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The Current Situation and Future of Beekeeping in Düzce

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Abstract

Düzce is one of the significant provinces for beekeeping in the Western Black Sea region of Türkiye due to its geographical location, climate, and floral diversity. The province has gained prominence in the apiculture sector through the registration of the Yığılca honey bee ecotype and the patenting of its chestnut honey. The Yığılca ecotype, which is endemic to the Yığılca district, is a highly specialized subspecies in terms of morphological, genetic, and physiological traits, and is known for its high productivity. Following the official registration of the Düzce-Yığılca ecotype by the Breed Registration Commission of the Ministry of Agriculture and Forestry, nine queen bee production enterprises were established in the district.

Currently, there are 713 registered beekeeping enterprises and 59,911 hives listed in the Beekeeping Registration System in Düzce. The province produces monofloral chestnut honey, Rhododendron honey, and polyfloral flower honey. However, beekeepers in Düzce primarily focus on monofloral chestnut (*Castanea*) and Rhododendron honey production. Based on a ten-year average, Düzce ranks 54th in Türkiye with an annual production of 551 tons of honey. The average annual production of beeswax is 22.117 tons, ranking 46th nationally. In recent years, increased attention has been paid to the production of high value-added bee products such as royal jelly and propolis, although these products are not yet reflected in official statistics.

Although Düzce does not rank among the top provinces in Türkiye in terms of total honey production, its unique flora and fauna, patented chestnut honey, and the Yığılca ecotype render it strategically important for the future of beekeeping in the country. The aim of this study is to examine the most recent data on beekeeping in Düzce including the production volumes of various bee products and colony management practices in order to develop a strategic roadmap and plan for the sustainable development of beekeeping in the province.

Keywords: *Beekeeping, Apis mellifera, raw material production, Düzce Province*

Düzce'de Arıcılığın Mevcut Durumu ve Geleceği

Özet

Düzce, Türkiye'nin Batı Karadeniz bölgesinde yer alan coğrafik konumu, iklimi ve floral yapısı bakımından arıcılık açısından önemli illerimizden biridir. Düzce arıcılık sektöründe tescilli Yığılca bal arısı ve patentli kestane balıyla ön plana çıkmıştır. Düzce'nin Yığılca ilçesine endemik olan Yığılca ekotipi morfolojik, genetik ve fizyolojik bakımlardan özelleşmiş, davranış ve performans bakımından yüksek verimli bir ekotiptir. Düzce Yığılca ekotipi Tarım Orman Bakanlığı ırk tescil komisyonu tarafından tescillendikten sonra İlçede 9 adet ana arı üretim işletmesi kurulmuştur. Düzce genelinde arıcılık kayıt sistemine kayıtlı 713 adet arıcılık işletmesi ve 59.911 adet arılı kovan bulunmaktadır. İlde monofloral kestane balı, ormangülü ve polifloral çiçek balı üretilmektedir. Ancak Düzce ilinde arıcılar monofloral kestane (*Castane*) ve orman gülü (*Rhododendron*) balı üretimi üzerinde yoğunlaşmıştır. Düzce'de on yıllık ortalamaya göre 551 ton/yıl bal üretimi yapılmakta olup Türkiye genelinde 54. Sırada yer almaktadır. Balmumu üretimi ise ortalama 22.117 ton olup 46. Sırada bulunmaktadır. Son dönemlerde arı sütü ve propolis gibi bal dışındaki katma değeri yüksek ürünlerin üretimine de ağırlık verilmiştir. Ancak bu üretim tipleri istatistiklere yansıtılmamıştır. Düzce ili arıcılık faaliyeti bakımından Türkiye'de üst sıralarda olmasada, yerel flora ve fauna kaynakları, patentli kestane balı ve eşsiz Yığılca ekotipi nedeniyle Düzce ili arıcılık faaliyetleri nedeniyle Türkiye için son derece önemlidir.

Bu çalışmanın amacı Düzce'de son yıllık süreçte arıcılığın durumu, arı ürünleri üretimi ve üretim miktarı, koloni bakım yönetiminde yapılan uygulamalara ilişkin verileri inceleyerek Düzce arıcılığı için gelecek planlamaları yapmak ve yol haritası oluşturmaktır.

Anahtar Kelimeler: Arıcılık, Apis mellifera, ham madde üretimi, Düzce

Introduction

Honey bees (*Apis mellifera*) hold significant importance due to their production of various substances with high pharmacological and nutritional value. These substances include eight different bee products: honey, pollen, beeswax, propolis, royal jelly, apilarnil, bee bread (perga), and bee venom. In addition to being used as nutritional supplements, these products also have widespread applications in the pharmaceutical and cosmetic industries. However, the role of honey bees in pollination which enhances both the quantitative and qualitative aspects of crop yields is considered even more vital than the products themselves (Free, 1993). Honey bees are responsible for approximately 85% of all insect-mediated pollination, positioning them as key contributors to ecological balance. Therefore, their role as primary pollinators is essential for environmental sustainability.

In contemporary agricultural practices, the intensive use of chemicals particularly pesticides has led to a significant decline in the populations of wild pollinators. As a result, honey bees have emerged as the sole effective pollinators capable of filling this ecological gap. One-third of the human diet is derived, either directly or indirectly, from plants that require bee pollination. For this reason, honey bee colonies are critical during vegetation periods to ensure sufficient pollination (Delaplane and Mayer, 2000).

Although wild bees and other insects also play a role in natural pollination, honey bees are considered the most effective due to their large colony sizes, ease of transportation, and manageability. Most of pollination activities in nature is carried out by honey bees, and the economic value of this service is estimated to be approximately 15 times greater than the value of honey. A mutually beneficial relationship exists between forests and bees: As the world's most important pollinating insects, bees also contribute to the propagation of herbaceous and woody plants that protect the soil, thereby helping to prevent erosion particularly critical in a country like Türkiye (Özbek, 2002). Beekeeping is a sector that must be supported and sustained due to its contributions to biodiversity conservation, sustainable food security, and the Turkish economy (Kekeçoğlu et al., 2014). Approximately 40,000 families in Türkiye rely on beekeeping for their livelihoods. There are 72,000 registered beekeepers, and it is estimated that 300,000 individuals are financially dependent on this sector (Table 1). Both local and national surveys indicate that the average age of beekeepers is around 49 years (Kekeçoğlu et al., 2007; Kekeçoğlu et al., 2013).

According to 2020 data from the Food and Agriculture Organization (FAO), the global number of bee colonies has reached 90.1 million. India ranks first with 13 million colonies and a 13.6% share, followed by China with 9 million colonies (10.1%), and Türkiye ranks third with 8 million colonies, corresponding to a 9.0% share. In terms of total honey production, China is the global leader with 446,900 tons, producing 49.39 kg per colony. Türkiye ranks second with 114,113 tons but falls far behind in colony productivity, with a yield of 14.36 kg per hive.

Table 1. Beekeeping data for 2023 by some country (FAO, 2023)

Rank	Country	Number of Colonies (units)	Total Honey Production (tons)	Honey Yield (kg/hive)
1	China	9,492,353	472,221.14	49.39
2	Türkiye	9,224,881	114,886.43	14.36
3	Ethiopia	6,794,876	84,591.00	8.31
4	Iran	7,358,044	80,389.00	11.75
5	Argentina	3,013,042	73,395.30	26.31
6	India	12,663,817	70,850.20	5.17
7	Russia	2,743,100	64,511.00	20.43
8	Brazil	1,026,934	64,189.00	41.62
9	United States	2,509,000	62,855.00	24.65
10	Mexico	2,201,329	58,033.20	29.58
11	Tanzania	3,080,237	31,613.10	10.13
12	South Korea	2,128,266	29,467.80	12.34
13	Angola	1,192,639	23,458.90	20.29
14	Kenya	1,676,583	17,151.00	13.38
15	Central African Republic	1,675,246	16,714.00	9.64
16	Serbia	1,103,300	11,346.00	12.50

When the average figures of the past four years in Türkiye are examined, the average number of beehives is 7,343,182; the number of beekeeping enterprises is 82,139; annual honey production is approximately 103,018 tons; and annual beeswax production is around 4,372 tons. In addition to honey, beeswax production on a global scale totals 66,099 tons. India ranks first with 25,691 tons of beeswax production, while Türkiye ranks fifth with 4,737 tons (TÜİK, 2021). Furthermore, although not officially recorded in national statistics, it is estimated that Türkiye produces approximately 100 tons of propolis, 3 tons of royal jelly, 150 tons of pollen, 10 tons of bee bread (perga), and 100 kilograms of bee venom annually.

As a branch of agricultural production, beekeeping contributes approximately 160 trillion Turkish Liras directly to the national economy through the production of honey and beeswax. When the contribution of pollination is

considered which is estimated to be at least 10 to 15 times greater than that of honey and beeswax production the total economic contribution of beekeeping to the Turkish economy rises to approximately 1.6 to 2.4 quadrillion Turkish Liras. In addition, beekeeping serves as a source of employment for nearly 150,000 individuals, the majority of whom live in rural areas and lack access to sufficient farmland. This further underscores the significance of beekeeping for the national economy.

Beekeeping in Düzce

When considering honey production at the provincial level in Türkiye, Ordu ranks first with 17,057 tons, followed by Muğla (14,688 tons) and Adana (11,077 tons) (FAO, 2020). Düzce ranks 54th in terms of total honey production. According to research, the active beekeeping season in Düzce spans June, July, and August (Albayrak and Bayır, 2019). The high number of rainy days and short beekeeping season constitute disadvantages for beekeeping in the province. On the other hand, the extensive forested areas, the abundance of chestnut and *Rhododendron* plants, and rich plant biodiversity provide significant advantages. Approximately 700 plant species, 10% of which are endemic, are found within Düzce's borders (Aksoy et al., 2010). One-third of the province is covered by forests. According to the General Directorate of Forestry, Türkiye has 262,045 hectares of chestnut forests, with approximately 15,767 hectares located in Düzce.

Two harvests take place annually in Düzce: *Rhododendron* honey is harvested in June, followed by chestnut honey in July. Both are classified as monofloral honeys. Chestnut and *Rhododendron* honeys, which are sold at higher prices and are valued for their apitherapeutic properties, form the primary production profile of Düzce. Scientific studies have confirmed the therapeutic properties of chestnut and wildflower honeys produced in the region, increasing the added value of local honey and propolis. Research indicates that the chestnut honey and propolis from Yığılca district exhibit antibacterial activity comparable to various antibiotics (Kekeçoğlu et al., 2021; 2022). More importantly, the most significant factor elevating Düzce's beekeeping profile and increasing its international visibility is the presence of the Yığılca honey bee ecotype (Kekeçoğlu, 2010; Gültekin, 2019; Kekeçoğlu, 2021). Unique to Yığılca district, this ecotype produces up to three times more honey than other native bee subspecies in Türkiye and shows superior spring development and overwintering abilities compared to Anatolian and Caucasian races. As a result of research conducted by the Beekeeping Research, Development and Application Center (DAGEM) at Düzce University, established in 2009, the Yığılca bee was granted legal protection by the Ministry of Agriculture and Forestry on September 14, 2017 (official letter no: 73291108-12502.04-E 2223544). On May 22, 2022, the ecotype was officially registered by the National Commission for the Registration of Native Animal Breeds. Scientific data generated by DAGEM played a pivotal role in this registration process (Kekeçoğlu, 2010; 2018; Kekeçoğlu et al., 2021; Bir and Kekeçoğlu, 2021).

DAGEM's work has not only contributed to the recognition of the Yığılca bee but has also increased the value of local bee products. The center has been instrumental in transforming bee products into high value-added goods, facilitating their commercialization and branding. Products like propolis and bee venom, which had not been previously produced in Düzce, have now entered production. The project titled *Beekeeping, Honey Forests and Sustainable Development*, implemented by DAGEM, won the 2011 European Enterprise Award, significantly enhancing international awareness of the Yığılca bee (Kekeçoğlu, 2021). As a result, national and international demand for Yığılca queen bees has been steadily increasing.

To support the development of beekeeping in Düzce, a comprehensive study was conducted to examine the structure of the sector and its challenges. Key issues identified include insufficient technical knowledge, inadequate colony management and feeding practices, failure to use ecotypes suited to local conditions, errors in overwintering preparation, and incorrect practices in combating bee diseases and pests. Based on these findings, a strategic roadmap was developed for the future of beekeeping in Düzce (Kekeçoğlu et al., 2013; 2014).

Kekeçoğlu et al. (2013), conducted face-to-face interviews with 412 beekeepers from 245 villages in Düzce and its districts to identify colony losses and challenges related to bee health. According to the findings, 81.2% of beekeepers experienced winter losses, while 18.8% did not. The causes of colony loss included queen loss (39.8%), Varroa infestation (23.8%), starvation (21.9%), and robbing behavior (3.9%). Additionally, 89.8% of beekeeping operations reported *Varroa* infestation, 51.6% reported wax moths, 18.2% reported *Nosema*, and 13.11% had American foulbrood disease (Kekeçoğlu et al., 2013).

The study concluded that there were significant shortcomings in overwintering preparation, colony management, and disease diagnosis and treatment. In response, several projects were launched to address these issues. The average age of beekeepers in Düzce was found to be 50; 73.1% were primary school graduates, 14.1% had completed high school, and 20.9% relied on beekeeping as their primary source of income. Although these figures have not changed dramatically, the average age has decreased slightly, and more young people and women are now entering the profession.

In 2013, 620 individuals were members of beekeeping associations—59.2% of them belonged to the Beekeepers' Union and 24.5% to the Honey Producers' Union. Today, that number has risen to 1,020 registered members. Regarding bee races, a 2013 study found that 61.5% of beekeepers preferred local ecotypes and 34.7% used Caucasian queens. However, problems related to access to high-quality breeding queens persist.

Approximately 46.8% of Düzce's beekeepers practice migratory beekeeping. The preferred nectar sources for honey production are sunflower (62.96%), chestnut (54.32%), wildflowers (22.22%), canola (11.73%), and Rhododendron (11.73%). According to the study, 79.1% of respondents considered beekeeping a secondary income source, 10.7% practiced it as a hobby, and only 11.4% relied on it as their primary livelihood (Kekeçoğlu et al., 2013; 2014).

In terms of honey production, Düzce ranks 54th in Türkiye with 551 tons and 46th in beeswax production with 22.117 tons. The province hosts 713 beekeeping enterprises and 59,911 Langstroth-type hives, making it one of the few provinces that no longer use traditional hives. Apart from honey and beeswax production, there are three queen bee production facilities in the districts of Yığılca, Çilimli, and Kaynaşlı, each with a capacity of 3,000 queens, totaling 9,000 queens annually (Anonim, 2020).

Since 2012, the number of beekeeping enterprises and hives in Düzce has steadily increased each year. Honey yield per hive has also shown improvement in the last three years compared to earlier periods. The highest honey production to date in Düzce was recorded in 2019 at 552 tons. For beeswax, the highest figure was 47 tons in 2015, and the lowest was 15 tons in 2017. As beekeeping is a nature-dependent activity, production volumes fluctuate annually. In years with heavy rainfall during nectar flow, honey yields tend to decline (Albayrak and Bayır, 2019). (Table 2).

Table 2. Annual honey and beeswax production, number of enterprises and hives in Düzce province (Anonym, 2020; TÜİK, 2023; TEPGE 2021, 2022, 2023, 2024)

Years	Honey(Tons)	Beeswax (Tons)	Number of Enterprises	Number of Hives	Honey Yield (kg/hive)
2012	470	-	442	36.164	12.99
2013	518	26	491	43.611	11.88
2014	470	19	530	48.222	9.75
2015	421	47	578	52.051	8.08
2016	450	23	610	53.266	8.45
2017	481	15	637	54.971	8.75
2018	540	22	674	60.356	8.95
2019	552	22,1	711	59.911	9.21
2020	518	21	713	58.473	8.85
2021	693	21	713	63.943	10.8
2022	531	16	744	65.903	8.1
2023	412	14	793	52.314	7.9

An examination of production data related to apicultural products in Düzce reveals that, in addition to honey and beeswax, other bee products such as pollen, propolis, and royal jelly are also produced (Kekeçoğlu et al., 2014). However, the limited production of these high-value-added products is primarily due to beekeepers concerns about market access (Kekeçoğlu et al., 2014). It has been noted that as the demand for bee products such as royal jelly, bee venom, honey, and pollen in the pharmaceutical and cosmetic sectors increases, their production is also expected to rise (Kekeçoğlu et al., 2014). Therefore, beekeeping in Düzce holds strong potential to be transformed into a high-value economic sector. Based on the numerical data presented in Table 2 and field research findings, the following annual revenues are estimated for Düzce: 100 million TL from honey, 3 million TL from beeswax, 700,000 TL from raw propolis, 1.5 million TL from processed propolis, 600,000 TL from pollen, approximately 700,000 TL from royal jelly, and approximately 2 million TL from queen bee production. The total economic contribution of beekeeping to Düzce's local economy exceeds 120 million Turkish Liras. This figure could be significantly increased through the production and value-added processing of next generation bee products such as bee venom, bee bread (perga), and apilarnil.Beekeeping is closely associated with forest ecosystems. Approximately 50% of Düzce's land area consists of forested terrain. This provides a valuable opportunity for beekeeping activities, which are best conducted away from areas subjected to chemical spraying and do not require flat or fertile agricultural land. The large extent of forest cover, along with the presence of high-nectar-yield plant species such as chestnut, linden, and *Rhododendron*, and the unique Yığılca honey bee ecotype, give Düzce significant potential to become a leading region in the beekeeping industry. Furthermore, due to the abundance of wood resources in these forest areas, the production of beehives could also be developed as a complementary local industry in Düzce.

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