Scientific Journal of Agricultural Sciences

Print (ISSN 2535-1796) / Online (ISSN 2535-180X)

Comprehensive Overview of Egyptian Beekeeping Sector in 2021-2022 Season

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Citation: Hatem Sharaf El-Din (2024). Comprehensive Overview of Egyptian Beekeeping Sector in 2021-2022 Season. Scientific Journal of Agricultural Sciences, 6 (4): 116-124. https://doi.org/10.21608/sjas.2024.336564.1481.

Publisher :
Beni-Suef University, Faculty of Agriculture

Received: 14 / 11 / 2024
Accepted: 30 / 12 / 2024

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ABSTRACT

Beekeeping sector in Egypt has expanded over the past few years, attracting new participators. Egypt now has promoted its rank in the global markets especially in exporting bee packages despite the recently massive losses in the sector due to the rise in raw materials prices and climate change. In order to approach the main objective of characterizing the sector's key characteristics, difficulties, and potential solutions, a face to face and an online survey was distributed to beekeepers and Micro, Small and Medium sized Enterprises (MSMEs) managers. The study revealed that Egyptian beekeepers are well experienced dependent beekeepers producing honey as a main product with more than half also producing bee packages and pollen. Lack of scientific knowledge in managing bee hives and relying solely on personal expertise to identify bee diseases were the biggest obstacles facing the industry. That could lead with climate change to loss about 20% of hives during 2021-22 season, radical solutions should undertake immediately to save that promising industry including financial, knowledge and academic support.

KEYWORDS: Beekeeping sector, beekeepers, Egypt, survey, colonies loss.

1. INTRODUCTION

Majority of blooming plants in the world depend on both wild and managed pollinators for reproduction, with domesticated bees making a significant contribution as controlled pollinators (Ollerton *et al.*, 2011). Honey bees are frequently moved to crops that depend on pollinators, as they are the most crucial crop pollinators (Spivak *et al.*, 2011). Recently, pesticides, diseases, and other environmental factors have caused honey bees stress.

The magnitude and speed of hives losses are matter of concern that was reported from all over the world (Core *et al.*, 2012; Ratnieks & Carreck, 2010; VanEngelsdorp *et al.*, 2015). Varroa, fungi, viruses, and their interactions have all been recorded as the primary causes of these losses (Bee *et al.*, 2021; Maori *et al.*, 2007; Neumann & Carreck, 2010; Williams *et al.*, 2010). *Varroa destructor, Nosema* spp. and Deformed wing virus seem to be the main factors that cause the most damage to colonies.

Since widespread of honey bees colonies loss were first reported in the USA in 2006

(Aizen & Harder, 2009; Goulson *et al.*, 2015; Potts *et al.*, 2010a), the situation of managed honey bees has been especially concerning. The higher rates of colony losses, particularly after overwintering was noticed (Neumann & Carreck, 2010). According to (Chauzat *et al.*, 2013), despite high rates of colony losses all over the world, honey bee colony numbers have increased in several nations since 2005. This is due to economic factors and beekeepers' ability to increase the number of their colonies either by splitting colonies or producing nucleus colonies (Potts *et al.*,2010b).

Many countries now conduct annual surveys of colony losses because to the size and widespread effects of varroa and other pests and diseases. In Canada, surveys have been conducted every year since 2007 with the help of the Canadian Association of Professional Apiculturists (CAPA) in response to issues with the emergence of varroa treatment resistance (Currie *et al.*, 2015; Ferland *et al.*, 2022) . With the Bee Informed Partnership, annual surveys of winter colony losses have continued since the USA's lost more than 35% of their commercial colonies in winter of 2006 (Kulhanek *et al.*, 2017; Seitz *et al.*, 2016) and about 48.2% of honey bee colonies were lost in USA during the period from April 2022 to 2023 (Steinhauer *et al.*, 2023).

Similar annual surveys have been started as a result of the high rates of overwintering colony losses throughout Europe, the Middle East, Africa, and Asia (Brodschneider *et al.*, 2016; Van Der Zee et al., 2012& 2014)

In order to match data collecting on colony losses, a working group was established in 2008 by the recently established international organization COLOSS (Prevention of Honey Bee COlony LOSSes) (Neumann & Carreck, 2010). This consortium of colony loss monitoring has been imitated in Europe, North America, and other regions to enable cross-national comparisons and pinpoint likely causes.

Over the past ten years, the beekeeping business in Egypt has expanded significantly. According to the Egyptian Ministry of Agriculture and Land Reclamation (2022), Egypt presently maintains 2.5 million beehives, which serve as the main source of income for between 25.000 and 30.000 beekeeping households in the country. Apiculture became one of the main agricultural sectors, and honey bee colony losses have recently become a significant and main concern for local beekeepers and scientists. Regarding that in 2021, Egypt exported honey bee packages and honey bee products that worth 300 million Egyptian pounds.

The current study is addressing the Egyptian beekeeping characteristics based on questionnaire analysis conducted for local beekeepers in [Location - e.g., a specific region of Egypt]. The analysis reveals a decline in honey production and beekeepers' earnings in recent years. This decline is attributed to several factors, most notably rising production costs and the unique challenges Egyptian beekeepers face accessing fruit orchards. Unlike other countries, Egyptian beekeepers must pay farmers for the privilege of placing their apiaries near orchards, leading to increased expenses and reduced profits.

Because of the lack formal information about beekeeping figures in Egypt, the current manuscript therefore shed the light on the beekeeping sector characteristics in Egypt from the perspective of the beekeepers who completed the questionnaire.

2. MATERIAL AND METHODS

For the purpose of enhancing the beekeeping industry in Egypt, during beekeepers' meetings in 2022, questionnaires were given out in person and online, and the data gathered were summarized to collect information regarding local Micro, Small and Medium sized Enterprises (MSMEs) and beekeepers' requirements and expectations.

This survey included the basic questions from global COLOSS surveys (Brodschneider *et al.*, 2016, 2018; Gray *et al.*, 2020, 2022; Mutinelli *et al.*, 2022). The percentage and reasons of overwinter colony losses, queen bee health and performance, signs of pests and diseases, natural and chemical treatments, supplemental feeding, and colony management were among the topics covered. This survey was accomplished by 176 beekeepers who provided the most important problems faced Egyptian beekeepers and beekeeping sector during 2021-2022 season.

The complete questionnaire is accessible as Table S1 and in terms of administering the

questionnaire and gathering data, the survey was distributed via the link.

https://forms.gle/qBi7wnKCaDifVzK57

Here, the questionnaire might be downloaded, completed on paper, and then emailed to collect data. Since there aren't reliable official figures of the of beekeeping sector in Egypt, the questionnaire was also promoted through social media groups, regional beekeepers' organizations, and beekeeping conferences. The survey could therefore be completed directly online or downloaded and completed on paper because it was computerized using the google forms program.

3. RESULTS

Most of contributed beekeepers were of middle-aged (59%), with experience ranged from 10 and 20 years (41%), having less than 50 hives (71%). Egyptian beekeepers rented the apiary's land (53%) and did not have their own land. Neither beekeeping organizations membership nor advisory services were popular in Egypt and the beekeepers were not familiar with their advantages (60 and 92% respectively).

The most concerning finding was that, instead of reliable academic sources, 75% of the beekeepers considered family and friends as sources of scientific information about beekeeping. This implies that, in the absence of scholarly validation, any beekeeper is free to express his or her own visions about beekeeping practices and to disseminate them to others as reliable knowledge.

Majority of beekeepers require help from employees (86%), and the main problem here is that most of the employees lack the necessary qualifications. As a result, 95% of the employees are hired to assist only with hive transportation during migratory beekeeping.

In an attempt to specify the most common commercial products produced by Egyptian beekeepers, honey was found to be the most widespread product which was produced by 96% of the beekeepers, followed by bee packages that were produced by 57% of the beekeepers. Several beekeepers (13%) reported that they made pollen substitutes and supplements for personal usage during dearth season. There were several common types of honey are produced, like Clover honey, which is the cheapest type of honey produced in Egypt and the most commonly produced one while more expensive types like Sidr honey was not common due to the unpopularity of Sidr trees all over the region.

Despite more than half of the beekeepers claimed that they follow the concept of value-added products, most of them only focus on the way of packaging not producing new products like wax-based products, honey candies or propolis and venom solutions.

In terms of controlling diseases, most of Egyptian beekeepers claimed that they could identify the hive disease's origin and treat it successfully. However, the majority of them utilize treatments as a preventative procedure without showing any symptoms. Additionally, beekeepers' lack of scientific training led them to combine treatments for the same issue. For instance, they used both of chemical and natural treatments for Varroa and the same trend was observed in Nosema and brood diseases. With so few therapies being certified in Egypt, the interactions between various treatments are extremely significant, unknown and deadly.

Colony losses can occur spontaneously or as a result of outside factors. Nearly 80% of Egyptian beekeepers lost less than 20% of their hives in 2021-2022 season (Figure 1). Factors like ineffective queens, starvation, chemical pesticides and unknown reasons were nearly equal in causing most of beekeepers loss up to 20% of their hives (Figure 2). The ineffective queens and unknown reason together were the main stressors that led 9% of beekeepers to loss 20-30% of the hives (Figure 3), in addition to that, nearly the same percentage of beekeepers lost more than 30% of their hives and the main cause was not detected by the beekeepers which require further studies (Figure 4).

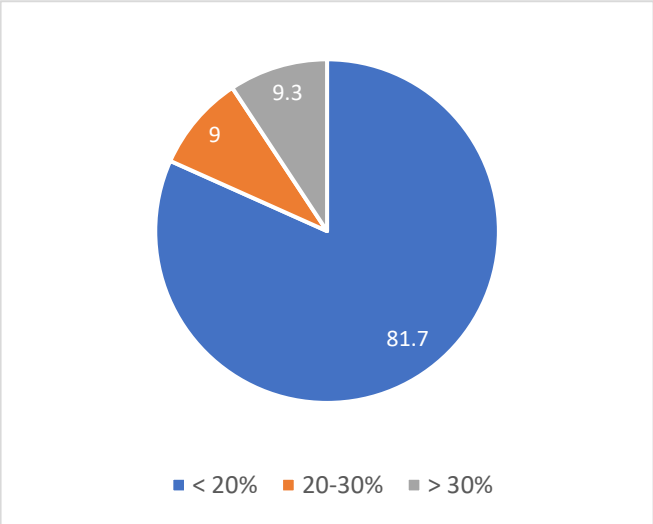

Figure 1. Colonies loss percentages

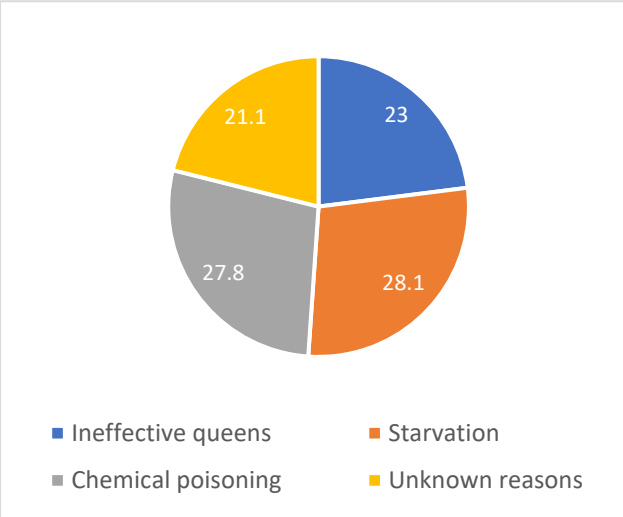

Figure 2. < 20 colonies loss main causes

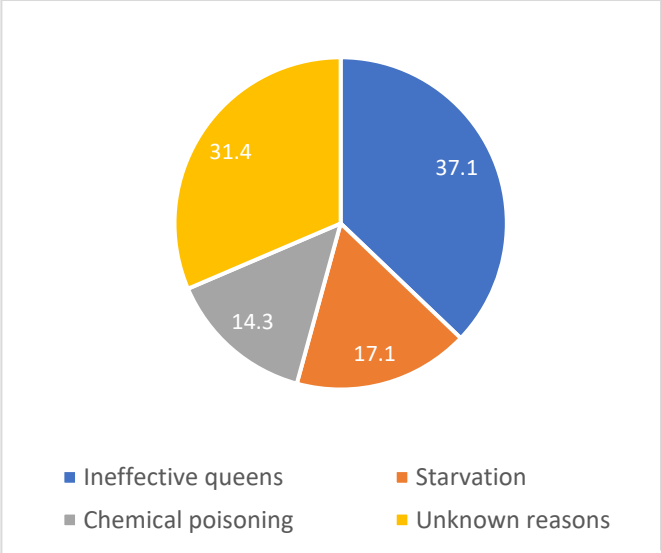

Figure 3. 20 -30% Colonies loss main causes

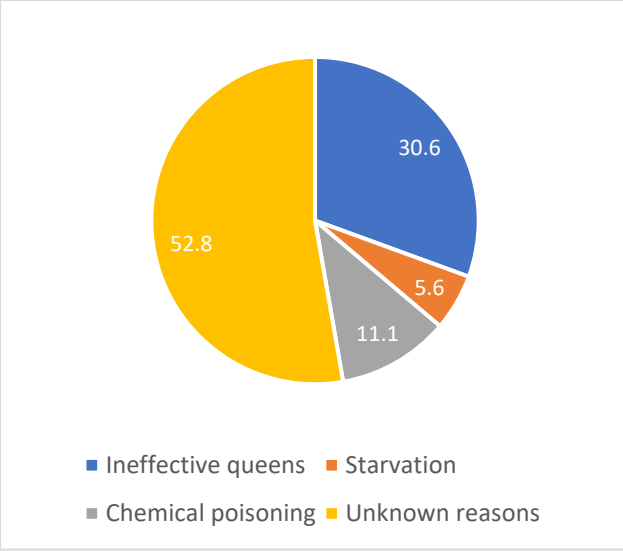

Figure 4. > 30% Colonies loss main

Illustrated data in Figure 5, revealed that sixty-five percent of Egyptian beekeepers believe that climate change was the most important issue facing beekeeping in Egypt and that it needs greater attention to be undertaken. Improvements must be made to hive winterization and ventilation, and new hive designs should be created to adapt the climate change. Diseases and production costs increase were rated as a serious concern by more than half of the beekeepers, in addition to marketing representing major issue by 39% of beekeepers.

4. DISCUSSION

Agriculture can increase revenue for farmers by diversifying their crops. The beekeeping industry is a crucial contributor to this effort by enhancing crop productivity through pollination and providing employment opportunities for rural communities. In Egypt, honey bees receive special attention due to their importance in pollination and their significant impact on the economy (Amro, 2021). Pollination is primarily conducted using Egyptian clover blooming in June, cotton flowering in August-September, and a minor contribution from citrus in April (Hussein, 2000 and Gupta, et al., 2014). However, thermal stress on Egyptian honey bee colonies during

summer may pose a substantial challenge for beekeepers in the future (Abou-Shaara, 2016 and Khalifa et al., 2021).

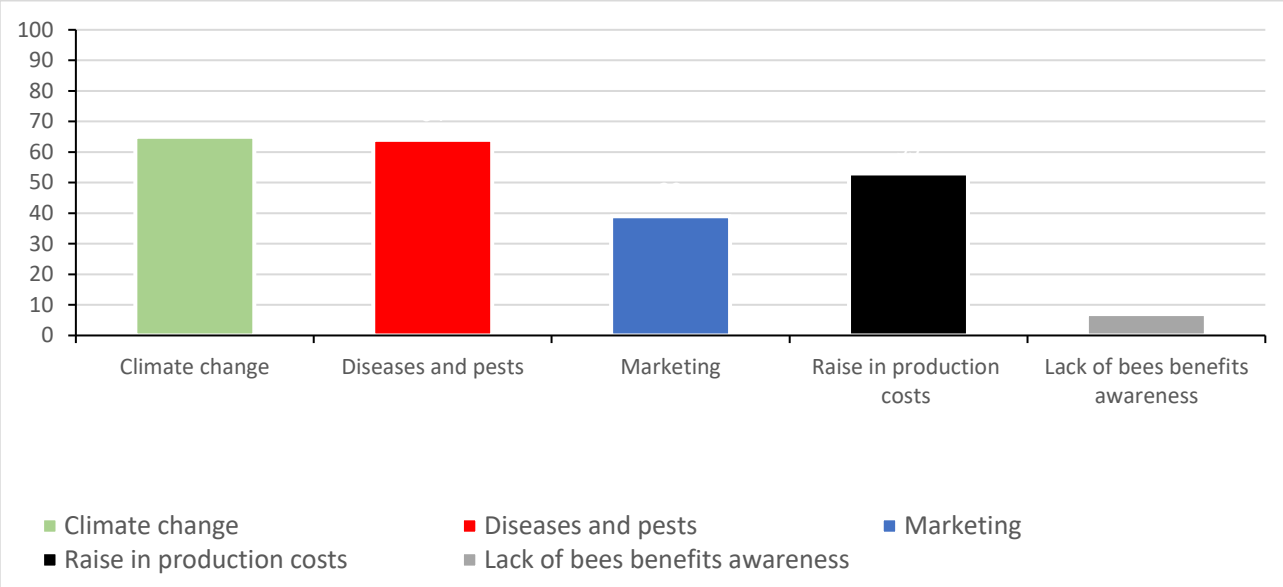

Figure 5. Main obstacles in beekeeping sector

To promote the industry, the government is implementing various programs, such as the Micro, Small and Medium sized Enterprises (MSMEs) agency, to establish sustainable competitive advantages and identify major obstacles to the sector's future development. Recent research suggests that beekeeping development projects can help conserve honey bees and their environment. More comparative studies on the different products and improvement potential of the local *Apis mellifera lamarckii* bee and other local species are needed (El-Seedi et al., 2022).

This study was aimed to identify the primary obstacles to the sustainable development of beekeeping in Egypt based on the respondents' point of view. One challenge faced by questionnaire studies in Egypt is that beekeepers typically refuse to provide official organizations with real numbers of hives they manage and the annually produced honey or any other bee products due to concerns about potential government-imposed taxes.

As a result, no official statistics on the beekeeping sector in Egypt are available. Previous research has noted this issue. For example, according to statistics from the Food and Agriculture Organization (FAO), Al Naggar *et al.*, (2018) and Arab Organization for Agricultural Development (2018), the number of beehives in Egypt in 2016 was 820516, which differed with the data provided by Trade Map (https://www.trademap.org) as Egypt exported about 1.6 million hives in the same year. According to Trade Map in 2022, Egypt was ranked first globally in exporting live bees, with a 20.9% of world market share with a value of $18.2 million.

A recent Strengths, Weaknesses, Opportunities, Threats (SWOT)analysis of the beekeeping sector in Egypt (Fahmy *et al.*, 2023) found that crop diversity and continuous blooming were the main strengths, while the death of exported bee packages due to airline negligence was the key weakness. The ability to produce early swarms provides a competitive advantage, but the random and irrational use of agricultural pesticides poses a major threat.

Based on the opinions of beekeepers and Micro, Small and Medium sized Enterprises (MSMEs) managers who contributed to the questionnaire, two main approaches should be followed. 1- Executive measures that could support the beekeeping industry in Egypt, including supporting beekeeping associations, developing honey market stocks, providing

financial assistance, increasing Sidr tree cultivation, promoting value-added products, establishing licensed queen-breeding facilities, encouraging scientific research, offering specialized treatments for honey bee diseases, regulating pesticide use, and improving air transport procedures. 2- academic programs to have academically qualified trainers such as, techniques for commercial production of bee venom, royal jelly, bee queens, and propolis, identification of honeybee diseases and their treatment, marketing and advertising, innovative techniques to mitigate the effects of climate change, and social media usage for beekeepers should be considered. Additionally, specific training programs on promoting honey products and cooking with honey should be offered to promote honey products to beekeepers, prospective business owners, SMEs, and startups.

5. ACKNOWLEDGMENT

The author would like to thank Dr. Yasser Ibrahim and Dr. Khaled Salah, for their assistance in distributing the questionnaire.

6. AUTHOR DECLARATIONs

Funding

This publication has been produced with the financial assistance of the European Union under the ENI CBC Mediterranean Sea Basin Programme (www.enicbcmed.eu.).

Publication fees was covered by Transformative Agreement between Springer Nature and Science, Technology & Innovation Funding Authority (STDF) in cooperation with Egyptian Knowledge Bank (EKB).

Conflict of interest

The authors declare no competing interests.

Ethics approval No approval of the Research Ethics Committee was required to achieve the goals of this study.

Consent to participate

All respondents approved to participate in the survey for research purposes.

Consent for publication

No approval was required as no personal data were published.

7. DATA AVAILABILITY

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

CODE AVAILABILITY *'Not applicable'*

AUTHOR CONTRIBUTION

HS: Conceptualization, Methodology, Writing-Original draft preparation, Data Analysis, Visualization, Reviewing and Editing.

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الملخص العربي

نظرة شاملة لقطاع تربية النحل المصري في موسم٢٠٢١ – ٢٠٢٢

حاتم شرف الدين

قسم الحشرات الاقتصادية ومبيدات الآفات، كلية الزراعة، جامعة القاهرة، ١٢٦١٣ الجيزة، مصر.

لقد شهد قطاع تربية النحل في مصر توسعًا ملحوظًا خلال السنوات القليلة الماضية، مما جذب مشاركين جددًا. وقد تمكنت مصر من تعزيز مكانتها في الأسواق العالمية، خاصة في تصدير طرود النحل، على الرغم من الخسائر الهائلة التي تعرض لها القطاع مؤخرًا بسبب ارتفاع أسعار المواد الخام وتغير المناخ. ولتحقيق الهدف الرئيسي المتمثل في تحديد الخصائص الرئيسية للقطاع والصعوبات التي يواجهها والحلول المحتملة، تم توزيع استبيان وجهاً لوجه وعبر الإنترنت على مربي النحل ومديري الشركات الصغيرة والمتوسطة. كشفت الدراسة أن مربي النحل المصريون يتمتعون بخبرة جيدة، ويهدفون لإنتاج العسل بشكل رئيسي، حيث يقوم أكثر من نصفهم أيضًا بإنتاج طرود النحل وحبوب اللقاح. وكان من بين أكبر العقبات التي تواجه هذا القطاع نقص المعرفة العلمية في إدارة خلايا النحل والاعتماد فقط على الخبرة الشخصية لتحديد أمراض النحل. وقد يكون ذلك هو السبب مع تغير المناخ في خسارة حوالي ٢٠٪ من الخلايا خلال موسم ٢٠٢١–٢٠٢٢، لذا يجب اتخاذ حلول جذرية على الفور لإنقاذ هذا القطاع الواعد، بما في ذلك الدعم المالي والمعرفي والأكاديمي.

الكلمات المفتاحية: قطاع تربية النحل، النحالين، مصر