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THE MELLIFEROUS BASE IN THE CISNĂDIOARA AREA, SIBIU COUNTY, ROMANIA AND ITS IMPORTANCE IN HONEY PRODUCTION

Iuliana ANTONIE

"Lucian Blaga" University, The Faculty of Agricultural Sciences, Food Industry and the Protection of the Environment, Sibiu, 7-9 Dr. Ion Raţiu, 550012, Sibiu, Romania, Phone: +40 269 211338, Fax: + 40 269 213381, E-mail: iuliana_antonie@yahoo.com

Corresponding author: iuliana_antonie@yahoo.com

Abstract

In order to increase beekeeping, a more detailed research of the honey flora is needed. The purpose that our study undertakes is the identification of plants with honeybee potential in the Cisnădioara area (Sibiu county), as well as the enrichment of knowledge on the honeybee floristic structure of the whole county. To achieve this goal, we used: bibliography, direct sampling of plants, photographs and discussions with local beekeepers. The study was finalized with drawing up a compiling list of plants with a melliferous potential in this zone. 38 botanical families and 117 species with a melliferous potential were identified and arranged into three groups related to their melliferous weight: a high, a medium and a low economical beekeeping weight. The absence of the plants with a very high economical beekeeping weight is highlighted. This fact determines the beekeepers in the studied area, to practice pastoral beekeeping, at large distances, in order to have an important honey production.

***Key words*:** *plants with melliferous potential, Cisnădioara, Sibiu county, Romania*

INTRODUCTION

The Melas-Bee, an amazing and unique creature! In antiquity it was considered a present from the Gods. In the lengthways of time the bee was regarded as being "the one animal sent by Divinity". In England it is said that the history of the bee is the history of mankind. It offered food to Gods and to the people. It was the substance of a mythological cycle known in all Greek world. It followed the human being even beyond death offering mankind the material for embalmment. The golden colour of honey was given as name to the rocks of one Mediterranean Island, that received the nickname "The Island of Honey" (Malta). The bee appears on the currency of some states, as a socio-economical model to be followed. The ethological studies about bees awarded scientists with the Nobel Prize. The bee as a symbol was even imprinted on the Imperial Mantle. The organization and the structure of the bee family was studied by the social sciences further taken as a model by the human society. The bee was and is till this present day a subject for the handbooks, treatises, encyclopaedias. It fascinates the writers who "praise" it in their literary works. The genetics even introduced it for a study of the ginormous. Honey production supports the food, cosmetic and medical- sanitary industries.

A source for legends and myths, the bee accompanied mankind by bringing special moments of peace and serenity. The magic of beekeeping gives the man at the "end" of his career, the feeling of reconciliation with nature and divinity.

The binomial bee-melliferous flora exists since forever meaning since the appearance of the flowering plants, about 200 million years ago [9]. Since then, it proceeds under the "sine qua non" meaning under the reciprocity sign. The melliferous flora offers the bee the raw material in return the bee offers pollination to the flora. One without the other would not exist.

The abundance of the flora in our country, inspired Pope John Paul the II-nd to call it: "The Holy Virgin's Garden".

As early as antiquity, Herodot mentioned that the lands beyond the Istru cannot be easily crossed because of the swarm of bees. Therefore, the abundance of the melliferous

plants is asserted. This fact is confirmed by Xenophon and later by the geographer and historian Polibius of Megalopolis and by the naturalist Claudius Aelianus. Also, Xenophon mentioned that the food of Getas consisted primarily of honey, vegetables, and milk products [8]. Nowadays, on the territory of Romania country are more than 11 million ha. with melliferous flora that assure the existence of more than 1.7 million bee families. These have at their disposal both the agricultural surfaces and forests, grasslands, and hay fields [1]. Beekeepers remarked the fact that bees prefer the melliferous flora that contains the principles of the medicinal flora.

The quality of honey from our flora was always appreciated on European level, and it incited the interest of coterminous imperial countries and commercial traders alike.

The present study has as purpose the identification of the melliferous flora from Cisnădioara area and the completion of the data base regarding the melliferous potential of the flora in Sibiu County. Currently, the plants with melliferous potential are studied, known, protected, and cultivated more on larger surfaces. These achievements lead to the knowledge and the conservation of the biodiversity, that implies the important of harvests and production.

MATERIALS AND METHODS

The research was carried out in Cisnădioara and its surroundings (Sibiu county), 10 km away from Sibiu municipality. The settlement is situated on a slope of the Subcarpathian hills, with a rich vegetation. The studied area presents both advantages and drawbacks.

1. Some advantages are: the presence of the forests near the settlement. This represents, during the springtime, an important source of pollen. After the exhaustion of this source, the cherry tree blossoms (*Cerasus avium* L.) and the hawthorn (*Crataegus monogyna* Jacq.) as well. At the same time the hayfields flora blossoms. All these harvests are good for the maintenance and development of the bee families and their preparation for the next important harvest.
2. The drawbacks in this area consists in a high number of beehives and the proximity of hearths belonging to the owners as a result of the land ownership right. Thus, there are sometimes deficiencies in the optimal load of a bee family per unit area and animosity among beekeepers. The current norms recommend 100 bee families per 5 km^2, unlike in the studied area where the number of bee families exceeds 5 times the norm [10].
3. Another problem faced by beekeepers in the area is the intense spraying on farms that does not take into account the location of the hearths.

The study of the melliferous flora was carried out in two major parts:

-The first and most important was the use of data from specialized literature.

-The second part implied the field research, observation and identification of melliferous species; collection of melliferous plants; taking photos and additional discussions with the beekeepers from area were led.

-The study was carried out during the period 2019-2020;

-Resources from specialized literature contributed in the identification of the flora in the laboratory [2, 7, 11-15, 20].

RESULTS AND DISCUSSIONS

The beekeepers in order to obtain a rich and diversified production must apply in the apiary a set of modern technologies for breeding and developing of the bee families. Moreover they must be connoisseurs of the melliferous plants thus recognising their specific features and qualities. Cisnădioara is a part of the 30 localities in Sibiu County that have been very well investigated concerning their botanical features disposing of an almost complete inventory of flora made by researchers from the Natural History Museum in Sibiu and their collaborators [3-5, 16-19].

After the floristic study in this area, based on the specialized literature and own observations in the field, 72 families of plants with 526 species were identified. Containing a melliferous potential in the Cisnădioara areal only 117 taxons in 38 botanical families were highlighted (Table 1).

Table 1. The melliferous potential of the flora from Cisnădioara

Nr. crt.	Family	Species	Beekeeping weight
1	Cupressaceae	*Juniperus communis* (L.)	Little
2	Berberidaceae	*Berberis vulgaris* (L.)	Medium
3	Ranunculaceae	*Anemone ranunculoides* (L.)	Medium
4		*Caltha palustris* (L.)	Medium
5		*Clematis vitalba* (L.)	Medium
6	Papaveraceae	*Chelidonium majus* (L.)	Little
7		*Corydalis solida* (L.)	Medium
8		*Chelidonium majus* (L.)	Little
9		*Corydalis solida* (L.)	Medium
10	Fagaceae	*Fagus sylvatica* (L.)	Medium
11		*Quercus petrea* (Mattuschka)	Medium
12		*Quercus robur* (L.)	Medium
13	Betulaceae	*Alnus glutinosa* (L.)	Medium
14		*Alnus incana* (L.)	Medium
15	Corylaceae	*Corylus avellana* (L.)	Medium
16	Polygonaceae	*Polygonum aviculare* (L.)	Little
17	Rosaceae	*Cerasus avium* (L.)	Medium
18		*Crataegus monogyna* (Jacq.)	Medium
19		*Filipendula ulmaria* (L.)	Medium
20		*Filipendula vulgaris* (Moench.)	Little
21		*Fragaria vesca* (L.)	Little
22		*Fragaria viridis* (Weston)	Medium
23		*Potentilla alba* (L.)	Little
24		*Potentilla reptans* (L.)	Little
25		*Prunus spinosa* (L.)	Medium
26		*Rosa arvensis* (Hudson)	Medium
27		*Rosa canina* (L.)	Medium
28		*Rubus idaeus* (L.)	Large
29		*Sorbus aucuparia* (L.)	Medium
30	Fabaceae	*Lotus corniculatus* (L.)	Medium
31		*Medicago falcata* (L.)	Medium
32		*Medicago lupulina* (L.)	Medium
33		*Trifolium campestre* (Schreber)	Medium
34		*Trifolium dubium* (Sm.)	Medium
35		*Trifolium medium* (L.)	Medium
36		*Trifolium pannonicum (*Jacq.)	Medium
37		*Trifolium pratense* (L.)	Medium
38		*Trifolium repens* (L.)	Large
39		*Vicia sepium* (L.)	Medium
40	Thymelaeaceae	*Daphne mezereum* (L.)	Medium
41	Cornaceae	*Cornus sanguinea* (L.)	Medium
42	Rhamnaceae	*Frangula alnus* (Miller)	Medium
43		*Rhamnus cathartica* (L.)	Medium
44	Aceraceae	*Acer campestre* (L.)	Medium
45		*Acer platanoides* (L.)	Medium
46		*Acer pseudoplatanus* (L.)	Medium
47	Geraniaceae	*Geranium pratense* (L.)	Medium
49	Apiaceae	*Angelica sylvestris* (L.)	Medium
50		*Anthriscus cerefolium* (L.)	Little
51		*Astrantia major* (L.)	Little
52		*Chaerophyllum aromaticum* (L.)	Little
53		*Daucus carota* (L.)	Medium
54		*Heracleum sphondyllium* (L.)	Little
55		*Pimpinella saxifraga* (L.)	Little
56	Tiliaceae	*Tilia platyphyllos* (Scop.)	Large
57	Violaceae	*Viola ambigua* (Waldst. et Kit.)	Medium
58		*Viola canina* (L.)	Medium
59		*Viola adorata* (L.)	Medium
60	Brassicaceae	*Cardamine pratensis* (L.)	Little
61		*Lunaria rediviva* (L.)	Medium
62	Resedaceae	*Reseda lutea* (L.)	Medium
63	Salicaceae	*Populus tremula* (L.)	Medium
64		*Salix caprea* (L.)	Large
65		*Salix cinerea* (L.)	Large
66	Ericaceae	*Vaccinium myrtillus* (L.)	Medium
67		*Vaccinium vitis-idaea* (L.)	Medium
68	Primulaceae	*Primula veris* (L.)	Medium
69	Apocynaceae	*Vinca minor* (L.)	Little
70	Oleaceae	*Fraxinus excelsior* (L.)	Medium
71		*Ligustrum vulgare* (L.)	Medium
72	Boraginaceae	*Cerinthe minor* (L.)	Medium
73		*Echium vulgare* (L.)	Little
74		*Myosotis sylvatica* (Ehrh.)	Medium
75	Verbenaceae	*Verbena officinalis* (L.)	Medium
76	Lamiaceae	*Ballota nigra* (L.)	Medium
77		*Glechoma hederacea* (L.)	Medium
78		*Glechoma hirsuta* (Waldst.)	Medium
79		*Lamium album* (L.)	Medium
80		*Lamium maculatum* (L.)	Medium
81		*Leonurus cardiaca* (L.)	Medium
82		*Melittis melissophyllum* (L.)	Medium
83		*Mentha arvensis* (L.)	Large
84		*Mentha longifolia* (L.)	Medium
85		*Origanum vulgare* (L.)	Medium
86		*Prunella vulgaris* (L.)	Medium
87		*Salvia verticillata* (L.)	Medium
88		*Stachys germanica* (L.)	Medium
89		*Stachys sylvatica* (L.)	Medium
90		*Teucrium chamaedrys* (L.)	Medium
91		*Thymus glabrescens* (Willd.)	Medium
92	Scrophulariaceae	*Linaria vulgaris* (Miller)	Medium
93		*Scrophularia nodosa* (L.)	Medium
94		*Verbascum lychnitis* (L.)	Medium
95		*Verbascum phlomoides* (L.)	Medium
96		*Veronica officinalis* (L.)	Medium
97		*Veronica orchidea* (Crantz)	Little
98	Rubiaceae	*Galium verum* (L.)	Little
99	Caprifoliaceae	*Viburnum lantana* (L.)	Medium
100	Valerianaceae	*Valeriana officinalis* (L.)	Medium
101	Dipsacaceae	*Scabiosa ochroleuca* (L.)	Medium
102	Asteraceae	*Arnica montana* (L.)	Little
103		*Bellis perennis* (L.)	Medium
104		*Centaurea jacea* (L.)	Medium
105		*Cichorium intybus* (L.)	Medium
106		*Echinops sphaerocephalus* (L.)	Medium
107		*Eupatorium cannabinum* (L.)	Medium
108		*Inula conyza* (DC.)	Little
109		*Solidago virgaurea* (L.)	Medium
110		*Taraxacum officinale* (Weber)	Medium
111		*Tussilago farfara* (L.)	Little
112	Liliaceae	*Gagea lutea* (L.) Ker.-Gawl.	Medium
113		*Lilium martagon* (L.)	Medium
114		*Ornithogalum umbellatum* (L.)	Medium
115	Amaryllidaceae	*Galanthus nivalis* (L.)	Medium
116	Orchidaceae	*Orchis morio* (L.)	Medium
117		*Orchis ustulata* (L.)	Medium

The source: [5].

Three botanical categories are highlighted by the analysis of the data from Table 1 concerning the number species/families:

-Well represented botanical families are: *Lamiaceae* with 16 species, *Rosaceae* 13 species, *Fabaceae*, and *Asteraceae* with 10 species, *Apiaceae* 7 species, *Scrophulariaceae* with 6 species, *Papaveraceae* with 4 species.

-The botanical families represented by a small number of species are: *Ranunculaceae*, *Fagaceae*, *Aceraceae*, *Violaceae*, *Salicaceae*, *Boraginaceae*, *Liliaceae* each of them with 3 species; *Betulaceae, Rhamnaceae*, *Brassicaceae*, *Ericaceae, Oleaceae*, *Orchidaceae* with 2 species per family.

-The botanical families represented only by a single species: *Cupressaceae*, *Berberidaceae*, *Corylaceae*, *Polygonaceae*, *Thymelaeaceae*, *Cornaceae*, *Geraniaceae*, *Tiliaceae*, *Resedaceae*, *Primulaceae*, *Apocynaceae*, *Verbenaceae*, *Rubiaceae*, *Caprifoliaceae*, *Valerianaceae*, *Dipsacaceae*, *Amaryllidaceae* (Table 2).

Table 2. The list of botanical families, the numerical and relative abundance of the species with a melliferous potential in the Cisnădioara area (Sibiu County)

Nr. crt.	Family	the numerical Abundance	the relative Abundance (%)
1	*Cupressaceae*	1	0,85
2	*Berberidaceae*	1	0,85
3	*Ranunculaceae*	3	2,56
4	*Papaveraceae*	4	3,41
5	*Fagaceae*	3	2,56
6	*Betulaceae*	2	1,70
7	*Corylaceae*	1	0,85
8	*Polygonaceae*	1	0,85
9	*Rosaceae*	13	11,11
10	*Fabaceae*	10	8,54
11	*Thymelaeaceae*	1	0,85
12	*Cornaceae*	1	0,85
13	*Rhamnaceae*	2	1,70
14	*Aceraceae*	3	2,56
15	*Geraniceae*	1	0,85
16	*Araliaceae*	1	0,85
17	*Apiaceae*	7	5,98
18	*Tiliaceae*	1	0,85
19	*Violaceae*	3	2,56
20	*Brassicaceae*	2	1,70
21	*Resedaceae*	1	0,85
22	*Salicaceae*	3	2,56
23	*Ericaceae*	2	1,70
24	*Primulaceae*	1	0,85
25	*Apocynaceae*	1	0,85
26	*Oleaceae*	2	1,70
27	*Boraginaceae*	3	2,56
28	*Verbenaceae*	1	0,85
29	*Lamiaceae*	16	13,67
30	*Scrophulariaceae*	6	6,12
31	*Rubiaceae*	1	0,85
32	*Caprifoliaceae*	1	0,85
33	*Valerianaceae*	1	0,85
34	*Dipsacaceae*	1	0,85
35	*Asteraceae*	10	8,54
36	*Alliaceae*	3	2,56
37	*Amaryllidaceae*	1	0,85
38	*Orchidaceae*	2	1,70
Total		117	100%

Source: Own calculation.

The beekeeping weight of each honey plant is given by the harmony of a number of factors including: the time and duration of flowering, nectar-pollinating effectiveness, the extent of the land occupied by each taxon, whether it is part of the wild or cultivated flora [6]. The analysis of this complex of factors on the territory of our country determined the grouping of melliferous resources in terms of importance for beekeeping in: very high beekeeping plants, high beekeeping plants, medium beekeeping plants, low beekeeping plants, plants without economic-beekeeping weight.

The total of 117 species of plants with a melliferous potential in Cisnădioara area and surroundings are divided into three groups:
-The species with a high economical beekeeping weight and a high melliferous potential: *Rubus idaeus* (L.), *Trifolium repens* (L.), *Tilia platyphyllos* (Scop.), *Salix caprea* (L.), *Salix cinerea* (L.), *Mentha arvensis* (L.). These 6 species (5%) can provide in the area periodically or annually the production harvest.
- The best represented category is the one with a medium economic weighting. The 90 species (79%) in this group provide significant nectar and pollen harvests.
- The third group is represented by 21 taxa (16%) with low economic value.
Plants with honey potential in the first 2 groups have obvious implications in beekeeping and are important for bees, providing annual or regular honey crops. In the area, the harvest is provided mainly by hayfields. Maintenance harvests are provided by trees, shrubs and herbaceous vegetation, especially in spring and early summer.
The most important category from economical point of view is missing meaning the plants with a very high economical weight, that yearly provide important harvests.
For the realization of large productions, the beekeepers from the area practice the pastoral beekeeping at the raspberry honey massifs. In recent years, but especially in the period 2019 - 2020, climate change has determined beekeepers in the area to practice long-distance pastoral beekeeping in the counties: Dolj, Mehedinți, Gorj, Argeș and Vâlcea, for acacia harvesting, in Tulcea county for harvesting linden trees and in Constanța county for sunflower harvesting.

CONCLUSIONS

The study of flora in the areas of Cisnădioara, confirms the fact that this area is well studied from a botanical point of view and presents an almost complete a floristic inventory.

In the studied area 526 taxon's were found, out of which only 117 taxon's (22,24%) present a melliferous potential.

The inventory of flora with a melluferous potential contains 38 botanical families. The best represented is the family *Lamiaceae* (16 species), followed by *Rosaceae* (13 species), *Fabaceae* and *Asteraceae* (10 species, each of them), *Apiaceae* (7species), *Scrophulariaceae* (6 species), *Papaveraceae* (4 species).

At the opposite pole, 17 families have only one single representative: *Cupressaceae, Berberidaceae, Corylaceae, Polygonaceae, Thymelaeaceae, Cornaceae, Geraniceae, Tiliaceae, Resedaceae, Primulaceae, Apocymaceae, Verbenaceae, Rubiaceae, Caprifoliaceae, Valerianaceae, Dipsacaceae, Amaryllidaceae*.

From the importance point of view for beekeeping, only two categories were identified: 6 species (5%) with a high economical beekeeping weight and 90 species (79%) with a medium economical beekeeping weight. Only species with a high beekeeping weight can ensure the production, periodically or annually, in the area. Due to an accumulation of natural factors (climate change, deficit of species with very high honey potential), but also anthropogenic (too many hives in the area, very close permanent hearths, which endanger the production of honey and other bee products, endangering and bee families) motivate beekeepers in the area to practice pastoral beekeeping in order to obtain significant production harvests.

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