INVESTIGATING THE ROLE OF THE MAIN MELLIFEROUS PLANTS FOR BEEKEEPING IN CORNETU, ILFOV COUNTY

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Abstract. This study describes the results of sowing certain cover crops from a stationary apiary in the Cornetu commune (in the south-west of the Ilfov County, Romania); these are phacelia, buckwheat, white mustard, spring peas, camelina variety - Mădălina and also a mix of seeds specially designed to attract bees favouring pollination. In order to determine the feeding behaviour and the preference of pollen sources by the bee colony, honey plants are identified in the vicinity of the apiary and up to the outskirts of the commune of Cornetu. The honeydew potential of Ilfov County includes several plants from the spontaneous flora which, through nectar secretions, pollen, and even manna secretions, provide bees with the raw material necessary for the maintenance and development of bee colonies. The research work aims to identify the plant species that form the melliferous base of the hive, according to their flowering, the specifics of the plants, of the production of nectar and pollen of the beehive in the conditions of the area, and the beekeeping share of each plant or group of plants. With their flowering period from February to March and until the end of October, these plants from the S-W region of Ilfov County provide a source of food for bee families throughout the active beekeeping season.

Keywords: apiary, agricultural ecosystem, beehive, melliferous plants, rural area, sustainable development.

Rezumat. Investigarea rolului principalelor plante melifere pentru apicultura din comuna Cornetu, județul Ilfov. Prezentul studiu descrie rezultatele semănării unor culturi de acoperire dintr-o stupină staționară situată în comuna Cornetu (în sud-vestul județului Ilfov, România) acestea fiind facelia, hrișca, muștar alb, măzăriche de primăvară, camelina soiul Mădălina dar și un mixt de semințe special concepute pentru atragerea albinelor favorizând polenizarea. Pentru determinarea comportamentului de hrănire și preferința surselor de polen de către colonia de albine, se identifică plantele melifere din vecinătatea stupinei și până la periferia comunei Cornetu. Potențialul melifer a județului Ilfov, cuprinde o serie de plante din flora spontană, care prin secreții de nectar, polen și chiar secreții de mană asigură albinelor materia primă necesară menținerii și dezvoltării familiilor de albine. Lucrarea de cercetare are ca scop identificarea speciilor de plante care alcătuiesc baza meliferă a stupinei în ordinea înfloririi lor, particularități ale plantelor, ale producției de nectar și polen ale stupului în condițiile din zonă și ponderea apicolă a fiecărei plante sau grup de plante. Prin înflorirea din luna februarie-martie și până la sfârșitul lunii octombrie aceste plante din regiunea S-V județului Ilfov furnizează familiilor de albine sursă de hrană pe întreg sezonul activ apicol.

Cuvinte cheie: stupină, ecosistem agricol, stup, plante melifere, zonă rurală, dezvoltare durabilă.

INTRODUCTION

The principle based on the study of the role of the main honey plants for beekeeping is applied with the aim of finding the minimum level of honey development and the most suitable crops with high honey potential, alternatives for continuous development of rural areas (DRĂGAN et al., 2022a). Thus, this improves the principle of ensuring better living conditions for bees in order for them to pollinate, and it raises the general level of the quality of life in the rural community. Practicing these ecological principles, by preserving the balance on the environment, diminishes the negative effects of sowing some agricultural crops of wheat, triticale, peas, sunflower, corn, and rape, by covering the land with other greening crops with melliferous potential such as white mustard, buckwheat, spring peas, phacelia (*Phacelia tanacetifolia*), the Mădălina camelina variety, but also through combinations of seeds between two pollinating crops (for example: camelina + peas; or peas + phacelia).

Honeybees play a vital role in ensuring the balance of the agricultural ecosystem and biodiversity through plant pollination. Spontaneous and cultivated flora is perpetuated by active pollination, with the honeybee being the essential link in the food chain for plant pollination.

Camelina flowers are a very good source of pollen and nectar for honey bees (*Apis melifera* **L.**), which usually need an amount between 100 -250 kg/year/colony (EBERLE et al., 2015). Ecological plants, from the species *Camelina species, C. microcarpa,* and *C. alyssum* are frequently visited by honeybees (SÉGUIN-SWARTZ et al., 2013), and according to the *Canadian Food Inspection Agency* (CFIA 2012), they provide abundant pollen compared to the shepherd's straw (*Capsella bursa pastoris*) a plant with important therapeutic properties. The work published by BERTI et al. (2016) with the title "*Camelina uses, genetics, genomics, production, and management*" mentions camelina crops sown in autumn, but also those in spring, as they provide pollen both for honeybees (*Apis mellifera* L.), as well as for seasonal wild pollinators and between harvesting the main honey plants. Through this research (BERTI et al., 2016), it has been shown that both varieties of camelina crops flower much earlier than soybeans, rapeseed, or oilseed species in the same area. Camelina sown in late autumn generates more pollen (100 kg/ha) compared to rapeseed (*Brassica napus oleifera*) flowers (82 kg/ha) (BERTI et al., 2016).

Rapeseed species (*Brassica napus oleifera and Brassica rapa oleifera*) are valued for their high honeydew potential. The area cultivated with rapeseed placed Romania, in 2020 (*https://insse.ro/cms/sites/default/files/field/publicatii/productia_vegetala_la_principalele_culturi_in_anul_2020.pdf*), in fifth place among the Member States, and

its share in the total area cultivated with rapeseed of the European Union increased by 0.2 percentage points, compared to the previous year. The area cultivated in 2022, compared to 2021, increased in rapeseed according to the Insse.ro study (*http://www.insse.ro/cms/ro/comunicate-de-presa*). Numerous bibliographic references, including SCHOUTEN et al. (2020), mention the importance, from a melliferous point of view, of fruit tree species blooming in the interval between March and April (raspberry, almond, apricot, peach, cherry, sour cherry, plum, hair, apple, and quince), as well as some garden flower species (PĂDUREANU et al., 2020; GARBUZOV & RATNIEKS, 2014) in terms of attractiveness to bees and other insects that visit early blooming flowers: narcissus (*Narcissus sp.*), hyacinth (*Hyacinthus orientalis*) or geranium (*Pelargonium domesticum*).

This study is based on the achievement of some objectives pursued in 2022, for the implementation of the project financed by the Agency for the Financing of Rural Investments - Romania, and the Regional Center for the Financing of Rural Investments 8 Bucharest - Ilfov, Project code: CRFIR-BUCURESTI-ILFOV, no: 16100000011884200019, with the title "*Project for raising the value of beekeeping production through the use of agricultural crops beneficial to bees and pollinators following agro-environmental conditions*" (with the acronym AGROAPIS). Since 2021, the multidisciplinary team of teaching staff and researchers of the University of Agronomic Sciences and Veterinary Medicine in Bucharest runs experiments with the aim of identifying schemes with plants that cover the land and capitalizing on them for the sustainable development of honey crops and later incorporation by mechanical plowing in the field, after the flowering period, estimated between the end of October and the middle of November (DRĂGAN et al., 2022a; b).

The correct application of cover crop rotation practices consists in developing soil microbial communities and ensuring its nutrient cycle (ROMDHANE et al., 2019). This agricultural practice aims to improve sustainable agriculture and support rural ecosystem services (SCHIPANSKI et al., 2014; GROFF et al., 2015). The development of rural areas through bee colonies and pollination activities will ensure the balance of the agricultural ecosystem in order to preserve environmental resources.

This paper integrates both the proposals and the development objectives proposed to the partners involved in the project (beekeepers and farmers, but also the rural society), as well as the results of our research on the territory of the basic apiary in order to ensure territorial balance. Thus, correlated with the objectives of the previously mentioned project, the personal contributions of the research reported in this paper refer to the area of experience studied (the basic apiary with the neighborhoods of the commune of Cornetu, Ilfov County), with the following elements:

a.) the geographical location of the commune of Cornetu where the experimental apiary is located;

b.) vegetation structure;

c.) the number of bee families in the community;

d.) the floristic composition of the South-West area of Ilfov County;

e.) the plant species that make up the melliferous base of the apiary in the order of flowering with their particularities;

f.) data related to the production of hive products in the conditions of the area and the bee weight of each plant or group of plants;

g.) biochemical analysis and soil structure in the apiary.

The idea of this research was based on the fact that, through knowledge of the honeydew flora in the area, contributions can be made to identifying the diversity of honeydew plants available for beekeeping activities during the dry and rainy seasons of the year in the South-West region of Ilfov County.

MATERIAL AND METHODS

- *The geographical location of the experience area.* The Ilfov County is located exclusively in the plain area, with an altitude between 50 and 120 m belonging (in whole or in part) to the subunits of the Vlăsia Plain (portions of the Snagov, Movilita, Câlnău plains, as well as all of the Bucharest Plain) with large inter-rivers (48 km), provided with roofs, hills, valleys, lakes. (GHINEA, 2002). The commune of Cornetu is located in the southwest of the Capital, on both sides of DN 6, Bucharest – Alexandria Road, at a distance of 11 km from Bucharest. The commune borders the localities of Clinceni, Bragadiru, Măgurele, and Mihăilești, Giurgiu County. Location and GPS coordinates (in WGS84 system) Latitude, Longitude: 44.35, 25.95 = in decimal degrees, 44° 21' 0", 25° 56' 59.9994" = in degrees minutes seconds (Fig. 1).
- *Relief and vegetation structure*. The commune of Cornetu occupies exclusively the plain area, with an altitude between 50 and 120 m, belonging entirely to the Bucharest Plain, where the Argeș River stands out. At the exit from the locality we can find the the Cornetu - Mihăilești reservoir, which occupies an area of 321 hectares in the territory of the Cornetu locality. The villages of Cornetu and Buda are located on an important communication route between Bucharest and the Danube, respectively the road that connects the Capital with the cities of Giurgiu. The climate is temperate-continental with excessive nuances, with hot and dry summers and cold winters, dominated by the frequent presence of cold continental air masses from the East, or Arctic from the North and strong winds that blow snow, and the average annual amount of precipitation is 460-500 mm. Summers are hot with a pronounced arid continental character, with average temperatures of 20°C - 23°C. (GHINEA, 2002).

The basic apiary in Cornetu, as indicated in Figure 1, has a population of 25 bee families, horizontal hives, with a capacity of up to 20 frames 1/1. The apiary is of a stationary type located outside the built-up area with a large proportion of spontaneous vegetation. According to the letter no. 4 dated 21.03.2023, the Village Hall of Cornetu communicates the existence of a number of 15 beekeepers and 340 families of bees owned by them within the radius of the locality.

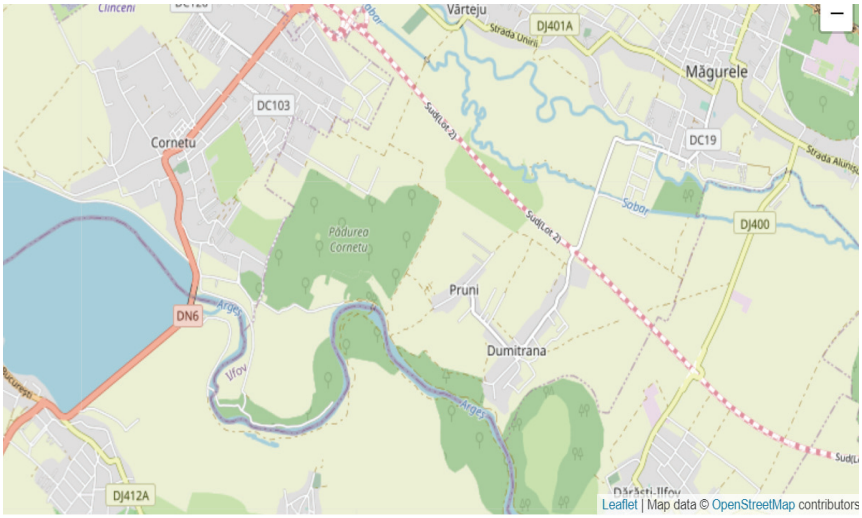

Figure 1. The basic apiary in the commune of Cornetu, located in the S-W of Ilfov County, on the left bank of the Argeș River (where it forms the Mihăilești reservoir, Giurgiu County) on the banks of the Sabar River, (source: website accessed on 4.03.2022, https://satellites.pro/Google_plan/Cornetu_map.Ilfov.Romania).

The results of the 2021 Population and Housing Census of Cornetu (RPL2021) showed an increase in the value of the resident population of approximately 16.84% compared to 2011, from 6,324 inhabitants to 7,389 inhabitants. (*https://www.primariacornetu.ro/comuna-cornetu/date-demografice/*). The locals are mainly engaged in agricultural activities of cultivating ornamental plants, as they are some of the main suppliers of the traders in the George Coșbuc flower market in Bucharest, sector 5, medicinal and leguminous plants. The forest around the commune offers a favourable environment for beekeeping. In this sense, to complete the information from this study, interviews were conducted with the 15 beekeepers in the area, with an argument for the implementation of this apiary development concern being the abundance of nectar and pollen in the months of March - June. Hives are stationary. The maximum number of bee families owned by a single beekeeper is about 40 hives. At the same time, it should be mentioned that pastoral beekeeping is not practiced in the Cornetu area.

- *Study of the floristic composition of the South-West area of Ilfov County and the plant species that make up the honey base of the apiary.* The flowering calendar of honey plants was drawn up based on our own study and the information obtained through interviews with beekeepers in the area. In addition, several bibliographic sources were consulted to confirm the flowering biology of important honey plants. Based on the data recorded in the field, a calendar will be compiled with records from the database of the global information network on biodiversity in the Cornetu area. The floral calendar resulting from the research will be made available to the local authorities, in order to inform beekeepers and farmers, to understand how directed sowing can be carried out, and also to determine the appropriate flora to increase flower production in periods of acute shortage of food for local bees.

The duration of the flowering interval (days) recorded for each plant species was classified based on the specificities of the agroclimatic conditions seen in the region (temperature variations, persistence of dry wind, rainy season period). These peculiarities encountered in different seasons also correspond to different stages of the local beekeeping cycle, such as harvest (May to June), post-harvest (June to September), and wintering periods (October to December).

- *Biochemical analysis and soil structure in the apiary*. Since the soil is an important element of the agroecosystem, agricultural lands are vulnerable to climate change, the increase or decrease of soil water deficit, depending on the duration of the drought in the atmosphere and the concrete properties of the soil such as texture, structure, compaction, porosity, and content of organic matter (DRĂGAN et al., 2022a). In 2021, the year before the initiation of the experiments reported in this paper, soil analyses were carried out in the basic apiary located in the Cornetu commune.

20 samples were taken according to the protocol provided by the soil analysis laboratory. The agrochemical analyses were carried out by ALCHIMEX S.A., a soil analysis laboratory in Heresti, Giurgiu County. Thus, before the actual sampling, the land surface was cleaned to a depth of 2-3 cm to remove organic remains (straw, cobs, roots, leaves, etc.). For the collection of soil samples, a container of approximately 100 - 200 ml was used, in order to fill it with the crushed earth. The soil thus sampled was collected in plastic bags and labeled. Through previous studies carried out by DRĂGAN et al. (2022b), it was found that, due to the replacement of perennial vegetation with annual vegetation in the rotation scheme, the organic substances at the soil surface decreased significantly. In figure 2, the soil samples from the laboratory can be seen.

Figure 2. Examination of soil samples in the laboratory (own source).

RESULTS AND DISCUSSIONS

According to the studies carried out by SCHOUTEN et al. (2020), the development of bee families, in the spring season, and their maintenance at a high biological and productive level requires the existence of a honey base to ensure the collection of nectar and pollen throughout the beekeeping season.

Through the data-gathering investigation related to the production of beehive products, it emerged that under the conditions analysed in the commune of Cornetu, this beekeeping business is currently practiced by men. These local beekeepers are aged between 40 and 80 years, and most of them have the social status of retired persons, practicing beekeeping as a family occupation, with the investment in artificial bee food of less than 10%. Of the 15 beekeepers declared by the Agricultural Register department of the Cornetu Village Hall, only 5 have studied in the field of beekeeping. The other 10 are trained by other rural beekeepers directly in the basic apiary, having minimal knowledge of modern beekeeping. Beekeepers keep apiaries close to residential areas and agricultural land, with easy access to daily beekeeping work.

Following the data taken from the local beekeepers, we concluded that most of them face, in the basic beehives, an attack by the *Varrooa destructor* (Anderson & Trueman). BARACCHI et al. (2012), also found, through their studies, that the attack of this external mite parasite on honeybees is limited if time is allocated to the daily care of the colonies by the beekeeper at the hive. Cleaning infested bees from the entrance to the hive ensures good hygiene for the colony.

Picking plants from the spontaneous flora targeted by bees in the apiary location

Following observations on the plant species that make up the honey base of the apiary in the order of flowering with their particularities, we have seen that the honey base in the commune of Cornetu, located in the South-West of the Ilfov county, is made up of cultivated plants, fodder crops, fruit trees, and shrubs, forest honey plants and honey plants specially cultivated for the maintenance of the apiary collection.

The share of forest vegetation is made up of deciduous species, such as: oak (*Quercus robur*), cerris (*Quercus cerris*), elm (*Ulmus carpinifolia*), hornbeam (*Carpinus betulus*), Tatar maple (*Acer tataricum*) and acacia (*Robinia pseudacacia*). The subtree of these forests consists of horn (*Cornus mas*), blackthorn (*Prunus spinosa*) (Fig. 3 a; c), hawthorn (*Crataegus monogyna*), dogwood (*Lygustrum arvense*), and rose hip (*Rosa canina*), etc. Among the illustrations inserted in figure 3 b, some of the perennial decorative garden plants can be observed: the cock's foot (*Ranunculus asiaticus*), the primrose (*Primula spp.),* the lungwort (*Pulmonaria officinalis*), the narcissus (*Narcissus*) and the hyacinth (*Hyacinthus orientalis*).

a.) *b.)* *c.)*

Figure 3. Representations of the species in bloom in March 2023, on the area of the commune of Cornetu, a.) fruit tree, b.) decorative garden plants, c.) forest vegetation (our own source).

The spring flowering species, which at the time of flowering form actual carpets in the forest areas but also in the gardens, are represented by: *snowdrops (Galanthus nivalis), alpine squill (Scilla bifolia), sweet violet (Viola*

odorata), Hollowroot (Corydalis cava), lily-of-the-valley (Convallaria majalis). The harvested honey is used for own consumption and free trade (*https://romaniadategeografice.net/unitati-admin-teritoriale/judete/judete-i/ilfov/*).

Through these studies, we want to adapt and inform farmers and beekeepers about their energy intake. Among the honey plants especially cultivated for the maintenance of the beehive collection we mention white mustard (*Sinapis alba*), phacelia (*Phacelia tanacetifolia*), buckwheat (*Fagopyrum esculentum*), spring peas (*Vicia sativa*), and the Mădălina camelina variety (*Camelina sativa*), notable for its abundant secretion of pollen and nectar throughout the flowering period, which are not common in honey cultivation in Romania.

The "cover crops" principle will be applied to the surfaces considered in the study, for maintain in the permanently green condition, without black soil periods, not covered by vegetation in order to obtain green fertilizers. By keeping the soil green, one aims at improving fertility and being able to obtain high yields. The application of green fertilizers increases the synthetic fertility indicator, enriches the amount of macro and microelements, increases the humus content, and improves soil respiration potential and enzyme activity.

Green fertilizers in the form of "cover crops" improve all the ecological and biological functions of the soil, ensuring nutritional balance and the durability of crops. On the soil permanently covered with the 5 plants related to the project: spring peas, the Mădălina camelina variety, phacelia (*Phacelia tanscetifolia*), buckwheat, and mustard, weeds are destroyed by the suffocation effect.

Figure 4 graphically illustrates the share of soil supply determined in the analysed samples, in macro and microelements. It was appreciated that, at the level of the taken samples, this supply is good with nitrogen, phosphorus, very good supply with potassium, magnesium, sulfur, iron, copper, zinc, organic carbon, with humus, and the reaction of the soil is weakly alkaline.

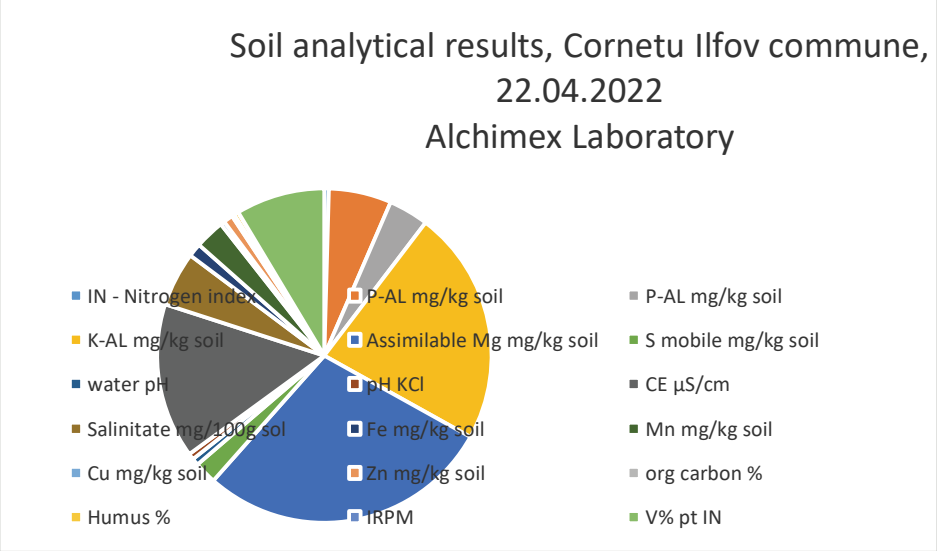

Figure 4. Results obtained from the pedological determinations carried out on the soil samples taken from the commune of Cornetu, Ilfov.

On March 10, 2022, mechanized processing activities were carried out on the plots with conventional crops in the base apiary located in the commune of Cornetu, to loosen the soil. Figure 5 shows the plowing works carried out on July 12, 2022, with the aim of preparing the soil for the sowing of buckwheat, chickpeas, mustard, phacelia (*Phacelia tanscetifolia*) and camelina (*variety Mădălina*). These crops ensured the pollen and nectar of the bee colonies throughout the dry period of autumn 2022 in the commune of Cornetu.

In order to achieve the study's objectives, the monitoring of the annual climate variations at the base apiary in the commune of Cornetu, Ilfov county was also considered. The precipitation diagram for Cornetu shows how many days per month a certain amount of precipitation is reached (Fig. 6). ***Meteoblue*** climate charts are based on 30 years of hourly simulations of weather patterns and are available for every place on Earth.

They provide good indications of typical climate patterns and expected conditions (temperature, precipitation, insolation and wind). (*Source- https://www.meteoblue.com/ro/vreme/ historyclimate/climatemodelled/cornetu_rom%C3%A2nia_680754*). The simulated weather data has a spatial resolution of approximately 30 km and may not reproduce all local weather effects such as storms, local winds or tornadoes, and local differences as they occur in urban, mountainous, or coastal areas. July is the hottest month of the year in Cornetu commune. According to the climate data recorded on the seeding date (July 12, 2022), at the base apiary in Cornetu, the temperature was 13°C at night with sporadic clouds and with slight wind intensifications.

Figure 5. Plowing works on March 10, 2022, Cornetu base apiary; Works to arrange in the furrow of the land prepared for sowing July 12, 2022; Greening Culture August 15, 2022. (own source).

Works to arrange in the furrow of the land prepared for sowing July 12, 2022; Greening Culture August 15, 2022.

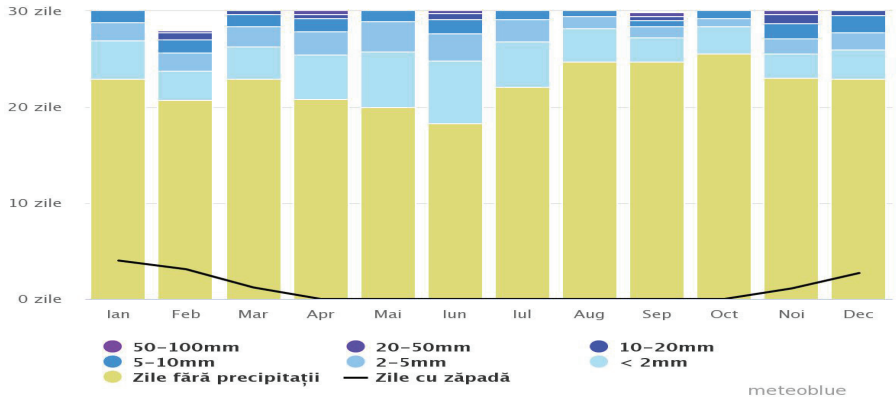

Figure 6. Precipitation graph in 2022, Cornetu commune, Ilfov, accessed 12.03.2022 (original).

The recorded results ensured that the buckwheat crop gave very good results taking into account the dry period from the second half of July and the first part of August 2022. The mustard crop had a good evolution compared to 2021, and the chickpea crops of spring and phacelia (*Phacelia tanscetifolia*) sown in the second period of July 2022 remained in the vegetation stage without open flowers. For camelina culture, the results recorded at the level of inflorescence development were satisfactory. These crops with high honeydew potential are sown in July in order to ensure the maintenance of honeydew harvest after the sunflower harvest for the August - September - October period.

The temperature in September - October 2022 was around 20 - 25°C during the day and around 3 - 6 degrees at night (*https://vremea.ido.ro/Cornetu~680749.htm*). The high temperatures recorded provided bee families with an abundant collection of nectar and pollen in order to form the fat body necessary for the winter period. Protein food is the food from whose component the bee extracts substances that will enter into the composition of its body, respectively will act in the formation of its cells, tissues, and organs. The essential content of pollen is proteins, hence the name of protein food. This study has the role of supporting the beekeeping sector by raising the values of beehive products, by using agricultural crops beneficial to bees and pollinators in accordance with agro-environmental conditions.

To assess the honeydew value of plants sown in the base apiary on July 12, 2022 as pollinator plants for bees, observations were made on the flowering of plots sown in the base apiary as well as the behaviour of bees that collected pollen and nectar from buckwheat (*Fagopyrum esculentum*), mustard (*Sinapis alba*) and camelina (*Camelina sativa*) plots. Buckwheat samples were determined in order to evaluate honeydew potential. The determination of the amount of nectar secretion accumulated within 24 hours in 50 flowers/inflorescence (mg) was made by the capillary method, the determination of the sugar concentration (%) of the nectar collected from the 50 flowers/inflorescence with the help of the refractometer was done according to the previously described procedure (DRĂGAN et al., 2022 b). Pollen and honey samples were taken for determining the degree of visitation of buckwheat and mustard flowers. The maximum densities of buckwheat and mustard flowers were about 2 000, 4 000 and 3 000 flowers/m2 and the maximum density of bees > 20 bees/m2. In 5 days of observation at the hive, days from August and September, feeding started between 05.00 and 07.00 and stopped between 19.00 and 21.00. Plots sown in early July 2022 flowered from early September to late November, plots sown with phacelia and spring peas did not flower. The cause of this negative result is due to the long periods of drought recorded during 2022.

According to the cultivation requirements, mentioned in the specialized literature, (BACQ-LABREUIL et al., 2019), phacelia and spring peas seeds need precipitation, as germination is carried out at a temperature of 7°C - 20°C. Since drought manifests itself more and more aggressively in the area of the Ilfov County, the camelina culture (*Camelina sativa*) had a good evolution in the climatic conditions of 2022, as the flowers bring a substantial supply of nectar and pollen to the food of the bees (Fig. 7). Crops written staggered flowering over 2-3 weeks, from February-March to the end of October.

Fig. 7. Camelina culture (*Camelina sativa*), *at the beginning of flowering in* the Cornetu base apiary (date October 10, 2022; own source).

With this choice of growing camelina, we appreciate that it can be an opportunity for farmers, especially since this plant is not at all demanding in terms of soil or weather conditions. This crop is very suitable for organic farming, ensuring the benefits of sustainable agriculture for farmers and various processing industries. The introduction of camelina (*Camelina sativa*) biomass into the soil is also beneficial through the reactivation of some mineral substances according to specialized literature (DOBRE et al., 2014).

CONCLUSIONS

The identification of nectar and pollen sources, the flowering time, and the criteria in the vicinity of the basic apiary in the commune of Cornetu (Ilfov County) contributed to ensuring a life cycle by maintaining bee colonies in perfect health and food during the drought period of the months of July – September. Thus, alongside the spontaneous vegetation found by bees in the commune of Cornetu, Ilfov County, experimental honeybee potential cultures were established in the basic apiary for the purpose of using the nectar taken from the flowers with staggered flowering for 2-3 weeks, from February-March until the end of October. The present research aimed to contribute directly and indirectly to increasing the productivity and sustainability of modern agriculture. Directly, because it contributes to improving and maintaining the health of bee colonies and to reducing bee colony losses during the winter, contributing again to better sustainability of their numbers and efficient use of resources. Indirectly, through stronger and healthier bee colonies and a more sustainable beekeeping sector, there will be a sufficient number of colonies per unit of agricultural land (km²) and, therefore, the productivity of the agricultural farm will increase.

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