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The Beekeeping Practice of Transhumance Bee Colonies—Quantitative Study of Honey Production Characteristics Based on a Questionnaire Survey in Hungary

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Abstract

This study examined the transhumance of bee colonies from the perspective of Hungarian beekeepers. Hungarian scientific literature on this topic is minimal. Therefore, it is necessary to assess the sustainability of the Hungarian beekeeping sector using a research method based on a survey of beekeepers. This research was based on a questionnaire (N = 1067). Basic statistical tools were used to analyse the data. To evaluate the differences between the individual category variables, we used the chi-square test for cross-stability and non-parametric tests were used. In this study, we defined four farm (apiary) size categories based on the number of bee colonies. Our results revealed statistically significant correlations between apiary size and transhumance, payment for the use of bee pastures and transhumance, as well as between the type of hive used and transhumance. Transhumance is mainly characteristic of semi-professional and professional apiaries. Hungarian beekeepers (typically small-scale and professional apiary size) traditionally give honey as a "gift" to landowners for the use of bee pastures, which is related to transhumance. In terms of the type of hive used, a significant difference can be seen between transhumance (28 kg/colony) and stationary apiaries (21 kg/colony) in the case of vertical hives.

Keywords: beekeeping; transhumance; apiary size; bee pastures; type of hive; type of honey; correlation; questionnaire; Hungary

Academic Editors: Katerina Melfou and Alexandros Theodoridis

Received: 18 May 2025
Revised: 22 June 2025
Accepted: 27 June 2025
Published: 29 June 2025

Citation: Feketéné Ferenczi, A.; Bauerné Gáthy, A.; Szűcs, I.; Kovácsné Soltész, A. The Beekeeping Practice of Transhumance Bee Colonies—Quantitative Study of Honey Production Characteristics Based on a Questionnaire Survey in Hungary. *Agriculture* **2025**, *15*, 1405. https://doi.org/10.3390/agriculture15131405

1. Introduction

Beekeeping is practised worldwide and is one of the oldest forms of agriculture [1,2]. Numerous studies have confirmed its importance in maintaining biodiversity, food production, and rural employment [3–12]. Despite this, beekeepers around the world are currently facing challenges, with climate change [13–15], cheap imported honey [14–18], and inadequate beekeeping [19–25] or other non-pollinator-friendly agricultural practices [26–29] being the main problems in some areas.

1.1. Key Factors in Beekeeping Practices

Beyond economic factors, the basis for successful beekeeping is the welfare of honeybee colonies (*Apis mellifera*), which constitute the foundation of production. In this context, it is important to consider the elements of beekeeping practices, i.e., the strategies beekeepers use to adapt their activities to achieve better efficiency and results [15,30–32].

The welfare of bees means maintaining the optimal conditions necessary for their health and survival [33], which in the case of domesticated bees (*Apis mellifera*) is primarily the beekeeper's responsibility. Good beekeeping practice involves using bee-friendly practices to manage various threats to the health of bee colonies, such as pests, predators, chemicals, climate change, and other stress factors. One aspect of this is ensuring that bees have access to sufficient quality and quantity of natural food, which is essential for the long-term health of bee colonies and ensures their productivity [34]. In addition to nutritional stress (bee pastures, lack of water sources), bee colonies' welfare is influenced by several other factors [35–40]. There is a proven link between poor beekeeping practices and bee colony losses, meaning beekeeping practices such as hive type, hygiene rules, proper wintering, and appropriate pest control are paramount [41]. Monoculture farming and insufficient flower diversity can lead to malnutrition, weakening the resistance of honey bees to diseases and environmental stressors [35], which also hurts productivity [34]. In order to make the most efficient use of bee pastures and increase honey yields, some beekeepers migrate their bee colonies. Transhumance beekeeping aims to find natural food sources for bees in line with flowering times, which also serves to increase honey yields [15]. Plants that are important for honey production bloom at different times, and beekeepers must consider this when planning migration [14,42], which is becoming increasingly complex due to factors such as simultaneous flowering caused by extreme weather conditions. Transhumance is an important issue for beekeepers, as it offers the possibility of increasing honey production but also involves significantly higher costs (e.g., fuel, labor), requires means of transport, and exposes bee colonies to various risks (e.g., disease, infection by parasites, poisoning by pesticides, and other damage to bee colonies).

1.2. The State of Honey Production in Hungary

In Hungary, beekeepers produced 20,000 tons of honey in 2023, almost the same as in 2004, but 37.5% less than the best result of 32,000 tons in 2017 (Figure 1) [43].

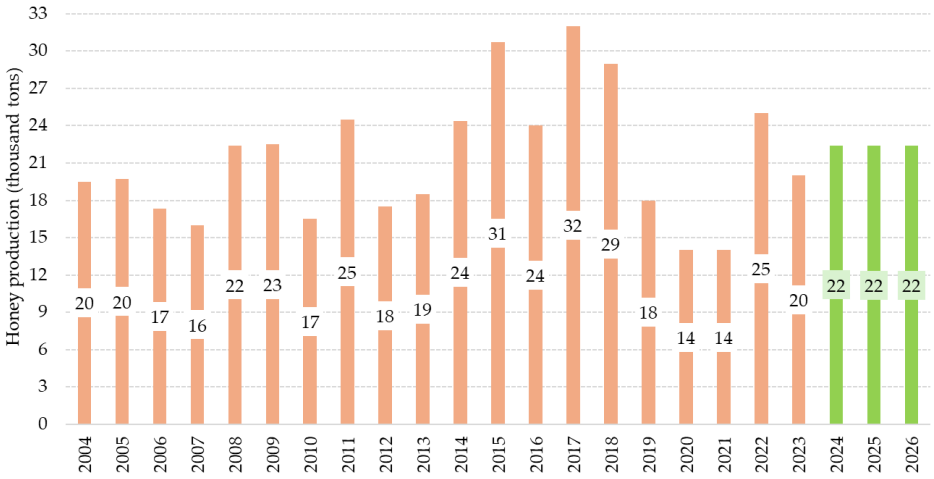

Figure 1. Honey production in Hungary (2004–2023).

Compared to honey production in the European Union, domestic honey production is much more volatile, with fluctuations and excellent years being similar in both cases. Hungarian beekeeping accounts for an average of 10% of EU-27 honey production, ranging from 6% in the weakest years (2020–2021) to 13% in the best year, 2017 [44]. Based on the two decades examined, the average national honey production was 21,300 tons, but the data vary significantly yearly. The 2020–2021 figures are particularly low, at 14,000 tons. After a good year in 2022, domestic honey production fell again in 2023 [43]. Honey production is influenced by several factors that vary significantly from one beekeeping season to another

and are reflected in the volume of domestic honey production. These factors include the level of infestation of Asian bee mite (*Varroa destructor*) in apiaries and weather conditions. In order to achieve higher yields, around 70% of Hungarian beekeepers migrate to other bee pastures. Figure 2 shows the development of honey yields in Hungary between 2004 and 2023 based on honey production and the number of bee colonies [43]. Based on these data, the highest specific yields were recorded in 2008, 2015, and 2017. In these years, the yield exceeded 25 kg/bee colony. Total honey production was also high in these years, while in 2020–2021, when low honey yields were recorded, honey production was also the lowest in the last two decades. The average honey yield for the twenty years studied was 19.61 kg/colony. This figure is like the honey yield of Hungarian bee colonies reported in EU reports (21 kg/colony) [45].

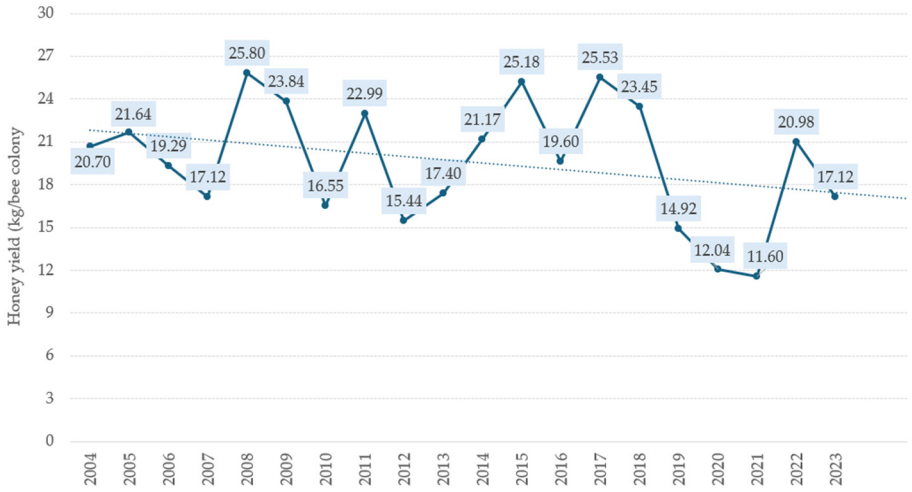

Figure 2. Honey production in Hungary (2004–2023).

Due to the lack of classification of production data, it was impossible to determine yield data at the county level from statistical data. However, the yield trends in individual regions and counties vary significantly from one beekeeping year to another, as seen from international and EU data. The yields of apiaries of different sizes, technologies, and efficiencies can be influenced by different factors to varying degrees during each beekeeping season.

This study is a continuation of an earlier study [46], which serves as a situation assessment for further research on the sustainability of beekeeping in Hungary through an analysis of the Hungarian beekeeping sector. It fills a gap in the literature by using the results of a questionnaire survey conducted with a large sample nationwide.

2. Materials and Methods

We used the Web of Science by Clarivate and ScienceDirect by Elsevier databases for secondary research to look for the relevant literature. The statistical data are sourced from the databases of the European Commission, the Hungarian Central Statistical Office, the Hungarian National Beekeeping Program, and the Hungarian Beekeepers' Association. In Hungary, the commencement and cessation of beekeeping must be declared to the local government of the apiary's location and the Breeding Information System. Between July 15 and October 15 each year, bee colonies are checked by an official bee health inspector appointed by the official veterinarian during monitoring tests carried out in apiaries to diagnose bee illnesses. The number of bee colonies per apiary is also registered [46]. The survey was based on a questionnaire compiled by us, designed to assess the sustainability of the Hungarian beekeeping sector. The questionnaire survey was completed from March 2023

to September 2024. The questionnaire included questions about the size, characteristics, and general operation of the apiary and the yields of the types of honey produced by the apiary. The questions included closed, simple, and multiple-choice questions. At the end of the questionnaire, we included questions aimed at examining the background variables of the respondents (age, beekeeper generation, type of activity, professional experience, educational level). Beekeepers were questioned using online and paper-based questionnaires, with the assistance of the Hungarian Beekeepers' Association, which distributed the questionnaire among its members. Beekeepers had the opportunity to complete the questionnaire at beekeeping association meetings, and it was also available in electronic form on the beekeepers' association website. The questionnaire contained a total of 39 questions for Hungarian beekeepers. This study included 11 questions related to the links between honey production and the migration of bee colonies and the factors determining these links, and six questions on the background variables of the respondents (Appendix A). The questions on the types of honey produced and the yields achieved referred to 2022. The questionnaire was first validated through preliminary testing involving five beekeepers (including one bee health expert) and experts from the beekeepers' association. The questions in the questionnaire were revised based on the professional comments and suggestions of the test experts in order to obtain the most accurate answers possible for the research. The survey targeted beekeepers operating in 19 counties of Hungary and in the capital city of Budapest. Based on the evaluation of the questionnaire survey, the number of valid responses was 1067 after excluding irrelevant responses. The participation of respondents was entirely consensual and anonymous. To determine the sample size, the authors used the following calculation for the finite population [47,48]:

$$n = (N \times Z^2 \times p \times (1 - p))/(E^2 \times (N - 1) + Z^2 \times p \times (1 - p)) \quad (1)$$

where N = 20,495 is the number of beekeepers in Hungary (2022) [49], Z-value is 1.96 at a 95% confidence level, and $p = 0.5$ is the expected margin of error of 5% (E = 0.05). Considering a 10% response refusal rate, the minimum sample size for evaluating the results is 440 people. Since not all questions received the same number of responses, the number of responses is indicated in each case during the analysis. According to the database of the Hungarian Beekeepers' Association (2022) [49], the sample is not representative of the distribution of apiaries by county ($\chi^2 = 100.63$, df = 19, $p < 0.001$). Thus, the results of the study are only valid for the database. However, more detailed data on beekeeping in Hungary are not available. The data were analysed using IBM SPSS version 22, supplemented by Microsoft 365 Excel 2410 16.0.18129.20158. We used basic statistical tools such as frequencies and averages to describe the data. We performed cross-stability tests using chi-square tests to evaluate differences between categorical variables. We used Mann-Whitney U and Kruskal-Wallis non-parametric tests to make comparisons between two groups and between three or more groups of quantitative variables. The significance level is set at $p = 0.05$ in all cases.

In terms of size, the apiaries surveyed were classified into the following categories: hobby (fewer than 20 bee colonies), small-scale (21–100 bee colonies), semi-professional (101–150 bee colonies) and professional (more than 150 bee colonies).

3. Results and Discussion

In the previous study, we already identified the main characteristics of the sample, which means that in terms of the age of the respondents, the majority, 63.3%, belong to the 31–59 age group [46]. The oldest age group, with 29.6% participated in the survey to the least extent, while the youngest (7.1%) participated in the survey to the least extent. Most respondents (60.9%) were first-generation beekeepers, while 18.8% were second-generation,

15.6% were third-generation, and 4.5% were more than third-generation beekeepers. Based on educational attainment, most respondents had a secondary school education (40.2%), followed by those with a higher education degree (33.3%). The smallest proportion of the sample was beekeepers with vocational qualifications (24.2%) and those with primary education (0.9%). The majority of respondents (64.1%) have professional qualifications in beekeeping, with approximately the same proportion having other agricultural qualifications (e.g., agricultural engineer, horticultural engineer, forest engineer, organic farmer; 8.1%) and master beekeeper qualifications (7.5%). The proportion of beekeepers without agricultural qualifications is low, at 19.9%. When asked about their professional experience in beekeeping, most respondents (73.7%) said they had been involved in beekeeping for more than 10 years. The proportion of those with 5-10 years of experience was 16.2%. The proportion of novice beekeepers with less than 1 year of experience was only 0.4%.

Regarding the form of activity, more than 50% of respondents practice beekeeping as a supplementary source of income alongside their primary job, while 28.9% are full-time beekeepers. The proportion of retired respondents was the lowest, at 18.8%. Completed questionnaires were received from all counties and the capital. Most responses came from eastern and southwestern Hungary, while the lowest proportion of beekeepers nationwide (0.7%) was in Budapest.

3.1. Determining the Size of Apiaries

Of those participating in the survey, 1067 provided information on the size of their apiary, i.e., the number of bee colonies. The minimum number of colonies was 1, while the maximum was 1200, averaging 102.57 colonies/beekeeper. Taking into account the farm size categories defined in the literature [50–53], we determined the apiary sizes shown in Table 1 as the result of the research. Based on this, most responses were received for the small-scale apiary category (between 21 and 100 bee colonies), i.e., 612 responses, representing 67.4% of the sample, and based on 178 respondents, semi-professional beekeepers, i.e., those with 101–150 bee colonies, accounted for 16.7%. In comparison, professional beekeepers with more than 151 bee colonies accounted for 172 respondents (16.1%). The fewest responses were received for hobby beekeeping (105, 9.8% of the sample).

Table 1. Determination of apiary size categories.

Apiary Size		n	Distribution (%)
Determination	**Number of Bee Colonies**		
Hobby	<20	105	9.8
Small-scale	21–100	612	57.4
Semi-professional	101–150	178	16.7
Professional	>151	172	16.1
Total	-	1067	100.0

The survey results show that the average number of bee colonies per apiary at the national level is 103, and most apiaries are small-scale operations, representing hobby or supplementary activities. In the European Union, only 3% of beekeepers belong to the professional category of 150 bee colonies or more [45]. In some European countries, the average number of bee colonies per respondent varied significantly between countries [54]. Greece and Romania have the highest proportion of professional beekeepers. In Eastern and Southern European countries, where the average number of bee colonies is between 70 and 131, beekeeping is a secondary occupation. In Portugal, 50% of respondents have more than 50 bee colonies, in Northern Cyprus, 56%, and in Ukraine, 45%. In Northern

Europe, most apiaries have fewer than 10 bee colonies; for example, this is true for almost all respondents in Iceland and more than half of those in Scotland, Ireland, and Sweden.

In Hungary, over half (59.3%) of the beekeepers who responded regularly practice transhumance with their bee colonies. Based on the distribution by county, migration is most common in the eastern half of the country, mainly in Hajdú-Bihar, Bács-Kiskun, Jász-Nagykun-Szolnok, Békés, and Csongrád-Csanád counties (Figure 3. The average number of bee colonies was also high in these counties. Based on these figures, the proportion of stationary beekeeping in the counties of Transdanubia (e.g., Tolna 66.7%, Zala 62.5%, Komárom-Esztergom 58.3%, Vas 57.1%, Fejér 56.5%, Győr-Moson-Sopron 56.0%) and 66.7% in Budapest.

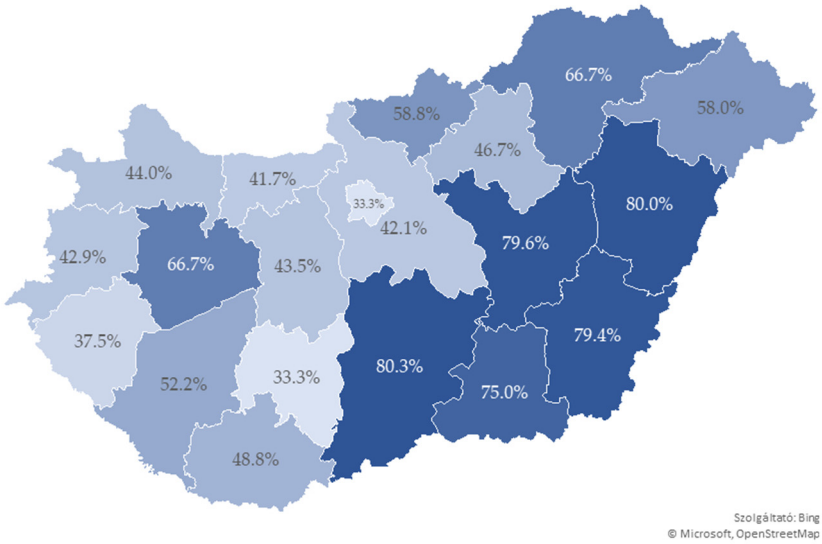

Figure 3. Distribution of bee migration by county in Hungary (n = 619).

3.2. Transhumance of Bee Colonies

A bee pasture refers to all plants from which bees collect nectar, pollen, and propolis; this is important for several reasons. On the one hand, it serves the survival of bees (when the collection does not necessarily result in a harvestable amount of honey). On the other hand, larger bee pastures (whether wild plants, forests, or cultivated crops) ensure the possibility of commercial honey production [55].

Honey production per bee colony depends on several factors, such as the strength of the colonies, natural food sources, good beekeeping practices, and other factors such as weather changes and their impact on nectar and pollen availability [56,57]. The lack of honey and pollen sources motivates transhumant beekeeping. In each beekeeping season, several factors determine beekeepers' activities and their decisions regarding migration routes [58]. In order to find new locations, beekeepers travel long distances with their vehicles to find suitable areas, meet with the owners, and agree on the placement of the bee colonies. Suppose beekeeping is the primary source of income. In that case, there is a direct correlation between the number of bee colonies and the average size of apiaries, which ranges from 101 to 300 colonies, with an average of 172 colonies [53]. Although the most experienced beekeepers mostly follow the same routes, they have to modify their schedules according to the condition of their colonies, the amount of temporary storage available, the national market price of each type of honey (which changes regularly), financial possibilities (which may also fluctuate) and many other factors [58].

In this study, the issue of migration was examined from several aspects, the results of which are summarised below. The size of apiaries determines whether beekeepers practice migration. According to the research results, there is a statistically significant relationship

between farm size and migration (χ^2 = 72.155, df = 3, $p < 0.001$) (Table 2); this means that transhumance is most common among semi-professional and professional operations, while it is less common among smaller apiaries.

Table 2. Correlation between transhumance and apiary size.

Transhumance		Apiary Size (Number of Bee Colonies)				Total
		<20	21–100	101–150	>151	
Yes	Count	7	202	73	80	297.0
	Expected count	31.5	210.4	61.2	58.8	297.0
No	Count	46	152	30	19	255.0
	Expected count	21.5	143.6	41.8	40.2	255.0
Sig		<0.001				

More than half of the beekeepers participating in the survey regularly migrate their bee colonies, which is most common among beekeepers with stationary apiaries in the eastern counties of the country. There are areas where this proportion is similar [59], where it is much higher [53,58], and where it is lower [7,60]. We also examined how often respondents migrate during a beekeeping season and how many bee colonies they migrate with, and we mapped the counties to which they most frequently migrate in Hungary. Respondents migrate an average of three times a year (n = 373), which means at least once and at most ten times. In this case, the average number of bee colonies is 89 colonies/apiary (n = 348), with a significant variation between 3 and 600 colonies. Regarding apiary size, the average size of the migrated colony is smallest for hobby apiaries and largest for professional apiaries (Figure 4).

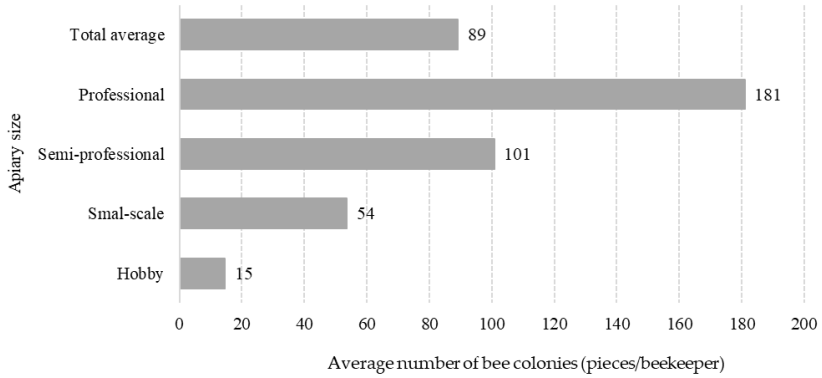

Figure 4. Average number of transhumanced bee colonies by apiary size (n = 342).

By examining the four apiary size categories and the size of the transhumanced stock from the total bee population (n = 342), we found that that the highest proportion of respondents were small-scale beekeepers and that the migrated population was less than 50 bee colonies (of their total population), as they do not always transport their entire bee colonies to other bee pastures, similar to the results of other studies [53]; this depends on several factors, such as transport options, the size of the apiary and the proportion of strong colonies within the total stock [7,61,62]. Transhumance is less common among hobby beekeepers, while semi-professional and professional respondents transport most or all of their colonies to other bee pastures (Table 3).

Table 3. Evaluation of the number of transhumance bee colonies by apiary size.

Number of Transhumanced Bee Colonies	Apiary Size (Number of Bee Colonies)				Total
	<20	21–100	101–150	>151	
<50	8	107	3	2	120
51–150	0	91	29	8	127
101–150	0	0	28	30	59
151–200	0	0	0	20	20
>200	0	0	0	16	16
Total	8	198	60	76	342

The beekeepers who responded typically migrate to bee pastures located within the country, in specific regions and counties. Based on the responses received, we identified the counties. The results show that the most common destinations are the northern and eastern counties, taking into account movements within the given county (Figure 5). The counties marked in the darkest colour are those with the most intense migration of bee colonies. The arrows indicate the direction of migration. Szabolcs-Szatmár-Bereg county ranks first, where migration to bee pastures is most common.

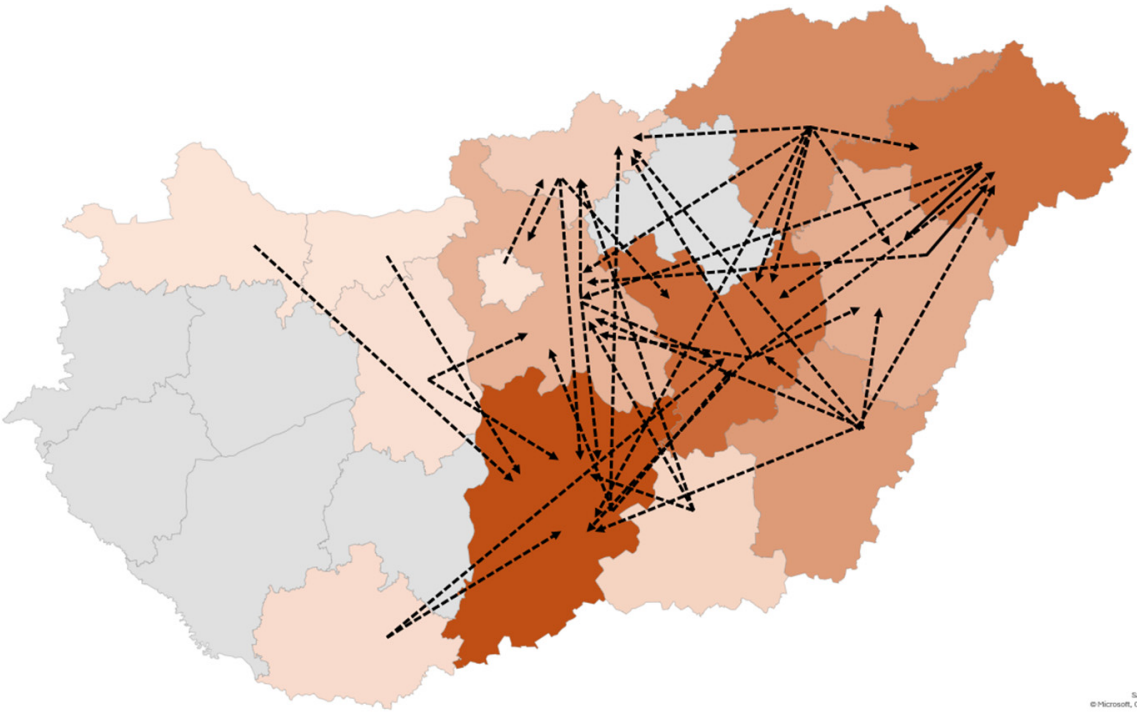

Figure 5. The most common destinations for transhumance according to Hungarian counties.

Table 4 shows the distance travelled during a beekeeping season, broken down by honey type. Respondents drove an average of 2509 km, with the longest distances for acacia honey, followed by sunflower and rapeseed honey. There is a significant variation between the minimum and maximum values due to the low number of responses to this question, so this result can only be considered indicative.

Table 4. Distance travelled during transhumance (km) by honey type.

Type of Honey	N	Min	Max	Sum	Mean	Std. Deviation
Rapeseed	71	6	8300	84,881.2	1195.5	1639.9
Acacia	89	1.2	8720	155,098.2	1742.7	1905.9
Sunflower	80	12	8600	133,168	1664.6	2092.2
Linden	16	10	6000	24,374	1523.4	1792.3
Ohter types	17	10	11,000	42,511	2500.6	3364.9

By examining the kilometres covered during migration by category, we found that survey participants covered the longest distances to check and visit their bee colonies during the migration period (Figure 6). That means that beekeepers regularly check the health of their bee colonies.

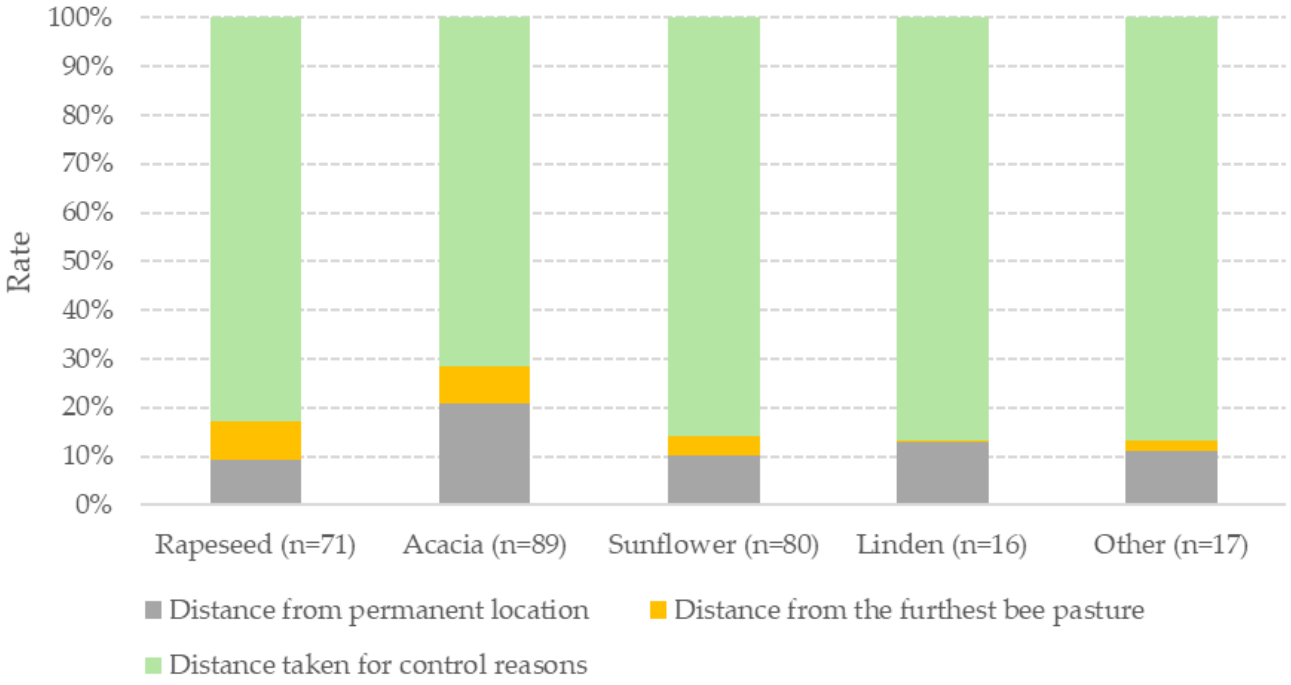

Figure 6. Distance travelled during transhumance by honey type.

The placement of bee colonies in different apiaries is adjusted to different flowering periods, depending on which plants are the most important sources of nectar in each region [15,46,59]. During the research, we also surveyed the characteristics of the vehicles that beekeepers use for migration. We found that apiaries use different categories of vehicles to transport their bee colonies to bee pastures, depending on their size (Figure 7). As the size of the apiary increases, so does the category of vehicles used for migration. The majority of hobby beekeepers (63.6%) and small-scale beekeepers (32.8%) use passenger cars for transport, although it should be noted that migration is less common among hobby beekeepers. Small trucks (up to 3.5 tons total weight) were the most common means of transport indicated by semi-professional (36.7%) and professional (34.1%) beekeepers in the survey. Larger trucks (over 3.5 tons total weight) accounted for a smaller proportion and are mostly used by professional beekeepers.

Based on the responses (n = 362), the average age of the vehicles was 18.3 years, with the youngest vehicle used in beekeeping being 1 year old and the oldest 45 years old, with vehicles aged 20 years being reported most frequently. We found no correlation between apiary size and vehicle age, as the average age was similar for all apiary sizes (Figure 8).

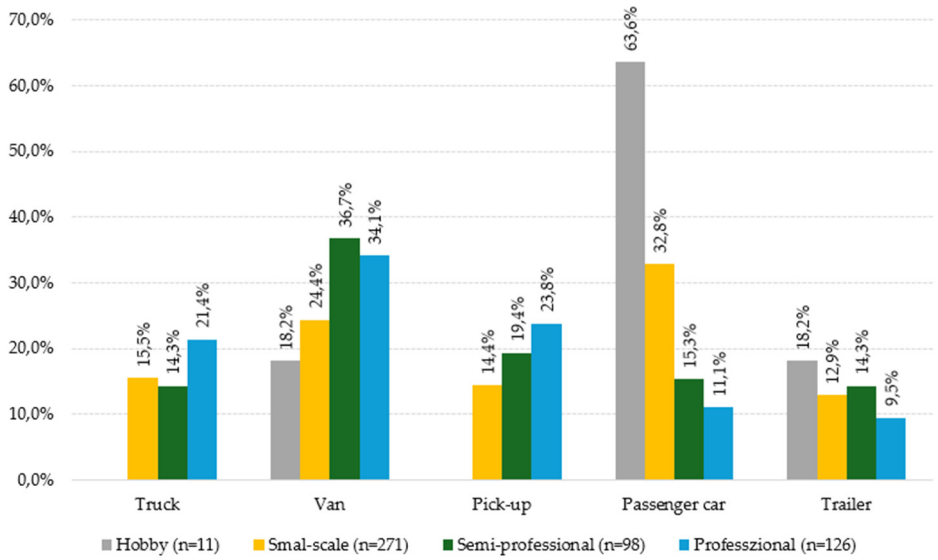

Figure 7. Vehicle categories by apiary size.

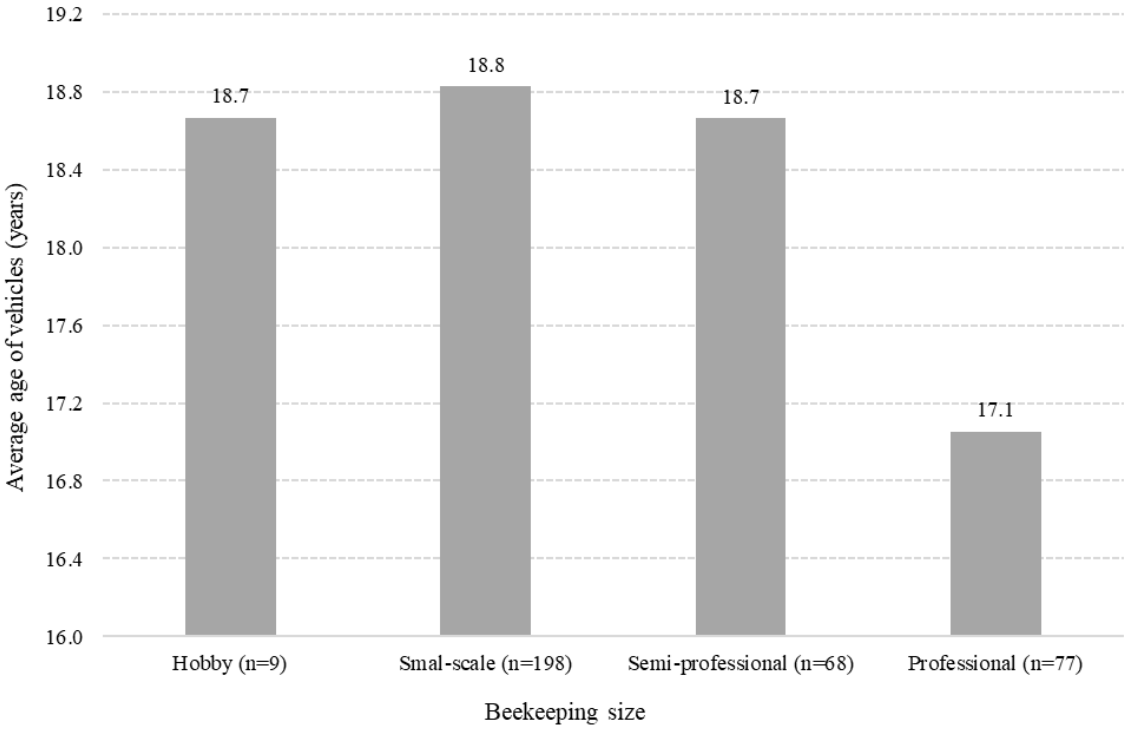

Figure 8. Average age of vehicles by apiary size.

Unlike other countries where beekeepers are paid to make their bee colonies available, such as the United States, Canada, Australia, New Zealand, Germany, and Thailand [63–65], Hungary has no pollination market. The transhumance of bee colonies raises the question of whether beekeepers pay landowners for using their land for beekeeping. In Hungary, this is usually performed by giving honey as a "gift", because Hungary has the highest bee density in the EU-27 (12.8 bee colonies/km^2), so domestic bee pastures are usually overloaded. The use of different bee pastures in Hungary often depends on personal relationships between the beekeeper and the landowner [66], unless the beekeeper is the landowner. During the survey, respondents could indicate how much honey (by honey type) they "paid" for using bee pastures or express this in monetary terms. We only analyzed responses relating to honey types, as the number of responses regarding monetary value was significantly lower

and included several outliers. Based on the responses, most beekeepers paid for using apiaries with acacia, sunflower, and rapeseed honey (Table 5).

Table 5. Bee pasture usage fees by honey type (n = 528).

Type of Honey	N	Fee for Using Bee Pastures				
		<15 kg	**16–30 kg**	**31–45 kg**	**46–60 kg**	**>61 kg**
Rapeseed	105	85	17	0	2	1
Acacia	204	113	51	11	4	9
Sunflower	137	93	38	1	1	4
Linden	34	28	6	0	0	0
Other	48	32	10	1	2	3

There is a statistically significant correlation between compensation for bee pastures and transhumance ($\chi^2 = 124.86$, df = 1, $p < 0.001$), which means that the number of beekeepers who transhumance and pay for the use of bee pastures is higher than expected, and the number of those who do not pay for the bee pastures visited with their bee colonies is lower than expected (Table 6).

Table 6. Correlation between transhumance and payment for the use of bee pastures (n = 565).

Have You Paid for the Use of the Bee Pasture Before?		Transhumance		Total
		Yes	**No**	
Yes	Count	255.0	49.0	304.0
	Expected count	191.0	113.0	304.0
No	Count	100.0	161.0	261.0
	Expected count	164.0	97.0	261.0
Sig			<0.001	

We also examined the trade-off between the use of bee pastures about apiary size, revealing a statistically significant relationship between the two variables ($\chi^2 = 44.143$, df = 3, $p < 0.001$); this means that small-scale and professional beekeepers typically pay for the use of bee pastures, and in these cases the proportion of yes answers was higher than expected compared to other apiary sizes (Table 7). The same cannot be said for hobby beekeepers, who do not typically pay for using bee pastures; this is partly because transhumance is not common, so there is no need to transport bees to land owned by others, and partly because some bee colonies can be kept on the beekeeper's own, even small bee pastures.

Table 7. Correlation between apiary size and payment for use of bee pastures (n = 552).

Have You Paid for the Use of the Bee Pasture Before?		Apiary Size (Number of Bee Colonies)				Total
		<20	**21–100**	**101–150**	**>151**	
Yes	Count	4.0	175.0	53.0	65.0	297.0
	Expected count	23.7	168.4	53.8	51.1	297.0
No	Count	40.0	138.0	47.0	30.0	255.0
	Expected count	20.3	144.6	46.2	43.9	255.0
Sig				<0.001		

We also examined the relationship between migration and other variables. About the type of hive used, we found a correlation between the use of vertical hive technology

and migration (K-W, $p < 0.001$), i.e., in the case of bee transhumance, the specific yield of beekeepers using vertical hives is higher (27.68 kg/colony) than the specific yield of stationary apiaries with vertical hives (20.98 kg/colony). This correlation is not statistically significant in the case of horizontal hives (Table 8).

Table 8. Correlation between the type of hive used for transhumanced beekeeping and honey yield (n = 626).

Type of Hive	Average Yield with Transhumance (kg/Bee Colony)	Average Yield Without Transhumance (kg/Bee Colony)
Horizontal	26.85	23.13
Vertical	27.68	20.98

Vertical hives are used by 67% of respondents and 47% of those who still regularly migrate their hives. Horizontal hives are used by 33% of respondents, but only 18% of those migrate their bee colonies. Based on the survey results, vertical hives use is significantly higher in professional apiaries ($\chi^2 = 4.474$, df = 1, $p = 0.034$), primarily in western and southern Hungary. The use of horizontal hives is significantly higher in the hobby and small-scale apiaries ($\chi^2 = 6.863$, df = 1, $p = 0.009$) and primarily in northeastern Hungary.

Numerous types of hives are used in beekeeping worldwide, with varying yields [50,67–69]. However, it should be noted that the hive type is one factor influencing yield [70,71]. According to previous research, there is a significant difference between the specific yield of acacia honey and sunflower honey in terms of bee migration and honey yield in Hungary [46]. In apiaries where bee colonies are transhumanced, higher yields were achieved for acacia honey and sunflower honey. These beehives cover a wide area, so beekeepers migrate to them more intensively. Besides, in the case of mixed flower honey, the difference is significant, with lower yields observed in the case of transhumance. Based on our research, this is because beekeepers do not collect some of the mixed flower honey from the bee colonies, so it stays in the hives and serves as natural food for the bees, reducing overfeeding and honey production costs.

In Hungary, specific yields were extremely low in 1991–1992, at only 13–14 kg/colony, but began to rise from 1993, reaching 23–25 kg per colony in 1994–1995 [51]. However, according to earlier sources, honey yields of 15–40 kg [72], 20–25 kg [73], and 30–40 kg [74] per year can be achieved from developed production families. Based on the most important economic indicators of Hungarian beekeeping for the period between 2000 and 2018, 14% of the average annual honey production of 20,000 tons was typically rapeseed honey, 40% was acacia honey, 26% was sunflower honey, and 10% was flower honey, with approximately 10% was other types of honey, such as chestnut, linden, or milkweed honey [75]. In 2015, the average yield per bee colony was 25 kg, which is estimated to have increased to 30 kg by 2018 [76]. Professional (more than 150 bee colonies) can achieve at least twice the honey yield of an average apiary, i.e., in 2015, the average yield of a professional apiary was 50 kg/colony, and in 2018, it was 60 kg/colony. In Hungary, the average annual honey yield per bee colony between 2000 and 2018 ranged between 16 and 30 kg, with an average of 22.08 kg per bee colony [75]. The values showed high dispersion in different years, which, according to the authors, can be attributed primarily to climatic reasons. The data are roughly in line with the estimated honey yields per bee colony reported in the Hungarian National Beekeeping Program (2016 and 2019) (25 kg/bee colony in 2015; 30 kg/bee colony in 2018) [76,77]. Annual honey production in Hungary was 27,963 tons in 2018, produced by 1,123,665 bee colonies, with an average annual honey yield of 22.61 kg per bee colony [75].

Our previous research confirmed the link between migration and professional experience in beekeeping, i.e., those with 5–10 years or more of professional experience are more likely to have their bee colonies transhumed than those with less professional experience. In addition, it has been confirmed that beekeepers' agricultural qualifications are also related to migration. Beekeepers with professional qualifications are more likely to visit other apiaries with their bees than those without such qualifications [46]. According to previous research, approximately 76% of Hungarian beekeepers do not have professional beekeeping qualifications, probably due to the high proportion of hobby beekeepers and those who keep bees as a supplementary activity [51].

4. Conclusions

This study examined the characteristics of Hungarian honey production based on data from Hungarian beekeepers, including the migration of bee colonies and the factors influencing it. The number of studies in this field in Hungary is limited. Therefore, this study fills a gap in the literature. The theoretical framework of the study was provided by a literature review conducted as part of secondary research, during which we identified the most important characteristics of beekeeping practices (e.g., transhumance, hive type, apiary size, types of honey produced) and the factors influencing them, focusing on the beekeeping situation in Hungary. Furthermore, the characteristics of the population studied were presented, published in a study that served as a precursor to the present research. During the primary research, the results of a nationwide questionnaire survey were processed using quantitative research methods.

Nearly 60% of the beekeepers who responded to the survey practice migratory beekeeping, with the destination usually being bee pastures in the eastern part of the country. This study examined aspects of beekeeping practices that are relevant to migration. Previously, for example, we found a statistically significant relationship between beekeeping experience, specialised (agricultural) education, and migration [46].

In the present study, we found statistically significant correlations between the size of apiaries and migration, migration and payment for using bee pastures, and between the type of hive used and migration. Migration is mainly characteristic of semi-professional and professional beekeepers. Most bee colonies (an average of 181 colonies) are moved to other apiaries by professional beekeepers, but the highest proportion of respondents who migrate are small-scale beekeepers. Respondents travel an average of 2509 km during a beekeeping season, with the longest distances driven to check bee colonies and produce acacia honey, which can be sold at a higher price in Hungary [66]. The vehicles' age is high, with all of them being over 17 years old. Hungarian beekeepers traditionally reward the landowner or tenant for using the pasture, mainly in the form of honey given as a gift related to migration. This type of "payment" is typically used by small-scale and professional beekeepers; transhumance beekeeping is not typical of hobby beekeepers, so neither is payment for access to bee pastures. According to the research results, in terms of the type of hive used, a significant difference can be observed between the honey yield of transhumance beekeepers (28 kg/colony) and stationary beekeepers (21 kg/colony) in the case of vertical hives.

The impact of transhumance beekeeping on beekeeping activities and bee health is complex and varies from country to country and region to region, depending on the quantity and quality of available pastures and human relationships [46,59,60,78–80].

This research is a continuation of a study exploring the situation of the Hungarian beekeeping sector, which, in a broader sense, contributes to the development of appropriate policies to regulate and support the sector, to the sustainability of the sector, and the evaluation of the effectiveness of measures taken so far. The limitation of the study is that

the sample is not representative, and the results are only valid for the population studied. The survey covered the 2022 beekeeping year, and it should be noted that performance can vary significantly between beekeeping years (e.g., due to weather conditions, the health of the bee population, and the availability of bee pastures). The research only took into account data from honey-producing apiaries.

Author Contributions: Conceptualisation, A.B.G. and I.S.; methodology, A.K.S.; software, A.K.S.; validation, I.S.; formal analysis, A.F.F.; investigation, A.F.F., A.B.G. and A.K.S.; resources, A.F.F.; data curation, A.F.F. and A.K.S.; writing—original draft preparation, A.F.F., A.B.G. and A.K.S.; writing—review and editing, A.F.F. and A.B.G.; visualisation, A.K.S.; supervision, I.S., A.B.G.; project administration, A.F.F.; funding acquisition, A.F.F. All authors have read and agreed to the published version of the manuscript.

Funding: Supported by the EKOP-24-3 University Research Scholarship Program of the Ministry for Culture and Innovation from the source of the National Research, Development and Innovation Fund. The APC was supported by the University of Debrecen Program for Scientific Publication.

Institutional Review Board Statement: Ethical review and approval were waived for this study due to the explanatory text preceding the questions drawing attention to the voluntary and anonymous nature of the questionnaire. No animals (bees) were involved in the survey.

Data Availability Statement: The dataset is available upon request from the authors. The raw data supporting the conclusions of this article will be made available by the authors on request.

Acknowledgments: Thanks to all beekeepers who contributed to this research by completing the questionnaire. Thanks to the National Hungarian Beekeepers' Association for coordinating the completion of the questionnaire.

Conflicts of Interest: The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Appendix A

The questions in the questionnaire were as follows:

1. Current number of bee colonies:
2. Please specify the type of hive used.
3. In which Hungarian county is your stationary apiary located?
4. Do you periodically relocate your bee colonies?
5. How many times a year?
6. How many bee colonies do you migrate each year?
7. Where do you usually migrate your bee colonies (county)?
8. During the 2022 beekeeping season, what type of vehicle did you use for migration, and how many kilometers did you travel, broken down by honey type?
9. Please specify the type and age of the vehicle used for migration!
10. Have you paid any fees (in cash or honey) to the landowner for placing your bee colonies on their land? If so, please specify the amount!
11. Please indicate the results of your beekeeping activities in 2022 in terms of the types of honey produced in your apiary!
12. Your age:
13. How many generations of beekeepers are there in your family?
14. In what form do you carry out your activity?
15. How much practical experience do you have in beekeeping?
16. Your highest level of education:
17. Do you have any relevant agricultural qualifications?

References

1. Gupta, R. *Beekeeping for Poverty Alleviation and Livelihood Security Vol. 1 Technological Aspects of Beekeeping*; Dl.Otvet.Gov.et Was First Indexed by Google in March 2021; Springer: Berlin/Heidelberg, Germany, 2021.
2. de Jesus, P. Journal of Ancient Egyptian Interconnections Sweetness Out of Chaos: The Archaeology of Early Beekeeping in the Near East and Aegean. *J. Anc. Egypt. Interconnect.* **2024**, *40*, 44–93.
3. Klein, A.-M.; Boreux, V.; Fornoff, F.; Mupepele, A.-C.; Pufal, G. Relevance of Wild and Managed Bees for Human Well-Being. *Curr. Opin. Insect Sci.* **2018**, *26*, 82–88. [CrossRef] [PubMed]
4. Minja, G.S.; Nkumilwa, T.J. The Role of Beekeeping on Forest Conservation and Poverty Alleviation in Moshi Rural District, Tanzania. *ESJ* **2016**, *12*, 366. [CrossRef]
5. Chanthayod, S.; Zhang, W.; Chen, J. People's Perceptions of the Benefits of Natural Beekeeping and Its Positive Outcomes for Forest Conservation: A Case Study in Northern Lao PDR. *Trop. Conserv. Sci.* **2017**, *10*, 1940082917697260. [CrossRef]
6. Mudzengi, C.; Kapembeza, C.S.; Dahwa, E.; Taderera, L.; Moyana, S.; Zimondi, M. Ecological Benefits of Apiculture on Savanna Rangelands. *Bee World* **2020**, *97*, 17–20. [CrossRef]
7. Pocol, C.B.; McDonough, M. Women, Apiculture and Development: Evaluating the Impact of a Beekeeping Project on Rural Women's Livelihoods. *Buasvmcn-Hort* **2015**, *72*, 487–492. [CrossRef]
8. Mazorodze, B.T. *The Contribution of Apiculture towards Rural Income in Honde Valley Zimbabwe*; AgEcon Search: St. Paul, MN, USA, 2015. [CrossRef]
9. Quezada-Euán, J.J.G. The Past, Present, and Future of Meliponiculture in Mexico. In *Stingless Bees of Mexico*; Springer International Publishing: Cham, Switzerland, 2018; pp. 243–269. [CrossRef]
10. Vinci, G.; Rapa, M.; Roscioli, F. Sustainable Development in Rural Areas of Mexico through Beekeeping. *IJSEI* **2018**, *4*, 1–7. [CrossRef]
11. Van Espen, M.; Williams, J.H.; Alves, F.; Hung, Y.; de Graaf, D.C.; Verbeke, W. Beekeeping in Europe Facing Climate Change: A Mixed Methods Study on Perceived Impacts and the Need to Adapt According to Stakeholders and Beekeepers. *Sci. Total Environ.* **2023**, *888*, 164255. [CrossRef]
12. Barahona, N.A.; Vergara, P.M.; Alaniz, A.J.; Carvajal, M.A.; Castro, S.A.; Quiroz, M.; Hidalgo-Corrotea, C.M.; Fierro, A. Understanding How Environmental Degradation, Microclimate, and Management Shape Honey Production across Different Spatial Scales. *Environ. Sci. Pollut. Res.* **2024**, *31*, 12257–12270. [CrossRef]
13. Vercelli, M.; Croce, L.; Mancuso, T. An Economic Approach to Assess the Annual Stock in Beekeeping Farms: The Honey Bee Colony Inventory Tool. *Sustainability* **2020**, *12*, 9258. [CrossRef]
14. Feketéné Ferenczi, A.; Szűcs, I.; Vida, V. A Hazai Méhészeti Ágazat Helyzetének Elemzése (Termelés, Kereskedelem). *Táplálkozás Marketing* **2021**, *8*, 21–34. (In Hungarian) [CrossRef]
15. Feketéné Ferenczi, A.; Szűcs, I.; Bauerné Gáthy, A. "What's Good for the Bees Will Be Good for Us!"—A Qualitative Study of the Factors Influencing Beekeeping Activity. *Agriculture* **2024**, *14*, 890. [CrossRef]
16. ÇevrïMlï, M.B.; Sakarya, E. Economic Analysis of Beekeeping Enterprises in Aegean Region, Turkey. *Ank. Üniversitesi Vet. Fakültesi Derg.* **2019**, *66*, 109–115. [CrossRef]
17. Rubinigg, M. European Honey Market. Available online: https://app.pollinatorhub.eu/articles/2 (accessed on 17 May 2025).
18. Phipps, R. *International Honey Market*; Apiservices; Apiculture.com. 2024. Available online: https://apiculture.com/files/17/International-Honey-Market/1202/International-Honey-Market-report-March-2024.pdf (accessed on 18 February 2025).
19. Genersch, E.; Von Der Ohe, W.; Kaatz, H.; Schroeder, A.; Otten, C.; Büchler, R.; Berg, S.; Ritter, W.; Mühlen, W.; Gisder, S.; et al. The German Bee Monitoring Project: A Long Term Study to Understand Periodically High Winter Losses of Honey Bee Colonies. *Apidologie* **2010**, *41*, 332–352. [CrossRef]
20. Van Dooremalen, C.; Gerritsen, L.; Cornelissen, B.; Van Der Steen, J.J.M.; Van Langevelde, F.; Blacquière, T. Winter Survival of Individual Honey Bees and Honey Bee Colonies Depends on Level of Varroa Destructor Infestation. *PLoS ONE* **2012**, *7*, e36285. [CrossRef]
21. Morawetz, L.; Köglberger, H.; Griesbacher, A.; Derakhshifar, I.; Crailsheim, K.; Brodschneider, R.; Moosbeckhofer, R. Health Status of Honey Bee Colonies (Apis Mellifera) and Disease-Related Risk Factors for Colony Losses in Austria. *PLoS ONE* **2019**, *14*, e0219293. [CrossRef] [PubMed]
22. Chantawannakul, P. Conservation and Management of Honey Bees in Southeast Asia. In *Imperiled: The Encyclopedia of Conservation*; Elsevier: Amsterdam, The Netherlands, 2022; pp. 538–548. [CrossRef]
23. Abrol, D.P. Beekeeping for Sustainable Economic Development of India: Challenges and Opportunities. *J. Indian. Inst. Sci.* **2023**, *103*, 997–1017. [CrossRef]
24. Kumar, A.; Vahoniya, D.R.; Rajwadi, A. Navigating the Honey Markets Across Europe and Africa. *Asian J. Agric. Ext. Econ. Sociol.* **2024**, *42*, 266–275. [CrossRef]
25. Hou, Y.; Zhao, Z.; Dong, H.; Ma, J.; Gao, Y. Beekeeping Behavior of Chinese Beekeepers Shows Spatial Contraction. *Agriculture* **2024**, *14*, 540. [CrossRef]

26. Becher, M.; Osborne, J.; Thorbek, P.; Kennedy, P.; Grimm, V. REVIEW: Towards a Systems Approach for Understanding Honeybee Decline: A Stocktaking and Synthesis of Existing Models. *J. Appl. Ecol.* **2013**, *50*, 868–880. [CrossRef] [PubMed]
27. Lambert, O.; Piroux, M.; Puyo, S.; Thorin, C.; L'Hostis, M.; Wiest, L.; Buleté, A.; Delbac, F.; Pouliquen, H. Widespread Occurrence of Chemical Residues in Beehive Matrices from Apiaries Located in Different Landscapes of Western France. *PLoS ONE* **2013**, *8*. [CrossRef]
28. European Court of Auditors. *Protection of Wild Pollinators in the EU—Commission Initiatives Have Not Borne Fruit Special Report*; European Court of Auditors: Luxembourg, 2020.
29. Martínez-López, V.; Ruiz, C.; Pires, M.; de la Rúa, P. Contrasting Effects of Beekeeping and Land Use on Plant-Pollinator Networks and Pathogen Prevalence in Mediterranean Semiarid Ecosystems. *Ecography* **2024**, *2024*, e06979. [CrossRef]
30. Underwood, R.M.; Traver, B.E.; López-Uribe, M.M. Beekeeping Management Practices Are Associated with Operation Size and Beekeepers' Philosophy towards in-Hive Chemicals. *Insects* **2019**, *10*, 10. [CrossRef]
31. Kahane, F.; Osborne, J.; Crowley, S.; Shaw, R. Motivations Underpinning Honeybee Management Practices: A Q Methodology Study with UK Beekeepers. *Ambio* **2022**, *51*, 2155–2168. [CrossRef]
32. Qiu, X.; Gajpal, Y.; Roy, V.; Appadoo, S. Migratory Beekeeping Routing: A Combinatorial Optimization Problem in Apiculture. *Annals of Operations Research* **2024**. [CrossRef]
33. EFSA Scientific Committee; More, S.; Bampidis, V.; Benford, D.; Bragard, C.; Halldorsson, T.; Hernández-Jerez, A.; Bennekou, S.H.; Koutsoumanis, K.; Machera, K.; et al. A Systems-based Approach to the Environmental Risk Assessment of Multiple Stressors in Honey Bees. *EFS2* **2021**, *19*, e06607. [CrossRef]
34. Naug, D. Nutritional Stress Due to Habitat Loss May Explain Recent Honeybee Colony Collapses. *Biol. Conserv.* **2009**, *142*, 2369–2372. [CrossRef]
35. Vaudo, A.D.; Tooker, J.F.; Grozinger, C.M.; Patch, H.M. Bee Nutrition and Floral Resource Restoration. *Curr. Opin. Insect Sci.* **2015**, *10*, 133–141. [CrossRef]
36. De Jongh, E.J.; Harper, S.L.; Yamamoto, S.S.; Wright, C.J.; Wilkinson, C.W.; Ghosh, S.; Otto, S.J.G. One Health, One Hive: A Scoping Review of Honey Bees, Climate Change, Pollutants, and Antimicrobial Resistance. *PLoS ONE* **2022**, *17*, e0242393. [CrossRef]
37. Le Conte, Y.; Navajas, M. Influencia de Los Cambios Climáticos En Las Poblaciones de Abejas y Sus Enfermedades: -EN- Climate Change: Impact on Honey Bee Populations and Diseases -FR- Changements Climatiques: Impact Sur Les Populations d'abeilles et Leurs Maladies -ES-. *Rev. Sci. Tech. OIE* **2008**, *27*, 485–510. [CrossRef]
38. Sperandio, G.; Simonetto, A.; Carnesecchi, E.; Costa, C.; Hatjina, F.; Tosi, S.; Gilioli, G. Beekeeping and Honey Bee Colony Health: A Review and Conceptualization of Beekeeping Management Practices Implemented in Europe. *Sci. Total Environ.* **2019**, *696*, 133795. [CrossRef]
39. Scott, A.; Hassler, E.; Formato, G.; Rünzel, M.A.S.; Wilkes, J.; Hassan, A.; Cazier, J. Data Mining Hive Inspections: More Frequently Inspected Honey Bee Colonies Have Higher over-Winter Survival Rates. *J. Apic. Res.* **2023**, *62*, 983–991. [CrossRef]
40. Hristov, P.; Shumkova, R.; Palova, N.; Neov, B. Honey Bee Colony Losses: Why Are Honey Bees Disappearing? *Sociobiology* **2021**, *68*, e5851. [CrossRef]
41. El Agrebi, N.; Steinhauer, N.; Tosi, S.; Leinartz, L.; De Graaf, D.C.; Saegerman, C. Risk and Protective Indicators of Beekeeping Management Practices. *Sci. Total Environ.* **2021**, *799*, 149381. [CrossRef]
42. Feketéné Ferenczi, A.; Szűcs, I.; Vida, V.; Feketéné Ferenczi, A.; Szűcs, I.; Vida, V. Családi Gazdasági Keretek Között Működő Méhészeti Vállalkozás Üzemtani Vizsgálata. *GAZDÁLKODÁS Sci. J. Agric. Econ.* **2021**, *65*, 237–255. (In Hungarian) [CrossRef]
43. Központi Statisztikai Hivatal. *Tej-, Tojás-, Gyapjú-, Toll- És Méztermelés*. 2024. Available online: https://www.ksh.hu/stadat_files/mez/hu/mez0034.html (accessed on 1 February 2025). (In Hungarian).
44. FAOSTAT. Crops and Livestock Products. 2024. Available online: https://www.fao.org/faostat/en/#data/QCL (accessed on 18 February 2025).
45. European Commission. Honey Market Presentation. Available online: https://agriculture.ec.europa.eu/farming/animal-products/honey_en#eu-support-for-the-apiculture-sector (accessed on 18 February 2025).
46. Feketéné Ferenczi, A.; Kovácsné Soltész, A.; Szűcs, I.; Bauerné Gáthy, A. Current Situation of Honey-Producing Apiaries—Quantitative Study of Honey Production Characteristics Based on a Questionnaire Survey in Hungary. *Agriculture* **2024**, *14*, 2100. [CrossRef]
47. Lwanga, S.K.; Lemeshow, S.; World Health Organization. Sample size determination in health studies: A practical manual/S. K. Lwanga and S. Lemeshow. In *Dt'ermination de la taille d' un čhantillon dans les t'udes sanomt'riques: Manuel pratique*; World Health Organization: Geneva, Switzerland, 1991.
48. Kerékgyártó, G.; Balogh, I.L.; Sugár, A.; Szarvas, B. *Statisztikai módszerek és alkalmazásuk a gazdasági és társadalmi elemzésekben*; Akadémiai Kiadó: Budapest, Hungary, 2017; (In Hungarian). [CrossRef]
49. Országos Magyar Méhészeti Egyesület. *Környezetterhelési Monitoringvizsgálat 2023–2024*; Országos Magyar Méhszeti Egyesület: Budapest, Hungary, 2024. (In Hungarian)
50. Tucak, Z.; Periscki, M.; Beslo, D.; Tucak, I. Influence of the Beehive Type on the Quality of Honey. *Coll. Antropol.* **2004**, *18*, 463–467.

51. Nagy, I.; Nagy, I. A Méhészeti Termelés Technológiai, Gazdasági, Társadalmi Összefüggéseinek Vizsgálata. Ph.D. Thesis, Mezőgazdaság- És Élelmiszertudományi Kar, Ujhelyi Imre Állattudományi Doktori Iskola, Mosonmagyaróvár, Hungary, 2013. (In Hungarian).
52. Takács, M.; Oláh, J. A pannon méh. *Őstermelő Gazdálkodók Lapja* **2017**, 21. (In Hungarian)
53. Chontal, G.L.; Peña, J.G.R.; Echeverría, E.F.; Mendoza, E.M.; Zorrilla, U.A.D.; Lambert, G.F. Bee Characterization in the Sierra Central-North Region of Veracruz: Context and Transhumance. *Rev. Mex. Cienc. Agrícolas* **2019**, *10*, 1339–1351.
54. Perichon, S.; Adamchuk, L.; Biber, L. Perception of Threats to Bee Colonies and the Future of Local Beekeeping by Beekeepers in Various European Countries. *Bull. de la Société Géographique de Liège* **2024**, *82*, 19–46. [CrossRef]
55. Ruff, J. *A Méhészmester Könyve*; Szaktudás Kiadó Ház: Budapest, Hungary, 2007. (In Hungarian)
56. Reyes, C.J.; Galarza, M.J.; Muñoz, S.R.; Moreno, R.A. Diagnóstico Territorial y Espacial de La Apicultura En Los Sistemas Agroecológicos de La Comarca Lagunera. *Rev. Mex. Cienc. Agríc.* **2014**, *5*, 215–228.
57. Magaña, M.M.; Tavera, C.M.; Salazar, B.L.; Sanginés, G.J.R. Productividad de La Apicultura En México y Su Impacto Sobre La Rentabilidad. *Rev. Mex. Cienc. Agríc.* **2016**, *7*, 1103–1115.
58. Grillot, C. When Bees Travel–Social and Economic Challenges of Chinese Transhumant Beekeepers. *ZANTHRO-Zur. Anthropol. Work. Pap.* **2020**, 10. Available online: https://www.isek.uzh.ch/dam/jcr:4f544e3c-97d7-4efb-92ca-6f644aac22bf/ZANTHRO_10.pdf (accessed on 1 February 2025).
59. Soare, I. Some Aspects Regarding the Transhumance of the Romanian Beekeepers, Members of the Black Sea Basin Network. *Annals of "Dunarea de Jos" University of Galati Fascicle I. Economics and Applied Informatics* **2020**, *26*, 119–128. [CrossRef]
60. Haider, Y.; Adjlane, N.; Haddad, N. Results of the Nationale Survery on Algerian Beekeebing (Breeding Practices, Health Situation). *S. F. J. Dev.* **2024**, *5*, e4618. [CrossRef]
61. Landaverde, R.; Rodriguez, M.T.; Parrella, J.A. Honey Production and Climate Change: Beekeepers' Perceptions, Farm Adaptation Strategies, and Information Needs. *Insects* **2023**, *14*, 493. [CrossRef]
62. Rani, S.R.; Saha, S.; Reddy, A.J. Migratory Beekeeping: A Boon to Both Farmer and Beekeeper, Swapna Rani K.Samrat SahaSamrat SahaAnkireddy JAWAHAR ReddyAnkireddy JAWAHAR Reddy. *Insect Environ.* **2023**, *26*, 65–70.
63. Rucker, R.R.; Thurman, W.N.; Burgett, M. Honey Bee Pollination Markets and the Internalization of Reciprocal Benefits. *Am. J. Agri. Econ.* **2012**, *94*, 956–977. [CrossRef]
64. Hoover, S.E.; Ovinge, L.P. Pollen Collection, Honey Production, and Pollination Services: Managing Honey Bees in an Agricultural Setting. *J. Econ. Entomol.* **2018**, *111*, 1509–1516. [CrossRef]
65. Goodrich, B.K. Do More Bees Imply Higher Fees? Honey Bee Colony Strength as a Determinant of Almond Pollination Fees. *Food Policy* **2019**, *83*, 150–160. [CrossRef]
66. Feketéné Ferenczi, A.; Szűcs, I.; Bauerné Gáthy, A. Economic Sustainability Assessment of a Beekeeping Farm in Hungary. *Agriculture* **2023**, *13*, 1262. [CrossRef]
67. Mujuni, A.; Natukunda, K.; Kugonza, D.R. Factors Affecting the Adoption of Beekeeping and Associated Technologies in Bushenyi District, Western Uganda. *Livest. Res. Rural Develop.* **2012**, *24*, 1–19.
68. Kinati, C.; Tolemariam, T.; Debele, K. Assessment of Honey Production and Marketing System in Gomma District, South Western Ethiopia. *Greener J. Bus. Manag. Stud.* **2013**, *3*, 99–107.
69. Al-Ghamdi, A.A.; Adgaba, N.; Tadesse, Y.; Getachew, A.; Al-Maktary, A.A. Comparative Study on the Dynamics and Performances of Apis Mellifera Jemenitica and Imported Hybrid Honeybee Colonies in Southwestern Saudi Arabia. *Saudi J. Biol. Sci.* **2017**, *24*, 1086–1093. [CrossRef] [PubMed]
70. Karadas, K.; Kadırhanogullari, I.H. Predicting Honey Production Using Data Mining and Artificial Neural Network Algorithms in Apiculture. *Pakistan Journal of Zoology* **2017**, *49*, 1611–1619. [CrossRef]
71. Aksoy, A.; Ertürk, Y.E.; Erdoğan, S.; Eyduran, E.; Tariq, M.M. Estimation of Honey Production in Beekeeping Enterprises from Eastern Part of Turkey through Some Data Mining Algorithms. *Pakistan Journal of Zoology* **2018**, *50*, 2199–2207. [CrossRef]
72. Örösi, P.Z. *Méhek Között.*; Börze Kft.: Budapest, Hungary, 1967. (In Hungarian)
73. Faluba, Z. *Méhek, Méhészkedés.*; Mezőgazdasági Kiadó: Budapest, Hungary, 1983. (In Hungarian)
74. Horváth, G. Egyes Speciális Agrártermékek Termelésének És Külkereskedelmének Főbb Kérdései. *Ph.D. Thesis*; Veszprémi Egyetem: Keszthely, Hungary, 2001. Available online: https://konyvtar.uni-pannon.hu/doktori/2001/Horvath_Gabor_dissertation.pdf (accessed on 1 February 2025). (In Hungarian).
75. Oravecz, T.; Mucha, L.; Illés, B.C. A magyar méhészeti ágazat elmúlt 20 éve—Termelési alapok. *GAZDÁLKODÁS: Sci. J. Agric. Econ.* **2020**, *64*, 435–451. (In Hungarian) [CrossRef]
76. Földművelésügyi Minisztérium. A MAGYAR MÉHÉSZETI NEMZETI PROGRAM 2016–2019. 2016. Available online: https://agriculture.ec.europa.eu/system/files/2020-06/nap-air-hu_hu_0.pdf (accessed on 18 February 2025). (In Hungarian).
77. Agrárminisztérium. Magyar Méhészeti Nemzeti Program Értékelés 2016–2019 és Tervezés 2019–2020. 2019. Available online: https://agriculture.ec.europa.eu/system/files/2020-06/nap-air-hu_hu_0.pdf (accessed on 18 February 2025). (In Hungarian).

78. Olate-Olave, V.R.; Verde, M.; Vallejos, L.; Perez Raymonda, L.; Cortese, M.C.; Doorn, M. Bee Health and Productivity in Apis Mellifera, a Consequence of Multiple Factors. *Vet. Sci.* **2021**, *8*, 76. [CrossRef]
79. Alger, S.A.; Burnham, P.A.; Lamas, Z.S.; Brody, A.K.; Richardson, L.L. Home Sick: Impacts of Migratory Beekeeping on Honey Bee (*Apis Mellifera*) Pests, Pathogens, and Colony Size. *PeerJ* **2018**, *6*, e5812. [CrossRef]
80. Formato, G.; Giannottu, E.; Lorenzi, V.; Roncoroni, C.; Pietropaoli, M.; Pedrelli, C.; Bagni, M.; Palomba, S. Definition and Identification of Honey Bee Welfare Practices Within the Five Domains Framework for Sustainable Beekeeping. *Appl. Sci.* **2024**, *14*, 11902. [CrossRef]