the coronavirus pandemic**.**

During the 2011 Egyptian Revolution, the number of tourists dropped by more than 37 percent, from 14 million in 2010 to 9 million by the end of 2011. This has affected a wide range of enterprises that are directly or indirectly reliant on tourism, including travel accommodations, tourist attractions, automobile rental, air transportation, and health and wellness industries. At locations on the Red Sea where costs are still lower than in 2011, travel operators offering substantial discounts to entice tourists back have had some success. Comparing the first half of 2014 to the same period in 2013, the number of tourists decreased by an additional 25 percent, while revenues also decreased by 25 percent. In 2013, Egypt ranked 85th as the world's best country for tourism and travel, down ten spots from its 2011 ranking of 75th. In 2017, it was ranked 75th overall, a little improvement from its position in 2016. According to the 2019 rankings, Egypt is ranked 65th overall.

In 2020, Egypt's tourism revenue decreased by around 70 percent to $4 billion, while visitor arrivals declined from 13.1 million in 2019 to 3.5 million. According to the Central Bank of Egypt (CBE), Egypt's tourism revenues for the months of the fiscal year 2020-2021 fell by 67.4 percent. According to Khaled El-Enany, the average number of visitors visiting Egypt in April 2021 is approximately half of the monthly average for 2019. Prior to the global Coronavirus epidemic, Germany sent the most tourists to Egypt in 2019 (2.5 million), followed by Ukraine (1.5 million), Saudi Arabia (1.4 million), and Libya (1.4 million) (0.75 million).

Table 10. Tourists' distribution, by country groups (percentage) (2010 – 2020)

Group	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
Arabs	25.1	24.3	26.8	29.7	36.3	18.6	16.5	18.6	19.7	18.3	14.2
Europeans	62.7	64.3	61.2	56.3	47.9	72.8	76.7	73.7	73	73.3	75.1
Americans	4.7	4.2	4	4.3	5.2	3.2	2.5	3.6	2.5	2.9	3.8
Others	7.5	7.2	8	9.6	10.6	5.4	4.4	4.1	4.9	5.5	6.1

Statistical Yearbook – Tourism 2021

Table 11. Occupancy percentage of hotels of some governorates (2010 - 2018)

Gov.	2018	2017	2016	2015	2014	2013	2012	2011	2010
Av.	30.5	34	30	35.4	48	36	39	43	55
Cairo	26.4	27	42	40.9	50.3	40	37	39	52
South Sinai	38	43	30	43.5	61.7	44	52	51	71
Luxor	14.3	18	14	14.6	12.2	13	14	18	44
Red sea	26.4	36	29	36.9	60.4	48	53	76	61
Aswan	9.2	18	17	16.2	11.8	7	10	10	34
Alex.	32.3	48	31	32.7	34.7	21	29	23	21
Giza	34	37	32	26.5	29.4	20	25	19	44

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Unfortunately, apitourism (tourism based on the honeybee) does not exist in Egypt, as it needs a cooperation with the government vision to support projects that spread the apicultural culture. Growing interest in agrotourism has also resulted in the creation of illustrated hives (glass hives) that allow visitors to safely approach bees and view hive life without upsetting the insects. Additionally, these types of hives can support educational initiatives for children, adolescents, and adults. Tourists are interested in discovering the secrets of technology, such as how to produce high-quality honey and its derivatives. Beehives become tourist attractions. Particularly appealing to tourists are the commodities in the production of which they engage firsthand. Beekeeping promotes the socioeconomic rehabilitation of rural communities, diversifies agricultural production, and provides both beekeepers and tourists with new options.

As a convergence between tradition, alternative medicine, and the sustainable income-generating activity of the beekeeper, apitourism blends sustainable beekeeping, niche, historical heritage, and health tourism. Ecology, also known as beekeeping, eco-beekeeping, or api-tourism, is a commonly utilised marketing strategy that blends beekeeping and tourism. The objective of beekeeping-oriented activities (bee products, apitherapy, beehive air, bee museums, production

activities, historical beekeeping activities, photos, etc.) is to attract beekeepers and people with an entrepreneurial spirit in order to boost sector and national income. Countries such as Slovenia, Hungary, Romania, Chile, and Indonesia are at the forefront of this strategy's implementation.

In Ukraine, apitourism took the form of journeys to distinct apiaries for resting on bees in special beds, tasting beekeeping goods directly from the hive, and making candles by hand. The Bodnarchuk Museum of Beekeeping is a popular tourist destination with over a thousand copies in multiple chambers and an outdoor exhibition. In beekeeping-focused museums, bees come to life. 2010 saw the opening of the "Cine" Beekeeping Museum in Aydn, which was the first beekeeping museum in Turkey and the 71st in the world. The museum provides services including a cafe, painting and art classes, and a playground where 2,000-year-old Roman and Turkish plays are shown, in addition to a training room with a capacity of forty people for courses and seminars.

The considerable cultural and environmental diversity in Italy has resulted in a wide variety of beekeeping practises. Numerous ethnographic museums throughout the country, such as the Museum of Uses and Costumi of Trentino people in San Michele all'Adige or the Piedmont Agriculture Museum of the University of Turin, have restored these practises. In Slovenia, beekeeping is gaining popularity not only as an agricultural activity, but also as a symbol of the importance of bees to the natural environment and life cycle.

Radovljica, the capital of beekeeping in Slovenia, is home to the only authorized museum of its kind in the country, the Museum of Apiculture. This is an excellent opportunity to learn about the history, distinctive characteristics, and art of beekeeping.

The honey museum in Gramont, France, produces and supplies mead, a classic artisanal and natural aperitif. Even while many fermented beverages contain honey, not all of them should be labelled "mead." Mead is a fermented beverage created solely from water and honey. This was one among the first alcoholic beverages consumed by humans and was known as the drink of the gods in ancient Greece. In Denmark, the first evidence of mead manufacturing dates back to the Bronze Age.

In addition to the activities already described, apitourism can be promoted by establishing new apiaries in tourist destinations.

The Nile Valley's ancient structures are among its most popular tourist attractions. The Pyramids and Great Sphinx at Giza, the Abu Simbel temples south of Aswan, and the Karnak

Temple Complex and Valley of the Kings in close proximity to Luxor are among the most notable. Cairo's attractions include the Cairo Museum and the Muhammad Ali Mosque. In addition to Hurghada city on the Red Sea coast and the 25-kilometer-from-Hurghada Famous El Gouna Resort, the Sinai Peninsula's shoreline contains popular beach resorts.

Therefore, we will concentrate on tourist destinations that are also suited for beekeeping; the goal is to show tourists the (ancient) hives used by ancient Egyptians by organising visits between historical sites and local apiaries.

- **Giza**, 20 km southwest of Cairo, contains numerous ruins from the 26th century B.C., including temples and pharaonic monuments such as the Great Sphinx and the Great Pyramids of Giza. There are currently a number of beekeepers (4 percent) in the Giza governorate that might be utilised to attract tourists.

- **Upper Egypt:** This region consists of numerous governorates and has approximately 29 percent of Egypt's beehives and 11 percent of the country's beekeepers; nonetheless, the local hives originated in upper Egypt and are still utilised in some apiaries there..
    - Luxor, about 500 km south of Cairo, is the site of the ancient city of Thebes. Within the modern city are the remnants of the temple complexes of Karnak and Luxor. The structures, temples, and tombs of the West Bank Necropolis, which include the Valley of the Kings and Valley of the Queens, are located on the opposite bank of the Nile.
    - Abu Simbel, about 850 km south of Cairo (near the Egypt–Sudan border) is an archaeological site comprising two massive rock temples originally carved out of a mountainside during the reign of Pharaoh Ramesses II (13th century BC). In the 1960s, the entire complex was relocated to prevent being drowned during the building of Lake Nasser. They are presently located on an artificial hill atop a dome-shaped structure, high above the reservoir of the Aswan High Dam.
    - Assiut: in south of Egypt has historic buildings from the time of the pharaohs and ancient mosques.
- **Alexandria** is a major summer destination because to its beaches, historical history, and museums, especially the Bibliotheca Alexandrina, a modern initiative centred on restoring the old Library of Alexandria ("Jabal Musa").
- Saint Catherine's Monastery may be the world's oldest active Christian monastery. **Sinai** comprises 0.11 percent of all beehives and 1.4percent of all beekeepers.

The peak season for tourism in Egypt is from mid-October through May, during the winter and spring.

During the months of May through October, daytime temperatures are relatively warm, particularly in Luxor and the south of the country. Egypt is one among the world's hottest and sunniest nations. Egypt has a desert environment, being totally within the Sahara, with the exception of a strip along the Mediterranean coast.

The Mediterranean coastal strip receives 100–200 mm of precipitation annually on average. In central and southern Egypt, significant precipitation may not fall for several years. In the south of Egypt, winters are often mild, but nighttime temperatures drop precipitously, especially in the desert. In the summer, the climate in southern Egypt is extremely hot and dry.

Marsa Matruh Governorate

Marsa Matruh is a coastal region It is located in the northwest of the country and shares a border with Libya. The core of the Matrouh Governorate includes the Siwa Oasis, which is part of Egypt's Western Desert. At 133 metres below sea level, the Qattara Depression is located in the middle of the Governorate.

Matruh Governorate features numerous World War II-related historical sites. These include El-Alamein, which has the cemetery of slain Axis and Allied soldiers. An estimated 16 million mines, planted by Europeans during the two wars and referred to as "devil's gardens," continue to impede the development of the majority of the governorate, despite ongoing efforts to remove them.

Marsa Matruh is a tourist town on the Mediterranean coast of Egypt, famous for its lagoons and white-sand beaches. On a huge bay, the resort stretches along the shoreline. West of the town, Cleopatra's Beach is encircled by rocks that form Cleopatra's Bath, a natural pool. Near Rommel's Beach is the Rommel Museum, containing artefacts and maps in the caves that served as the German commander's headquarters during World War II.Marsa Matruh is considered a migratory place for beekeeping; the number of based beekeepers are extremely low (not more than 500 hives) as beekeepers move to it in certain periods. The period from November till April is the flowering season of the aromatic plants that grow on the rainfalls which are the main source of honey and pollen. During this period the number of hives could reach 200,000 hives as it could be a wintering region. However, the region is very suitable for beekeeping due to the suitable climate all the year and the region is pesticides free as there are not any regular farming.

Alexandria Governorate

Alexandria is the third-largest city in Egypt after Cairo and Giza, the ninth-largest city in Africa, and a major economic hub. Known as the "Bride of the Mediterranean" by locals, Alexandria is also the largest city on the Mediterranean, the fourth-largest city in the Arab world, and the 79th largest urban area by population on Earth. The city stretches around 40 kilometres along the northern Egyptian coast of the Mediterranean Sea. Due to its natural gas and oil pipelines from Suez, Alexandria is a significant industrial hub and a famous tourist destination.

There are around 0.4percent of the total beehives and 1.4percent of the total beekeepers in Alexandria. It has a scorching desert temperature, like the rest of Egypt's northern coast, but the predominant north wind that blows over the Mediterranean offers the city a milder climate than the surrounding desert. Alexandria is among the wettest locations in Egypt, along with Kafr el-Dawwar (Behiera) and Marsa Matruh. The city's climate is moderated by the Mediterranean Sea, which causes variable rainy winters and moderately hot and slightly prolonged summers that can be very humid at times; January and February are the coolest months, with daily maximum temperatures typically ranging from 12 to 18 °C and minimum temperatures reaching 5 °C.T

There are various places of worship in Alexandria. Abu al-Abdul-Mursi Mosque in Bahary is the most prominent mosque in Alexandria. Alexandria was previously regarded as the third-most significant Christian site after Rome and Constantinople. The majority of Africa was under the jurisdiction of the Church of Alexandria. The Agioi Anargyroi Church in Alexandria is the most significant Eastern Orthodox Church. The Eliyahu Hanavi Synagogue in Alexandria is the most significant synagogue in the city.

To enjoy the weather and beekeeping in the same location, trips could be made between apiaries, historical landmarks, and beaches. Recently, Alexandria had its final Egyptian honey festival, which attracted a large number of people and promoted the use of bee products. There, the headquarters of Organo Corporation are located.

Behaira Governorate

Behaira Governorate is strategically situated west of the Rosetta branch of the Nile. It includes the Cairo-Alexandria desert route, the Cairo agricultural road, the international road, and the circular road. Important businesses such as cotton, chemicals, carpets, energy, and fishing can be found in Behaira's 13 hubs and 14 cities.There are numerous archaeological sites in the governorate, including Abu El Matamir, Abu Hummus, Damanhour, Rosetta (Rashid), and Kafr El-

Wwar. At Kom El Giza and Kom El Hamam in Beheira, archaeologists have uncovered coins, lamps, animal bones

, and ceramics from the Roman and later Eastern Roman (Byzantine) periods.

14 percent of the total number of beehives and around 21 percent of the beekeepers are located in Behaira, making it simple to plan visits to apiaries. This location serves as the headquarters for both Younis and Gawad, two beekeeping companies.

Kafr El Sheikh Governorate

Kafr El Sheikh is located in the Nile Delta along the western branch of the Nile in the country's north. The nation's capital is Kafr El Sheikh. Kafr El Sheikh ranks top in the nation for the exportation of long-staple cotton. 4 percent of the beehives and 14 percent of the beekeepers in Egypt are located in Kafr El Sheikh.

Dakahlia Governorate

Dakahlia is a governorate in Egypt located northeast of Cairo. Approximately 3,500 km2 in size. Mansoura is the capital of this country. It contains 5 percent of the beehives and 6 percent of the beekeepers in Egypt.

Egypt's Ministry of Antiquities reports that in February 2020, Egyptian archaeologists discovered 83 tombs from the Naqada III period, which dates back to 4,000 B.C. In addition to seashells, beauty utensils, eyeliner pots, and jewelry, the burial yielded a variety of small pots of varying sizes, shapes, and materials.

In April 2021, Egyptian archaeologists revealed the discovery of 110 tombs in the archaeological site of Koum el-Khulgan. They included 68 oval tombs from the Predynastic Period and 37 rectangle tombs from the Second Intermediate Period. The remainder were from the Naqada III period. The tombs also featured the skeletal remains of adults and a baby (buried in a jar), a collection of ovens, stoves, mud-brick foundation remnants, funerary equipment, cylindrical, pear-shaped vessels, and a bowl with geometric designs.

Damietta Governorate

“Dumyat” or Damietta is one of Egypt's governorates. It is located in the country's northeast and has a population of about one million. Damietta is the nation's capital. The area of the governorate is 1,029 km2, or approximately 5percent of the territory of the Delta and 1percent of

the area of Egypt. The populated area is approximately 589.2 km2. It contains 2 percent of the beehives and 4 percent of the beekeepers in Egypt.

Damietta (city) is renowned for its guava orchards and palm trees that line the shore from Ras El Bar in the east to Gamasa in the west. Every year, the governorate ships millions of palm trees to nations such as Greece and China. Wheat, maize, cotton, rice, potatoes, lemon, grapes, and tomatoes are also produced in Damietta. It is also renowned for its confectionary sector, sardine processing, and Domiati cheese. Ras El Bar, one of Egypt's oldest summer resorts, is situated where the Nile meets the Mediterranean Sea.
This governorate is distinguished by the Damietta Port, which has been able to handle the movement of ships when poor weather prevents other adjacent ports from doing so.

Sharkia Governorate

It is the third most populated of Egypt's governorates and is located in the country's northern region; its seat is Zagazig. Bilbeis is the historic capital of Sharkia. Agriculture, poultry, and fish aquaculture are significant industries in Sharkia. It contains 7 percent of the beehives and 6 percent of the beekeepers in Egypt.

Ismailia Governorate

Ismailia is one of Egypt's governorates in the Canal Zone. Ismailia, located in the northeastern portion of the country, serves as its capital. It is situated between the two other canal governorates, Port Said Governorate in northern Egypt and Suez Governorate in the south. Ismailia has irregular beekeeping, as no resident beekeepers were located there, despite the fact that, according to official statistics from 2018, it contains approximately 0.9percent of the beehives in Egypt, making it an ideal location for establishing new apiaries with little competition

Ismailia Canal

The Ismailia Governorate is located on the Suez Canal, and its Ismailia Canal connects the Nile River near Cairo to the Suez Canal at the city of Ismailia on Lake Timsah. The Ismailia Canal was constructed to provide workers with potable water during the construction of the Suez Canal. Ismailia has multiple official fishing landing points. One is at Lake Timsah, while the other is at Lake Bitter.

Port Said Governorate

It is a city in north-eastern Egypt, stretching roughly 30 kilometres along the Mediterranean Sea shore, north of the Suez Canal. With a population of approximately 603,787 (2010), it is the

fifth largest city in Egypt. The city was founded during the construction of the Suez Canal in 1859. Unfortunately, there was no evidence of beehives or beekeepers in this governorate, but there appears to be an opportunity to start new apiaries there with little competition.

Numerous antique residences with large balconies on all floors give the city its unique appearance. Port Fuad, which is located on the eastern bank of the Suez Canal, is Port Said's twin city. The two cities coexist to the degree that Port Fuad has almost no town centre. The cities are linked by free boats that run continuously throughout the day, and together they form a metropolitan region with more than a million citizens that extends on both the African and Asian sides of the Suez Canal. Istanbul is the only other urban area in the world that spans two continents.

Port Said is aimed to attract logistics startups as well as import-export businesses due to its advantageous geographical location. Under the direction of Egyptian President Abdel Fattah El-Sisi, the city witnessed the construction of the New Suez Canal in 2019.Port Said is a major summer resort and tourist attraction, due to its public and private beaches, cosmopolitan heritage, Museums and duty-free port, beside the other landmarks such as the Lighthouse of Port Said, Port Said Martyrs Memorial that has the shape of the Pharaonic ancient obelisks and the building of the Suez Canal Authority headquarter in Port Said, also Tennis island situated in lake Manzaleh is a destination that attracts tourists to enjoy visiting this ancient Islamic city which was demolished during the crusades.

The Port

The port of Port Said is the busiest container seaport in Egypt, with 3,470,000 TEU transported in 2009. It is the 28th busiest seaport for container shipping, the second-busiest in the Arab world (only behind the port of Salalah in Oman), and the 28th busiest in the world.

Products and services based on the honeybee

In spite of the absence of apitourism in Egypt, numerous initiatives have lately been launched to promote the culture and benefits of bee products. Egypt honey festival (https://egypthoneyfestival.com/?lang=en) was launched for the first time in 2019 under the sponsorship of the Ministry of Agriculture, Ministry of Environment, Council of Arab Economic Unity, and Arab Beekeepers Union, with the aim of becoming a global leader.

This festival might easily attract travellers due to the numerous activities that make it an inexpensive and entertaining destination.The festival takes place in Giza Governorate's Orman Park. It is one of the largest and oldest botanical gardens in the world, and contains a variety of trees and palms that are quite uncommon. Festival is the greatest meeting of Egyptian honey firms, hive goods, and beekeepers to display their products and offer discounts and tasting campaigns to festival attendees.Honey and hive products exhibition, Beekeeping, honey production and packaging exhibition, and Young Beekeeper Program for children, which is a simplified course to explain the basics of beekeeping and the production of honey in a small apiary and to teach youth how to deal with bees and differentiate the queen from the workers and how to dress for working with bees, taught by professional trainers accredited by the Arab Beekeepers Union. Further activities includes;

- An assortment of games and activities for youngsters, including screening
- A variety of games and activities for youngsters, such as showing bee-themed films and exercising with coaches
- Contests and daily prizes of valued bee goods
- The festival theatre features artistic and musical acts
- Scientific and marketing lectures and workshops for beekeepers
- Workshops for beekeepers to learn the most important methods and steps for developing effective marketing plans for their products to help them expand their market share
- Permanent performances on stage to interact with the audience, such as zumba, and to provide recipes for honey and bee products by professional chefs
- Contests for the audience on the stage “Fatter and Honey”.
- Open sports competitions for the general public

Furthermore, Organo business also hosts an annual convention of beekeepers in Luxor and Aswan, during which the beekeepers travel along the Nile between the two towns and visit the historical sites in Upper Egypt.

Chapter 9: Honey in the local/ traditional gastronomy

The ancient Egyptians prized the bee above all other insects, as it was not only associated with the royal philosophy as the symbol of legitimacy, but was also depicted atop the cartouche of every reigning sovereign throughout ancient Egyptian history. The relationship between bees and various gods in the ancient Egyptian pantheon gave them immense significance. It appears that the ancient Egyptians understood the significance of bees as the sole supply of honey, therefore they began beekeeping as early as the Old Kingdom and throughout the Roman Empire.

The ancient Egyptians were able to harvest honey from combs and they produced different grades of honey according to its concentration and usage; the purest virgin honey, which was the first obtained from the comb, was only limited for the usage of gods and kings. The second-grade honey was lighter, as they had to press the comb with a percentage of water to obtain the rest of the honey. This was probably for commercial use. As for the third grade honey, it was used as a sweetener for making cakes a process or even added to beer or wine. They understood the nature of honey, which can be easily affected by heat and moisture, so they stored it in different vessels, which they sealed to protect its contents.

Late in Egyptian history, honey was even used in the process of embalming. In a separate context, honey was referenced with precious metals such as gold and silver. Thus, the ancient Egyptians acknowledged it as a valued product with a certain economic value.

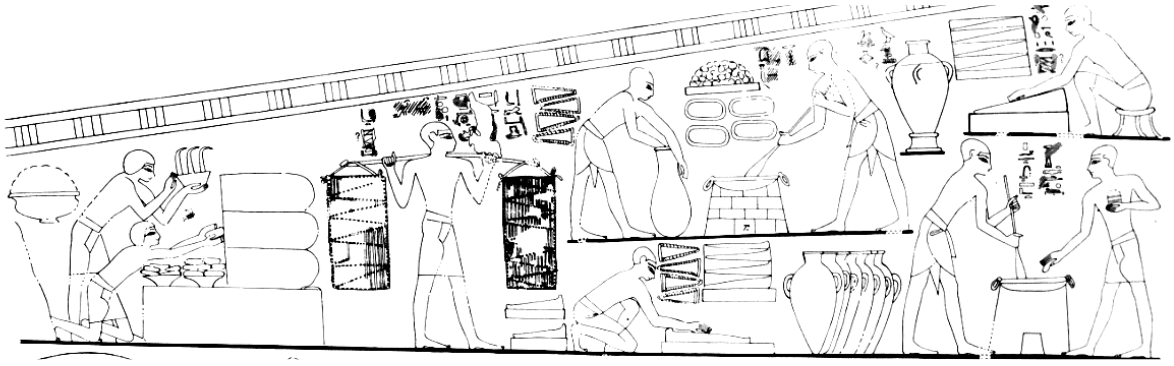

Figure8. Part of the scene of preparing the provisions for the temple showing baking honey loaves. After N. Davies, The tomb of Rekhmira at Thebes Vol.1 (New York, 1973), pl XLIX.

Despite the long history of consuming honey in ancient Egypt, nowadays honey is not considered a main product in Egypt; Egyptians rarely consume honey and often use it for

therapeutic cases as the yearly consumed honey decreased from 0.13 kg/person in 2002 to 0.05 kg/person in 2013.

Consumption of honey in Egypt is largely driven by its alleged health added value as well as by population growth. Some consumers believe honey with its antibacterial and anti-inflammatory activity is highly beneficial for any type of wound, whereas other see honey as natural aid helpful in case diseases of the intestine. Other groups of consumers perceive honey as useful skin treatment aid, effecting skin moisture, wrinkle reduction etc.

Egyptians' awareness of honey has recently increased again especially with the organization of the Egyptian Honey Festival in 2019 and which is organized by the Arab Beekeepers Union. Mostly Honey is used sparingly in the production of oriental sweets such as baklawa, konafa, or pies, as well as other sweets such as nuts in honey, candies, chocolates, cakes, muffins, pizza, and cookies. The high price of these items limited their consumption and sales. In some instances, it is used in cooking, particularly with meat and poultry, to preserve the moisture of tissues and impart more taste. Restaurants have recently substituted honey for white sugar on their menus; the honey is typically packaged in little packets.

Figure 9. examples of value-added products

Chapter 10: Needs & expectations of the local MSMEs and people in building up a bee-business

For the purpose of enhancing the beekeeping industry in Egypt, an electronic questionnaire was disseminated – hard and soft copies - to collect information regarding local MSMEs' and beekeepers' requirements and expectations.

Characteristics of the contributors:

According to Table 11, the majority of Egyptian beekeepers are middle-aged (59 percent), have less than 50 hives (71 percent), and have 10 to 20 years of experience (41 percent). The occupancy of apiary land is divided between the owner (47 percent) and a tenant (23 percent) (53 percent). Sixty percent of Egyptian beekeepers are not members of any beekeeping association, indicating that they are unaware of the associations' benefits.

Beekeepers do not consider guidance services as 92% of them do not have this service in their areas. The most dangerous observation here is that the source of the scientific information about beekeeping is mostly comes from relatives and friends (75%) not the trusted academic sources. This means that every beekeeper can provide his own thoughts to beekeeping techniques and spread it to other as a trusted information without any academic confirmation.

Egyptian beekeepers produce various commercial products, honey is the most popular product as 96% of the beekeepers produce honey, then comes the production of bee packages with a rate of 57%. Royal jelly and pollen are commercially produced by 51% of the beekeepers, then comes the production of bee wax (49%). Meanwhile both of bee venom and propolis had the least rate of production (35%, 15%, respectively), some of beekeepers also make protein substitutes (21%) to be used in their own hives during the winter season.

Beekeeping is not a solitary business, most of beekeepers (86%) needs workers with them and the main issue here is most of the workers are not sufficiently qualified which results in that most of the workers are hired to help in transport hives (95%), while the rate of hiring in the rest of jobs like hives fixing, cleaning, feeding and observation ranging from 47% to 29%.

The most popular honey type produced in Egypt is clover honey (94%) which is considered the cheapest type, while expensive types like sider honey is limited (11%) as the sidr trees are not popular in Egypt.

Knowledge of value-added products is not available to 41% of the beekeepers as they only produce their products and sell it as row material, even the rest of them (59%) have shortage in many information as only 2% of them make honey candies, bee wax products are also so

limited in Egypt only 7% of the beekeepers are involved in it. Propolis cannot be used as row material and has to be purified, only 9% of beekeepers do that and 11% of beekeepers dissolve collected bee venom into solution.

Regarding diseases and pests control, 68% of the beekeepers claimed that they can determine the hive disease cause and treat it successfully which is need more investigation as they most of them (73%) use treatments in a preventive way without any apparent symptoms.

Moreover, beekeepers lack of scientific background resulted in using more than one type of treatment for the same cause at the same time, for example 28% of beekeepers use chemicals to treat Varroa and 87% use the natural products. This means that they actually use both types of treatments, the same pattern was observed in Nosema and brood diseases (45%, 73% and 37%,76%, respectively). The interactions between different treatments are very serious and dangerous especially with the lack of certified treatments.

Colonies loss has numerous causes and may happen naturally or by external causes. sixty nine percent of the beekeepers lost about 20% of their colonies due to ineffective queens, the same cause is responsible for 20-30% loss of honey bee colonies for 17% of the beekeepers and 14% of the beekeepers lost more than 30% of their colonies. Starvation is responsible for less than 20% loss of honey bee colonies for 92% of beekeepers. Eighty-nine percentage of the beekeepers claimed that chemicals are responsible for < 20% of colonies loss. The most important results here is that 64% of the beekeepers lost less than 20% of their colonies for unknown reasons, 14% of them lost 20-30% and 22% lost more than 30% of their colonies with no clear cause, which really need more investigation and research.

Climate change is a growing problem worldwide, and 65 percent of Egyptian beekeepers consider it to be the most significant problem confronting beekeeping in Egypt, requiring more attention to solve. The winterization and ventilation of hives must be enhanced, and new hive designs must be developed. 64 percent of beekeepers agreed that diseases are a major issue, 53 percent of beekeepers ranked the increase in production costs as the third major issue, and 39 percent of beekeepers ranked marketing as the last major issue.

Needed investments by bee-business MSMEs

1. Support beekeeping associations so that they can reach beekeepers readily and effectively; they should offer beekeepers consulting services, new techniques, and inexpensive equipment.
2. Honey market stock should be established to prevent market monopoly
3. Marketing and promotion agency with free or low prices

4. Financial support should be provided to the beekeeper to cover high production and migratory expenses.
5. Cultivate more sidr trees
6. Spreading of value-added products culture
7. Certified queen rearing stations
8. Support scientific researches on cause of honey bee colonies loss
9. Provide row production material with low prices
10. Provide certified honey bee diseases treatments
11. Regulation of pesticides usage
12. Better protocols with airlines responsible for air shipment
13. Prevent importing artificial honey

Training requirements by academic certified trainers

1- Methods of commercial bee venom, royal jelly, bee queen, and propolis production

2- Items with added value, such as bee wax-based products, honey candy, propolis purification, and bee venom solution.

3- Identification of honeybee diseases, methods of treatment, and the dangers of combining chemical treatments

4- Promotion and marketing

5- New strategies and methods to combat climate change, particularly heat and cold waves

6-Courses on the use of social media (for beekeepers, women who cook or sell honey products/ honeybee based cosmetics / artistic honeybee handicrafts, etc.)

7- New craftwork. Identification and promotion of bee goods among beekeepers/potential entrepreneurs/SMEs/startups.

8- Specific training courses on cooking with honey and honey-based goods and how to promote them in the community, raise awareness, and sell domestically and globally.

Table 12. Distribution of participants according to their characteristics

	Characteristics	Percentage
1	**Age**	
	20-25 years	16
	26- 45 years	59
	46-65 years	25
2	**Years of experience**	
	1-9 years	31
	10-20 years	41
	21-50	28
3	**Owned hives**	
	1-50 hives	71
	60-150 hives	16
	200-2000 hives	13
4	**Land occupancy**	
	Owner	47
	Renter	53
5	**Membership in beekeeping associations**	
	Member	40
	Not a member	60
6	**Guidance services availability**	
	Available	8
	Not available	92
7	**Scientific information source**	
	Relatives and friends	75
	Social media	21
	Job requirements	6
	Guidance services	8
	Beekeeping Associations	13
8	**Products of beekeepers**	
	Honey	96
	Royal Jelly	51
	Bee venom	35
	Propolis	15
	Bee packages	57
	Pollen	51
	Bee wax	49
	Bee queens	38
	Protein substitutes	13
9	**Employ others**	
	Yes	86
	No	14
10	**Activities needs employees**	
	Hives transportation	95
	Hives feeding	47
	Hives fixing	34
	Apiaries cleaning	31
	Hives observation	29
11	**Honey Main types**	
	Clover	94

	Citrus			57
	Medicinal and aromatic plants			19
	Sidr			11
12	**Knowledge of value-added products availability**			
	Available			59
	Not available			41
13	**Value-added products measures**			
	Attractive label			73
	Use special packages			78
	Honey mixtures			69
	Candies with honey			2
	Dissolve bee venom to solution			11
	Manufacture bee wax-based products			7
	Dried pollen			38
	Propolis purification			9
	Honeycomb sale			40
14	**Diseases and pests control**			
	Ability to determine hive disease			68
	Protective treatment without any symptoms			73
	Use of chemicals to treat Varroa			28
	Use of natural substances to treat Varroa			87
	Use of chemicals to treat Nosema			45
	Use of natural substances to treat Nosema			73
	Use of chemicals to treat brood diseases			37
	Use of natural substances to treat brood diseases			76
15	**Colonies loss main causes**			
		< 20%	**20% -30%**	**> 30%**
	Ineffective queens	69	17	14
	Starvation	92	7	1
	Chemical poisoning	89	6	6
	Unknown reasons	64	14	22
16	**Main problems**			
	Climate change			65
	Diseases and pests			64
	Marketing			39
	Raise in production costs			53
	Lack of bees benefits awareness			7

Annexes

Table 13. The area (Feddan) and production (Tons) of Aromatic and Medical Plants according to governorates

Governorate	Production	Area
Cairo	0	126
Alexandria	100	264
Port Said	40	54
Suez	0	8
Damietta	9	15
Dakahlia	704	686
Sharkia	115	241
Qalyoubia	5670	618
Kafr-El shikh	3068	3971
Gharbia	5604	2546
Menoufia	238	264
Behera	2242	2107
Ismailia	2177	698
Giza	1909	672
Beni- Suief	226386	16408
Fayoum	172945	26881
Menia	48692	21904
Assuit	112657	10576
Suhag	0	0
Qena	1759	1013
Aswan	25776	12241
Luxor	1499	3343
Red- Sea	312	108
El- wadi El- Gadid	16697	2576
Marsa Matruh	1959	212
North Sinai	12	19
South Sinai	0	104

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Table 14. The area (Feddan) and production (Tons) of Citrus according to governorates

Governorate	Citrus Type							
	Mandrine		Orange		Sour oranges		Grape Fruit	
	Production	Area	Production	Area	Production	Area	Production	Area
Cairo	3973	512	1927	213	91	13	0	0
Alexandria	0	0	6825	632	0	0	0	0
Port Said	65	30	175	50	0	0	0	0
Suez	4749	818	21104	3380	0	0	84	15
Damietta	110	15	181	25	0	0	0	0
Dakahlia	925	122	32330	3384	0	0	0	0
Sharkia	65544	8549	320434	35161	0	0	73	8
Qalyoubia	8729	828	289036	26753	93	24	133	10
Kafr-El shikh	7699	720	33479	3191	2	1	0	0
Gharbia	7224	677	117868	10950	827	190	45	4
Menoufia	17875	2057	202457	20303	0	0	56	8
Behera	37639	3405	636043	58565	0	0	0	0
Ismailia	92141	10577	475147	44129	0	0	94	20
Giza	35850	5131	46128	5393	105	20	64	15
Beni- Suief	20751	2042	21804	2165	6	1	5	1
Fayoum	1571	149	3621	359	0	0	0	0
Menia	27485	3282	7368	972	0	0	0	0
Assuit	52676	4162	82491	7180	0	0	0	0
Suhag	10458	1254	8232	1037	0	0	0	6
Qena	569	100	840	140	0	0	0	0
Aswan	886	118	2641	347	0	0	0	0
Luxor	761	128	1167	215	0	0	0	0
Red- Sea	0	0	0	0	0	0	0	0
El- wadi El- gadid	6790	932	21521	3741	275	117	0	0
Marsa Matruh	563	203	7995	1698	3	2	0	0
North Sinai	305	46	540	90	0	0	0	0
South Sinai	66	200	392	167	0	0	0	0

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Table 15. The area (Feddan) and production (Tons) of Citrus according to governorates

Governorate	Citrus Type					
	Sweet Lime		Sour Lime		Rough Lime	
	Production	Area	Production	Area	Production	Area
Cairo	124	16	693	84	0	0
Alexandria	0	0	0	0	0	0
Port Said	0	0	130	37	0	0
Suez	0	0	264	54	0	0

Damietta	0	0	6181	989	0	0
Dakahlia	0	0	80	12	0	0
Sharkia	276	30	24943	2158	180	20
Qalyoubia	0	0	1170	157	0	0
Kafr-El shikh	0	0	395	31	415	51
Gharbia	0	0	491	54	8	2
Menoufia	0	0	2833	383	43	5
Behera	0	0	35556	3697	1346	144
Ismailia	0	0	6085	849	106	20
Giza	535	115	1220	440	141	25
Beni- Suief	0	0	249	31	0	0
Fayoum	0	0	15283	2145	0	0
Menia	0	0	4872	439	0	0
Assuit	53	6	21115	2021	0	0
Suhag	0	0	3156	458	233	50
Qena	0	0	5861	845	0	0
Aswan	0	0	3146	534	0	0
Luxor	0	0	1304	184	0	0
Red- Sea	0	0	0	0	0	0
El- wadi El-Gadid	21	14	7572	1370	2	1
Marsa Matruh	34	14	78	22	23	9
North Sinai	0	0	474	57	0	0
South Sinai	0	0	111	349	0	0

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Table 16. Comparison between area and production of field crops and change rate 2018, 2019

Field Crop	Change percent	Production (Tons)		Change percent	Area (Feddan)	
		2019	2018		2019	2018
Clover	21.8	55954964	45941197	15.5	1814322	1571095
Alfalfa	61.6	3156757	1953422	0.2	73469	73321
Medical and Aromatic Plants	10.5	642233	581338	4.5	110112	105336
Oranges	-0.6	3066651	3085986	-1.5	291976	296493
Mandarin	-2.9	860458	885767	-3.3	90237	93326
Sour Lime	-11.5	312110	352556	-10.2	31240	34779
Sweet Lime	-2.4	1043	1069	-8.5	195	213
Other Citrus	9	5422	4975	4.7	940	898

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