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DIVERSITATEA HIMENOPTERELOR (HYMENOPTERA L.) PE PLANTELE DE *PHACELIA TANACETIFOLIA* BENTH. DIN COLECȚIA GRĂDINII BOTANICE NAȚIONALE (INSTITUT) „ALEXANDRU CIUBOTARU"

THE DIVERSITY OF HYMENOPTERA SPECIES (HYMENOPTERA L.) ON THE *PHACELIA TANACETIFOLIA* BENTH. PLANTS IN THE „ALEXANDRU CIUBOTARU" NATIONAL BOTANICAL GARDEN (INSTITUTE)

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Rezumat. *Lucrarea reprezintă diversitatea himenopterelor (Hymenoptera L.) identificate pe plantele de Phacelia tanacetifolia Benth., soiul „Melifera", plante din cadrul Grădinii Botanice Naționale (Institut) „Alexandru Ciubotaru". Au fost identificate 8 specii de insecte (Apis mellifera, Bombus terrestris, B. lapidarius, B. hortorum, Megachile sp., Lasioglossum malachurus, Xylocopa violacea, Megascolia maculata) din ordinul Hymenoptera L., încadrate în 5 familii (Apidae, Megachilidae, Halictidae, Anthophoridae, Scoliidae) și 6 genuri. Se atestă prezența în număr mare a speciei Apis mellifera, ce confirmă potențialul melifer al faceliei.*
Cuvinte-cheie: *Hymenoptera L. Phacelia tanacetifolia Benth., entomofaună, diversitate.*
Abstract. *The article presents the diversity of Hymenoptera species (Hymenoptera L.) identified on the Phacelia tanacetifolia Benth. cv. 'Melifera' plants, grown in the collection of "Alexandru Ciubotaru" National Botanical Garden (Institute). Eight insect species of the order Hymenoptera L. have been identified (Apis mellifera, Bombus terrestris, B. lapidarius, B. hortorum, Megachile sp., Lasioglossum malachurus, Xylocopa violacea, Megascolia maculata), included in 5 families (Apidae, Megachilidae, Halictidae, Anthophoridae, Scoliidae)) and 6 genera. The presence of Apis mellifera specimens in large numbers has been recorded, which attests the potential of phacelia as honey plant.*
Keywords: *Hymenoptera L. Phacelia tanacetifolia Benth., entomofauna, diversity.*

Introduction

The role of insects is vital in biocenoses. The identification of entomofaunal diversity is one of the main objectives with respect to the exploitation of honey plant resources. There is a close connection between insects and the plant world, thus insects regardless of their development stage

(adult, young insects) feed exclusively on plant products: nectar and manna as energy sources and pollen as a protein and mineral source [7]. *Phacelia tanacetifolia* is known as a high-potential honey plant but also as a fodder and siderate (companion) crop, used to boost the regeneration processes of degraded soils. In Europe, it is used as an effective method against harmful insects [10]. Phacelia is included in the top twenty species of major significance as honey plants worldwide, but mostly in countries with well-developed beekeeping industry [5]. The amount of nectar produced from one flower can range from 1.0-4.5 mg, with an average sugar concentration of 28% [9]. During 24 hours, in the nectar of a flower, 0.25-0.5 (2-5) mg of sugar is formed [13].

The order Hymenoptera L. is a very large one, with numerous species of recognized insects, such as bees, bumblebees, wasps, ants etc., the most well-organized and diverse species. Adult Hymenoptera are phytophagous (feeding on flower nectar and fruit juice), fewer species use food of animal origin. The role of hymenoptera in nature is huge, being the main pollinators of plants, but also regulating the number of insect species that are harmful to agricultural crops [4]. For thousands of years, humans, by domesticating the honey bee, have obtained blooming fields, abundant fruit and vegetable yields, honey and a variety of bee products. *Apis mellifera* L. is one of the 20,000 known bee species, being the most common pollinator and classic honey making insect [8]. The exploitation of high potential resources of honey plants is of particular importance for the plant and animal world and the development of beekeeping. The cultivation of honey plants as a branch of beekeeping has direct links with systematic botany, plant ecology, plant engineering, breeding and entomology [7]. Our research has been aimed at detecting insect species of the order Hymenoptera L. and identifying their role in making use of the melliferous potential of the phacelia.

Materials and Methods

The research has been conducted in the collections of the "Alexandru Ciubotaru" National Botanical Garden (Institute) (NBGI) in 2020-2023, on experimental sectors planted with *Phacelia tanacetifolia* Benth. cultivar 'Melifera'. The sectors have different sizes depending on the specific details of the research. Phacelia is an annual species; it is sown in March, directly on the experimental plots. The seeds are small, and should be planted at 2-3 cm deep and at 15 cm distance between rows.

Surveys were carried out to evaluate the process of plant growth and development along the phenological stages (the phenological study was carried out according to the guidelines in force [12], as well as the identification of the entomofauna associated with these plants. Visual observations and digital camera recordings were made, samples were collected manually, field notes were taken, and later the data and samples were examined under laboratory conditions and guidelines for botanical and entomological determination were consulted [11, 14].

Results and Discussions

As a result of the research carried out at NBGI on phacelia plants, the morphological description of phacelia was made – annual, herbaceous species, with growing season of about 80-104 days, with long flowering stage lasting 45-55 days, depending by the weather conditions and the sowing time, which occurs in May-July. The species is known as a valuable source of nectar and pollen for a wide range of insects, being available over a long period. The plants produce a large number of flowers, found in 15-20 fan-shaped, scorpioid cyme inflorescences with acropetal order of flower arrangement. The inflorescences consist of 4-8 coils, with about 18-22 flowers on each of them. The flowers are bell-shaped, violet-blue, sessile, with double perianth and long style protruding from the flower. The stem is erect, branched, growing up to 20-25 shoots with side branches, alternate, sessile, pinnately-lobed leaves with toothed margin.

Previous research carried out on the entomofauna detected on the vegetative and generative organs of phacelia plants resulted in the identification of 27 species of insects belonging, as taxonomic units, to 6 orders, 20 families and 24 genera. According to the taxonomical analysis of associated entomofauna, the largest share is represented by species of the order Hymenoptera with 35% of the detected insects, it is followed by Coleoptera – 26%, Hemiptera – 18%, Diptera – 12%, Lepidoptera – 6% and Homoptera with 3% of the total number of insect species identified [2, 3].

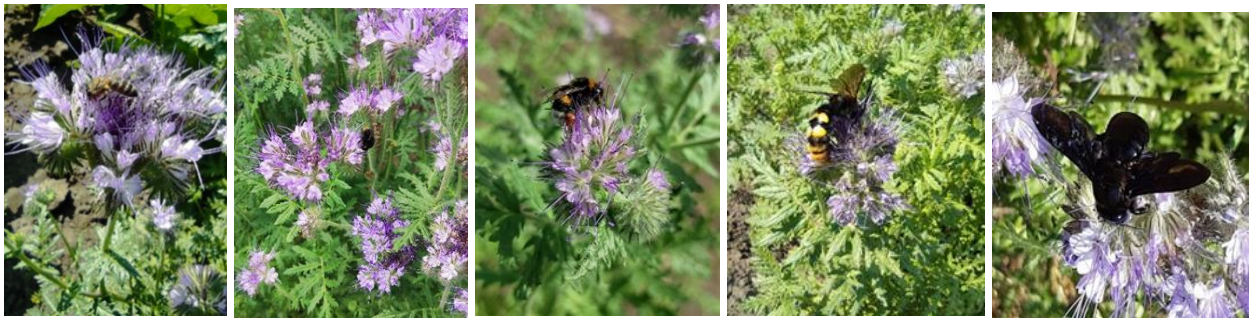
Being a valuable honey plant, known for its high productivity of honey per hectare (300 (556), (600-100) kg/ha [1, 6] in the current study special attention was paid to insects of the order Hymenoptera L, which includes the most useful insects, such as honey producers and pollinators. The 8 species of insects identified were taxonomically classified into 5 families, 6 genera. Pollen-eating and nectar-eating insects were classified according to the trophic spectrum (Table 1).

Table 1. The diversity of Hymenoptera insects detected on *P. tanacetifolia* plants with the systematization of taxonomic units classified according to the trophic spectrum

Nr	Family	Species	Trophic spectrum
1.	Apidae	*Apis mellifera* (Linnaeus, 1758)	Pollen and nectar
2.		*Bombus terrestris* (Linnaeus, 1758)	Pollen and nectar
3.		*B. lapidarius* (Linnaeus, 1758)	Pollen and nectar
4.		*B. hortorum* (Linnaeus, 1761)	Pollen and nectar
5.	Megachilidae	*Megachile sp.*	Pollen and nectar
6.	Anthophoridae	*Xylocopa violacea* (Linnaeus, 1758)	Pollen and nectar
7.	Halictidae	*Lasioglossum malachurus* (Kirby, 1802	Pollen and nectar
8.	Scoliidae	*Megascolia maculata (Drury, 1773)*	Pollen and nectar

The surveys were made during the flowering stage, between 8:30 and 18:00. The hours when the insects were most active (11:30-12:30) were identified, the presence of the honeybee on the inflorescence being 4-12 seconds depending on the size of the inflorescence, a bumblebee visited a flower on average for 8-10 seconds. On a flowering phacelia plant, up to 5-9 insects were detected at the same time. Regardless of air temperature and atmospheric humidity, the most active and abundant species on the plants were honeybee – *Apis mellifera* L. and the bumblebees *Bombus terrestris L., B. lapidarius* L. Honeybees predominated on phacelia flowers in terms of their abundance and frequency, being also the main pollinators and therefore playing a key role in the formation of flowers and seeds. The giant species *X. violacea* and *M. maculata* (Figure 1) which are species included in the Red Book of the Republic of Moldova, were detected 1-2 times during the flowering stage, as single individuals that actively flew from flower to flower.

The beekeeping sector for the Republic of Moldova is one of major importance. The annual production of honey and by-products of beekeeping (honey, propolis, royal jelly) depends on the honey plants, climatic conditions and honey-making insects. In addition to the main types of traditional honey plants used in the country, recently beekeepers have become interested in creating phacelia plantations, which would meet part of the requirements of local beekeeping.



a **b** **c** **d** **e**

Fig. 1. *Phacelia tanacetifolia* flowers with honey and pollinating insects: a – *Apis mellifera,* b – *Bombus lapidarius,* c – *B. Terrestris,* d – *Megascolia maculata,* e - *Xylocopa violacea*

Conclusions

Based on the research on *P. tanacetifolia* plants made in the experimental sectors of the "Alexandru Ciubotaru" National Botanical Garden (Institute), 8 species of insects belonging to the order Hymenoptera were identified (*Apis mellifera, Bombus terrestris, B. lapidarius, B. hortorum, Megachile sp., Lasioglossum malachurus, Xylocopa violacea, Megascolia maculata),* included in 5 families (Apidae, Megachilidae, Halictidae, Anthophoridae, Scoliidae) and 6 genera. These insect species are of essential importance for the beekeeping sector and the pollination process.

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