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SURVEY ON FACTORS AFFECTING HONEY BEES COLONIES IN ROMANIA: PRELIMINARY DATA

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Abstract

The longevity of honey bees, although genetically conditioned, is impacted by numerous factors including diseases, parasites, pesticides, predators, but also by environmental and socio-economic factors. Additionally, the decrease in pollen resources reduces the queen's brood and finally the longevity of the bee colony. Therefore, a survey, based on clinical examinations in apiaries and a questionnaire completed by beekeepers was conducted in 2023 to analyze the major factors that adversely impact the honey bees colonies. For this a total of 50 beekeepers from five counties in Central and South-eastern Romania were enrolled in the study. Among the factors causing honey bee losses, diseases (including varroosis, wax moth, nosemosis, others) and unfavourable climatic conditions, such as longer dryness and cold periods, rains, or strong winds were reported. These findings emphasize on the importance of continuous monitoring, investigations, and specific control measures to be taken in order to preserve the health and activity of honey bee colonies.

Key words*: honey bee, colony survival, colony losses, Romania.*

INTRODUCTION

Honey bee - *Apis mellifera* Linnaeus 1758 (the European honey bee) - is well known as the most important pollinator of agricultural crops and natural vegetation, but as well as important producer of honney and bee-by products (Pirk et al., 2014; Bekić et al., 2014). Subsequently, the role of honey bees is vital in agriculture. For instance, bees maintain 78% of the native flora and bring revenues to the European Union of over 1.4 bilion euros, while in the USA, the California almond industry alone is worth $2 billion annually and relies on over 1 million honey bee hives for cross-pollination (Ratnieks and Norman, 2010). There are studies reporting that 52 of the 115 leading global food commodities depend on honey bee pollination for either fruit or seed set (Klein et al., 2007).

Managed honey bees are considered ideally suited for the pollination of large monocrop plantings. Subsequently, honey bees are recognized as the most important pollinator for most crop monocultures worldwide (Delaplane and Mayer, 2000; van Engelsdorp & Meixner, 2010).

However, managed honey bee populations are impacted by various and multiple factors including diseases (viral, bacterial, fungal, microsporidial (i.e. *Nosema* spp.), parasites (i.e. *Varroa destructor*), pesticides, predators, pests (i.e. moths), colony collapse disorder (CCD), but also by environment, and socio-economic factors (Morse and Flottum, 1997; Genersch, 2010; van Engelsdorp & Meixner, 2010). Each of these can act alone or in combination, and can adversely affect the productivity and survival of honey bee colonies (Oldroyd, 2007).

Bee colony loss it is a problem that it is reported worldwide (Higes et al., 2010; Lee et al., 2015; Pirk et al. 2009; Smith et al., 2013). Beekeepers knowledge of the common bees diseases and clinical and laboratory bees surveillance in order to prevent infection of new colonies are extremely useful to highlight the factors that lead to honey bee loses (Dumitru et al., 2020). Biosecurity measures in beekeeping and beekeepers knowledge regarding the risk factors are important to prevent possible sources of contamination of honeybees or honey (Borum et al., 2022).

In Romania, beekeeping is common occupation, being considered "national wealth" (Law 383/2013). It is well known the importance of continous monitoring and surveillance to identify risk factors affecting the survival and productivity of managed honey bee colonies in a particular geographical area.
Therefore, a questionnaire-based survey among beekeepers from several counties in Romania was undertaken aiming to identify major causes that lead to honey bees colonies losses and implicitly to the decrease of bee by-products, especially honey production.

MATERIALS AND METHODS

A survey based on a set of 3 questionnaires (A, B, C) elaborated by Romapis (romapis.org) (Federation of Beekeeping Associations from Romania), from which there were selected questions that were relevant to the purpose of this study, was performed. The questionnaires were distributed during of March-May 2023 period, among Romapis members and beekeepers that voluntarily answered to the questionnaires. The tree sets of questionnaires included:

(i) Questionnaire A - with questions for highlighting the management of the apiary and health status of bees:

- How often do you inspect the apiary?
- Extreme weather conditions in 2022?
- Do you keep bees stationary or do you migrate with your bees?
- Do you buy/sell biological materials (queens, bees swarm, bees colonies)?
- Which pathological conditions (diseases, parasites, pests, others) noticed in your colonies in recent year?
- Have you requested consultancy from a veterinarian?
- Have you treated against any disease your apiary or used antibiotics treatments?
- Did you feed your bees (sugar, old honey or proteic food)?
- Do you participate in apicultural fairs, conferences or meetings?
- How many bee colony you had at July 31, 2022 and how many did you have at the beginnig of winter?

(ii) Questionnaire B - on bee products:

- type of flora for harvesting;
- bee-products obtained.

(iii) Questionnaire C:

- movement investigations of bee colonies during 2013-2022.

The questionnaires were collected and answers were introduced into a database using Excel Microsoft spreadsheet software for analysis.

RESULTS AND DISCUSSION

Results

In order to identify risk factors that lead to losses in Romanian bee colonies, a questionnaire based survey was undertaken. For this, a total of 50 beekeepers from 32 localities and five counties (Brasov, Prahova, Giurgiu, Valcea, Ialomita) in Center and Southestern Romania were enrroled in the study.
The main results are presented by each questionnaire, as following.

(i) For the Questionnaire A

- Regarding the apiary's management: of the 50 beekeepers enrolled in the study, the majority (52%; n = 26), answered that they inspect the apiary weekly, while 36% (n = 18) daily, and 12% (n = 6) at more than 2 weeks (Figure 1). Also, 26% (13/50) of the surveyed beekeepers are taking notes in the apiary's notebook.

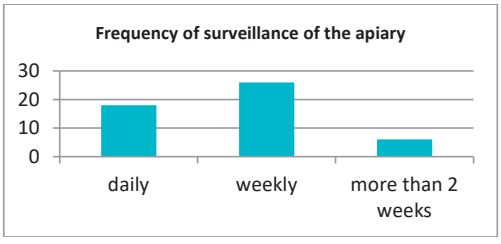

Figure 1. Frequency of surveillance of the apiary (answers from 50 beekepers in five counties from Center and Southern Romania)

- With regards to registering extreme weather conditions in 2022, the following were reported: draught (74%; n = 34), long cold period or rain (50, and strong wind (26%) (Figure 2).

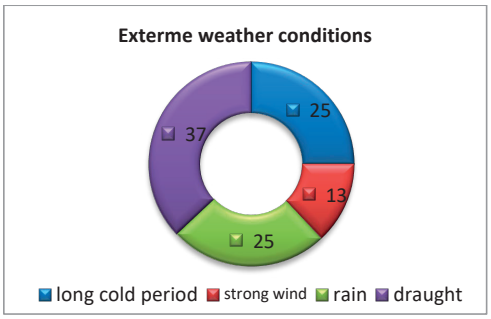

Figure 2. Extreme weather conditions registered in 2022 (answers from 50 beekepers in five counties from Center and Southern Romania)

○ With regards to the beekeeping operational type, 18 beekeepers (36%) were migrating with their bees to other types of harvesting than from the originating area.

○ Another important factor followed was the exchange of biological material (bees, queens, swarms) between apiaries: 32% (n = 16) of the beekepers reported the practice of these exchanges, 62% (n = 31) no practiced, and 3 did not answer.

○ Amongst the pathological conditions notticed in the surveyed apiaries, the most reported was varoosis (80% of the beekeepers noticed it), followed by the wax moth and Chalkbrood/Stonebrood, reported by 29 (58%) and 27 (54%), respectively beekeepers, while other conditions were reported by lower frequency, such as nosemosis (22.0%) or American/European foulbrood (4%). Details are presented in Table 1.

Other pathological conditions (i.e. paralysis, malformations) were observed by 14.0% (n = 7) of the beekeepers.

Table 1. Pathological conditions noticed by beekeepers (number of apiaries)

Pathological condition	American/ European foulbrood	Nosemosis	Varoosis	Galleriosis	Chalkbrood/ Stonebrood
Positive apiaries	2	11	40	29	27
Negative apiaries	41	37	10	18	17
No answer	7	2	0	3	6

○ Collaboration with a veterinarian was mentioned by 31 (62.0%) of the questioned beekeepers, while 12 (34.0%) answered no, and 7 did not answer this question.

○ Honey bee treatments: all of the surveyed beekeepers stated that they used antivarroa treatment, 32% (n = 16) treated for nosemosis. The antibiotic treatment was mentioned by 8% (n = 4) of the beekeepers.

○ Regarding feeding techniques, 41 (82%) of the beekeepers specified that they had to feed the bee families, 31 (62%) of them also using old recovered honey.

○ Assessing the beekeepers level of information concerning good practices in beekeeping, 35 (70.0%) answered that they do participate to bee conferences or beekeeping fairs, while 15 of them had never participated of any instruction regarding apiculture or beekeeping.

○ Regarding the number of colonies monitored on July 31 in 2022, 24 of the 50 surveyed answered, summarizing a total of 2043 colonies, of which 1919 colonies were introduced at winter.

(ii) For the Questionnaire B - on the harvesting flora type and bee-products obtained, answers were collected from 40 apiaries located in two counties (Prahova, n = 16 and Brasov, n = 24).

○ The survey showed that the main type of flora for harvesting was acacia (87.5%), followed by sunflower and rapeseed (about 50%), linden, meadow, others (from 30% to 22%) (Table 2).

Table 2. Harvesting flora type in surveyed apiaries from Central and Southeastern of Romania

Flora type	Number of apiary, by originating county		Total (n = 40)	
	BV*	PH*	No.	%
Acacia	22	13	35	*87.5*
Rapessed	8	10	18	*45.0*
Sunflower	14	*9*	23	*57.5*
Linden	10	*2*	12	*30.0*
meadow	7	*2*	*9*	*22.5*
Others	9	*1*	*10*	*25.0*
Fruit trees	2	1	*3*	*7.5*
Mint	0	*1*	*1*	*2.5*

*BV: Brasov county; PH: Prahova county

○ In terms of bee-by products obtained, other than honey, the most reported were swarms, fertilized queens and wax (Table 3).

Table 3. The bee-by products obtained in the surveyed apiaries, in the 2022 year (stratified by county)

Bee-by product		Honney	Swarms	Fertilized queens	Wax	Propolis	Pollen
Total	**n**	**40**	**27**	**26**	**26**	**19**	**5**
	%	***100***	***67.5***	***65.0***	***65.0***	***47.5***	***12.5***
BV	**n**	24	21	21	17	13	2
	%	*100*	*87.50*	*87.50*	*70.8*	*54.14*	*8.33*
PH	**n**	*16*	*6*	*5*	*9*	*6*	*3*
	%	*100*	*37.5*	*31.3*	*56.3*	*37.5*	*18.7*

(ii) For the Questionnaire C

We investigated the movement of bees colonies during 2013-2022 year and if the beekeepers sold or bought bees families. However, since not all of them recorded those movements in the apiary book, not all 50 beekeepers investigated were able to complete that the questionnaire C; some of them were new beekeepers.

Therefore, the answers were collected from 36 beekeepers, one of them having apiary only since 2022. The details are presented in Table 4.

Table 4. Movement of the bee colonies over the last 10 years (survey of 36 beekeepers) from two counties, Romania

Year		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
No. colonies	BV	792	1024	1087	1249	1570	1706	1660	1811	1974	2014
	PH	610	605	315	701	789	792	810	891	815	1058
No. beekepers	BV	14	14	15	16	18	20	21	21	23	23
	PH	9	9	9	9	9	10	10	11	10	13
	total	23	23	24	25	27	30	31	32	33	36

Discussion

Through this questionnaire based survey aiming for investigating potential causes that lead to honeybees colonies losses and subsequently decrease of bee by-products it was revealed that the apiaries enrolled in the survey were affected by various, commonly reported factors, including management practices, diseases, but also enviromental and climatic conditions. These are in agreement with recent studies reporting on influence of the season and bee technologies on the epidemiology of bee diseases, in Romania (Dumitru et al., 2020).

It is well known that regular apiary surveillance is vital for early detection of any signs of illness. Additionally, implementing a biosecurity plan and keeping records are imperative in preventing colonies loss.

As mentioned, in Romania, beekeeping is a an occupation practiced by most beekeepers in a stationary form, apiaries with 26-76 colonies being the most common, according to data provided in 2016 (romapis.org). This fact was confirmed also in our survey, where 64% of the 50 beekeepers were not migrate with their bees. Beekeeping migration, if the sanitary-veterinary norms in force and good beekeping practices are observed, is very beneficial both for bees and economically, in terms of honey production; also, the mortality is slightly lower than in stationary apiaries (Lee et al., 2015). However, there are some studies that include beekeeping migration in terms of losses in bee colonies (Pirk et al., 2014).

By means of QA we noticed that not all beekeepers implement the rules of biosecurity in beekeeping. This could be also influenced also by the operation type. It is acknowledged that recent data about the operation type in a particular geographical area is of high relevance to better document and identify potential causes of colony losses. In a study, Lee et al (2015) surveying the annual colony losses in the USA, showed that beekepers tend to have different management practicess, according to the by operation type. Therefore, backyard beekeepers tend to be stationary, have fewer colonies, and manage less rigorously (Lee et al., 2015).

Also, the apiary's notebook should also include notes on climatic conditions, as climate changes affect flora and implicitly the bees by decreasing pollen resources and longevity of bee colonies (Jones et al., 2021), as showed also in the present survey.

Extreme weather conditions in the 2022 year in many counties of Romania led to a decrease in honey production by up to 45% acording to ACA, Romanian Beekeepers Association.

Biological material trades are one among the main factors for the emergence and

dissemination of diseases (Mutinelli, 2011), especially if the biological material, mainly queen bees, are not accompanied by health certificates (Borum, 2022).

The main bee pathological conditions, such as nosemosis, varroosis, galleriosis, American/ European foulbrood, Chalkbrood/Stonebrood were reported also in the present survey. Therefore, introduced, monitoring and proper measure for their control, must be implemented, as they can can cause high mortality and subsequently clonoy losses (Mitrea, 2011).

Collaborating with a veterinarian and the request for veterinary services is necessary for the prevention and early detection of any possible bee disease (Kyle et al., 2021).

Sampling and analyzing bees or bee-by products must be part of the biosecurity plan in each beekeeping farm (Mitrea, 2002).

Medicinal residues in honey and hive by-products would be significantly reduced if the treatments instituted were diminished, especially to avoid parasites drug resistance (Mitrea, 2002) a desideratum that can be achieved through beekeepers education (Jacques et al., 2017). In this regards, some reports on essential oils efficacy or other compunds against honey bees nosemosis, due to their antiseptic properties, in order to obtain residue-free bee products (Chioveanu et al., 2004; Dumitru et al., 2017, 2018).

In 2022, long periods of drought were reported, followed by periods of cooler temperatures than the average of 2022. Thus, beekeepers specified that they had to feed the bee families out of necessity, due to lack of harvesting, using old recovered honey this signals another potential factor incriminated in the loss of colonies, by perpetuating certain diseases, such as nosemosis (Dumitru et al., 2018; Salkova et al., 2022).

Beekeeping health status monitoring of the apiaries by implementing good beekeeping practices, declaring and registering with the County animal laboratory and official veterinarians is a moral and legal obligation of apiary owners, due to possible thefts between compliant and unregistered apiaries. All this, along more rigorous information of beekeepers, can greatly reduce losses among bee colonies.

Regarding the number of colonies monitored on July 31, 2022, only 24 of the 50 surveyed answeredș these 24 apiaries belong to the Fagaras Country area; the result showed a loss over 6%. It is well known that documenting colony losses is critical to characterise the losses into broad frame and to identify potential causes of mortality, especially in different areas.

Also from the 40 beekeepers originating form Brasov and Prahova counties we managed to centralize the bee-by products obtained during the studied year (in Questionnaire B). However, Apilarnil and royal jelly, although extremely beneficial to health, were not among the products targeted by beekeepers the surveyed areas.

Refusal to answer regarding the diseases reported in apiaries, along with the confirmation of 30% of beekeepers regarding the fact that they do not participate in beekeeping fairs, conferences or counsels, highlights the fact that the beekeeping sector in Romania still has many gaps in term of biosecurity and good practices in beekeeping, those affecting honey bees colonies.

An increased number of bee colonies in the last decade along with the decrease in honey production shows that the increased density of apiaries for commercial purposes may contributes to the spread of diseases. Recent surveys show an increasing trend in beekeepers number, although bees colonies number worldwide is far from being sufficient to ensure entomophilous cultivated plants areas pollination. Industrial agriculture involves large areas requireing plants pollination, bees providing 80% of their pollination (Borum et al., 2022) in addition to entomophilous plants specific to each area, being ranked as one of the main causes leading to bee colonies loss (Shanahan, 2022).

CONCLUSIONS

The findings of the present study emphasize the importance of continuous monitoring, investigations, and specific control measures to be taken in order to preserve the health and longevity of honey bee colonies. Additionally, it is showed the need for implementing up-to-date information programs regarding beekeeping for beekeepers in Romania.

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