AROMATIC SPECIES WITH MELLIFEROUS POTENTIAL OF THE LAMIACEAE L. FAMILY STUDIED IN THE BOTANICAL GARDEN

SPECII AROMATICE CU POTENȚIAL MELIFER DIN FAMILIA LAMIACEAE L. STUDIATE ÎN GRĂDINA BOTANICĂ

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Sumar. *Lucrarea de față prezintă un studiu privind identificarea speciilor de plante aromatice cu potențial melifer semnificativ, desfășurat în cadrul Laboratorului de Resurse Vegetale. Fondul genetic al plantelor utile include o gamă largă de specii care oferă albinelor polen și nectar pe toată durata sezonului de vegetație. Prin urmare, mobilizarea și dezvoltarea unui sector dedicat plantelor aromatice cu potențial melifer reprezintă un obiectiv-cheie de cercetare, urmărit prin introducerea atât a speciilor autohtone, cât și alogene. Pe parcursul a trei ani, au fost identificate aproximativ 50 de specii promițătoare, clasificate în 15 genuri, valoroase atât pentru conținutul lor în uleiuri esențiale, cât și pentru potențialul melifer ridicat. Aceste specii parcurg complet ciclul de vegetație și se caracterizează printr-o perioadă de înflorire prelungită și o capacitate mare de producere a polenului. Identificarea de noi specii de plante aromatice cu potențial melifer este deosebit de importantă pentru extinderea gamei de culturi aromatice și pentru asigurarea unei baze melifere constante și durabile.*

Cuvinte-cheie: *conservare, plante melifere, mobilizare, plante aromatice, utilizare.*

INTRODUCTION

Biological diversity significantly influences both the quantity and quality of the melliferous base. The conservation of biodiversity is essential for maintaining a rich

and stable supply of nectar and pollen sources, thereby supporting the sustainable use of these natural resources. This aspect supports beekeeping – a traditional occupation that offers both ecological and socio-economic benefits [1].

Bees play a vital role in plant pollination and contribute substantially to the beekeeping industry. A key requirement for the successful and profitable management of bee colonies for the production of bee products (such as honey, pollen, wax, etc.) is a thorough understanding of melliferous plants, including their geographical distribution, flowering periods, and nectar and pollen value [2].

Many plant species bloom according to distinct seasonal patterns, which can be synchronized with the life cycles of specific pollinators [3]. Flowers react differently to certain pollinators, coexisting with them by providing diverse flowering periods, colors, and aromas, thus enhancing their reproductive success. Depending on the characteristics of the flower, the number of visits made by pollinators may be higher or lower [4].

In the study of melliferous resources, in addition to nectar and pollen productivity, one of the most critical aspects is understanding the flowering periods of plants. Systematic phenological observations enable the development of a phenological calendar, which can be used to forecast flowering times and help establish a continuous nectar flow, often referred to as a "honey conveyor." To ensure such a continuous supply, it is advisable to include nectar and pollen producing plants that exhibit the following traits: high honey productivity, a perennial growth cycle, an extended and stable flowering period, vigorous growth, consistent nectar secretion throughout the day, and floral structures that are easily accessible to pollinators [5].

The spontaneous flora of the Republic of Moldova includes several species of aromatic plants with significant melliferous potential, known for their high honey productivity, which can enhance and diversify the honey base in specific regions of the country [6]. At the "Alexandru Ciubotaru" National Botanical Garden (Institute), within the experimental sector of the Plant Resources Laboratory, in the aromatic plant collection, approximately 50 aromatic-melliferous species have been identified and cultivated. These species, considered among the most valuable and promising for cultivation in Moldova, belong to 15 genera, including *Agastache* Gronov., *Hyssopus* L., *Lavandula* L., *Nepeta* L., *Salvia* L., *Thymus* L., *Mentha* L., and *Satureja* L.

MATERIALS AND METHODS

As subjects for the current research served the aromatic species with melliferous potential from the Collection of Aromatic Plants of the Chisinau Botanical Garden. The research carried out covers the period 2022-2024, during which the creation of the group of aromatic-meliferous plants was initiated. The experiments were carried out on the territory of the Collection of Aromatic Plants, Plant Resources Laboratory.

Over the years, various aromatic-melliferous species have been identified and studied, with particular attention given to their ontogenetic growth and development under local climatic conditions. During the growing season, systematic phenological observations were made on the perennial development cycle, determination of flowering periods, and the number of visits made by pollinators depending on environmental factors. [7]. The essential oil content was determined by the hydrodistillation method [8].

RESULTS AND DISCUSSION

In the Botanical Garden, over the years, a number of aromatic species obtained from seeds through the international seed exchange program - *Delectus seminum* - have been introduced and researched. The diversity of species in the collection demonstrates a high potential for honey production, necessary for the organization of an efficient melliferous base. The aromatic plant collection in the NBGI counts over 170 species from 67 genera and 14 families. Respectively, within the collection, aromatic species were highlighted, which also represent significant sources of melliferous plants, which are characterized by long flowering period and produce high amounts of pollen and nectar content, and can be used in obtaining beekeeping products. This group is represented by the genera: *Agastache* Gronov, *Hyssopus* L, *Lavandula* L, *Nepeta* L, *Salvia* L, *Thymus* L, *Clinopodium* L, *Mentha* L, *Satureja*, etc. The study in question refers to some genera of the Lamiaceae family present in the collection, of major importance in the field of beekeeping.

The genus *Agastache* Gronov, of the Lamiaceae family, comprises 22 species, native to North America, most of which are aromatic and melliferous plants. In the collection of aromatic plants of the Botanical Garden, 4 species have been introduced and researched: A. nepetoides (L.) Kuntze, *A. urticifolia* (Benth.) Kuntze, *A. foeniculum* (Pursh) Kuntze, *A. rugosa* (Fisch. & C.A. Mey.) Kuntze. Herbaceous, perennial plants with strongly developed fibrous roots. These are herbaceous, perennial plants characterized by well-developed fibrous root systems and erect, quadrangular, reddish-brown stems. The leaves are lanceolate with sharp tips and evenly toothed margins, those located at the base are elongated and those found near the top – heart-shaped. Flowering occurs over an extended period from June to October. The small, tubular flowers are arranged in spikes measuring 4-8 cm and come in shades of blue, purple, pink, or white. They emit a strong fragrance reminiscent of mint, anise, and lavender. These plants are considered highly valuable for pollinators and are frequently visited by wild bees, honeybees, butterflies, bumblebees and other pollinating insects (Fig. 1).



Figure 1. Species of the genus *Agastache* Gronov :
1. A. nepetoides (L.) Kuntze 2. *A. urticifolia* (Benth.) Kuntze 3. *A. foeniculum* (Pursh) Kuntze
2. 4. *A. rugosa* Kuntze

Another genus is *Salvia* L., which includes over 900 species. The species *Salvia sclarea L.*, *Salvia cleistogama* Bary & Paul, *Salvia deserta* Schangin, *Salvia dolomitica* Codd, *Salvia grandiflora* Ettling., *Salvia officinalis* L., *Salvia officinalis* 'Tricolor' L., *Salvia nemorosa* L., *Salvia tesquicola* Klok & Pobed, *Salvia verbenaca* L., *Salvia fruticosa* L., introduced from the spontaneous flora and other geographical regions, are researched in the collection of aromatic plants of NBGI. The essential oil extracted from sage species is highly valued and widely used in phytotherapy, aromatherapy, cosmetics and gastronomy. In recent years, sage has also been recognized for its considerable honey-producing potential. The leaves are typically oval or lanceolate, with a slightly downy texture and a silvery-green hue. The entire plant emits a distinct, mildly peppery and balsamic fragrance, attributed to the diverse chemical composition of its essential oil. Phenological observations indicate that sage species generally have a flowering period of 30-35 days, often with the potential for repeat blooming. The plants produce large, colorful flowers ranging in shades of blue, purple, pink, or white, arranged in spikes or racemes. These flowers are highly attractive to bees and other pollinators (Fig. 2).



Figure 2. Some species of the genus *Salvia* L.
1. S. fruticosa L 2. *S. grandiflora* Ettling 3. *S.officinalis* L. 4. *S. sclarea* L.

Another genus with melliferous potential present in the collection is *Thymus* L., which includes several aromatic species studied in the laboratory. The aromatic plant collection comprises seven species: *Thymus comosus* Boiss, *Thymus longicaulis* C. Presl, *Thymus praecox* Opiz, *Thymus vulgaris* L., *Thymus vulgaris* var. citriodorum, *Thymus zigioides* Griseb. These are perennial, herbaceous plants with erect to ascending stems that terminate in flowering or sterile branches. The leaves vary in shape –linear, lanceolate, or ovate – and may be glabrous or pubescent. The flowers are compact and pink-violet, arranged in axillary whorls. These species are characterized by prolific flowering, which begins in mid-May and extends through July. This extended and intense flowering period attracts a wide variety of pollinators, particularly bees and butterflies, which collect the abundant nectar and pollen (Fig. 3).



Figure 3. Species of the genus *Thymus* L.
1.T. vulgaris L. 2. *T. comosus* Boiss 3. *T. longicaulis* C. Presl 4. *T. praecox* Opiz

The genus *Lavanda* L. includes perennial plants that grow in the form of bushes. They thrive in sunny areas with southern or western exposure. Their height typically ranges between 50 and 120 cm. The stems are thin, grouped in bushes, the leaves are gray-green, and the flowers are lilac-reddish. They are drought-resistant plants. Within the collection, the genus is represented by several species of lavender: *Lavandula angustifolia* Mill. cv. 'Lavinie de grădină' – cultivar approved in the NBGI, *Lavandula dentata* L., *Lavandula angustifolia* Mill. cultivar (K-90), *Lavandula angustifolia* Mill. subsp. Pyrenoica, *Lavandula x hybrida* , *Lavandula pinnata* Lundmark (Fig. 4).

As an aromatic and melliferous plant, lavender is valued for its extended flowering period, which begins in early June and continues through the late September. The flowers are rich in nectar and are visited by bees throughout the day. Therefore lavender is cultivated as a high-potential species for both aromatic and beekeeping purposes.



Figure 4. Species of the genus *Lavandula* L.
1. *L. angustifolia* Mill. subsp. Pyrenoica 2. *L. dentata* L 3. *L. pinnata* Lundmark
4. *L. angustifolia* Mill. cultivar 'Lavinie de grădină'

The genus *Nepeta* L. comprises approximately 200 aromatic, culinary, ornamental, and melliferous species, predominantly found in northern and western Europe, including Ireland and southern Norway. The plants are characterized by high ecological plasticity. They are of considerable interest as melliferous species, and are also a source of essential oil used in various fields. The collection of aromatic plants includes 4 species from the local spontaneous flora and from other geographical areas, including: *Nepeta transcaucasica* Grossch, *Nepeta grandiflora* Bieb., *Nepeta cataria* L., *Nepeta melissifolia* L. The species are characterized by fibrous roots, which start from a woody, branched rhizome. The stem is erect, branched, reaching 40-100 cm in height. The leaves are ovate, with a cordate base. Under the environmental conditions of the Republic of Moldova, these species flower from May through late summer. The duration of the flowering phase for each species lasts on average 40-45 days. Notably, the species *N. transcaucasica* Grossch can bloom twice under the local conditions. The flowers vary in color depending on the species, with shades ranging from pink and purple to white, and are arranged in dense whorls. Throughout the flowering period, the plants are intensely visited by pollinating insects (Fig. 5).



Figure 5. Species of the genus *Nepeta* L .
1. N. cataria L . 2. *N. transcaucasica* Grossch 3. *N. grandiflora* Bieb

CONCLUSIONS

In conclusion, the diversity of aromatic plants provides a valuable and supportive habitat for pollinating insects. The identification and promotion of species with high-quality essential oil content, ornamental value, and melliferous potential represent key priorities for the beekeeping sector. Thus, within the aromatic plant collection of NBGI, over the last three years, a group of aromatic plants with honey-producing potential was initiated and created. This group brings together about 50 species with a diverse systematic classification, including both native and non-native species, as well as plants acquired through collaboration with national and international research institutions. Daily monitoring and phenological observations of these melliferous species enabled the determination of the duration of the flowering phase, the identification of the diversity of pollinating insects and the assessment of visit frequency for each species.

The results of this research show that the plants of the Lamiaceae family – the genera *Agastache* Gronov, *Lavandula* L, *Nepeta* L, *Salvia* L, *Thymus* L and the included species – constitute important sources of essential oil and a stable honey base, therefore, they can be successfully recommended for cultivation on industrial areas as high-value melliferous crops.

The comprehensive study and the recognition of these high-value melliferous plants contribute meaningfully to diversifying the range of aromatic plants and play an important role in enhancing national beekeeping productivity.

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