MOBILIZATION AND *EX SITU* CONSERVATION OF THE GENE POOL OF AROMATIC PLANTS IN THE BOTANICAL GARDEN

MOBILIZAREA ȘI CONSERVAREA *EX SITU* A BASCULUI DE GENE AL PLANTELOR AROMATE DIN GRĂDINA BOTANICĂ

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Summary. *Under the current conditions, when we witness a drastic decline in plant diversity globally, the main mission of botanical gardens, which is the preservation and conservation of biodiversity, has become a necessity. The technological progress and the intensive use of natural resources have considerably increased the anthropogenic impact on biological diversity, essentially reducing the number of species and varieties of living organisms. In the global practice, botanical gardens are mainly involved in ex situ conservation activities, based in particular on the creation and maintenance of living plant collections and herbaria, therefore, they propose their own management based on the promotion of the concepts of biodiversity conservation and sustainable use of plant resources, the implementation and influence of the national and international policy on biodiversity conservation.*

Keywords*: collection, conservation, gene pool, mobilization, aromatic plants.*

INTRODUCTION

The mobilization of the gene pool of aromatic plants, the addition of new species to the collections, the research on the ecological and biomorphological peculiarities of endemic and introduced species, highlighting the most promising ones for the national economy, are the basic directives of the current botanical research. Solving the problem of conservation and rational use of natural resources remains one of the most pressing global tasks. In order to maintain the stability of biological resources, a sufficiently developed basis for their reproduction is necessary, based on a preliminary study of the characteristics of the development of individual organisms, both in the natural environment and during their cultivation.

At the heart of the activities of each botanical garden is the solution of introduction of plants from other geographical regions. The main goal in this case, on the one hand, is the enrichment of the flora of a certain region with new economically valuable species, and on the other hand, is the complex and rational use of natural resources. [1].

A significant role in preventing the extinction of species and the decline in their genetic diversity and in the rational use of plant resources by current and future generations

is played by the collections of living or dried plants of the Botanical Garden, such as the collection of aromatic plants. This collection includes a large number of plants, belonging to different families, with an annual, biennial or perennial lifespan and, depending on the species, the vegetative parts, fruits or seeds, characterized by remarkable essential oil content, are investigated, being of interest for aromatherapy, phytotherapy, culinary art, cosmetic and food industry. Due to the wide range of uses, aromatic plants are natural sources that are used throughout the year, fresh or dried.

MATERIALS AND METHODS

Materials and investigation methods for the *ex situ* conservation of aromatic plants comply with the conceptual framework and levels of approach to plant diversity, international reference documents and procedural guidelines used in flora and vegetation research. The research carried out covers the period 2000-2024, during which, the gene pool of aromatic plants was mobilized, based on the collection created by dr. hab. Mihai Bodrug. The experiments were set on the sector of the collection of aromatic plants of the Plant Resources Laboratory. The mobilization of aromatic plant resources was carried out through the International Exchange of Seeds, carried out with over 100 botanical gardens from different countries, through the introduction of plants from the wild flora, and an impressive number of plants was obtained as a result of the collaboration with many specialized scientific research institutions. Over the years, the factors that limit the adaptation of plants to the new conditions of development have been highlighted, research has been carried out on the ontogenetic peculiarities of plants, the content and chemical composition of essential oils have been determined. During the growing season, observations were made on the reaction of plants to low temperatures recorded in the early autumn, late spring frosts, their resistance to frost, the influence of light intensity, the influence of the shortage and excess of atmospheric precipitation, the resistance of plants to diseases and pests. The species of the collections, as mini-populations, are distributed in equal plots (3x1.5 m) that fit into the relief inclined to the East. The rich chernozem soil, in some places a little sandy, favors the normal development of the introduced species.

RESULTS AND DISCUSSIONS

In the spontaneous flora of the Republic of Moldova, there are 163 species of plants that contain essential oil and they are grouped as follows: 68 species occur throughout the territory of Moldova, 23 species occur in the forest areas, 33 – in steppes, 13 – in meadows, 6 – on rocky and calcareous lands, 5 – on soils with an increased level of salinization [2]. The aromatic plants from the wild flora cannot serve as a basis for collecting plant raw material, because their resources are limited, so, they are used as a source of collecting material for its further propagation and growth within the Botanical Garden.

Therefore, many aromatic species from the spontaneous flora have been introduced into the Botanical Garden over the years. The diversity of the species in the collection, as

well as their plasticity, demonstrate an important germplasm potential, which can serve as a basis for identifying the forms with a high productivity of herba and essential oil that would complete the assortment of cultivated ones.

One of the basic tasks of the research group is the introduction of aromatic plants from other geographical regions, the pedoclimatic conditions of our country being an opportunity, since they are favorable for the development and accumulation of biologically active substances. In order to achieve this goal, the research includes the following objectives: the identification of the best propagation techniques and the biomorphological features of plants under the new growth conditions; the assessment of seed production according to plant age; the determination of the essential oil content and its basic components depending on the plant organ where it is produced, phenological stage and plant age; the research on the antimicrobial, antifungal and insecticidal properties of the essential oil; making experiments with herba and essential oil samples in the perfume and cosmetics industry, in the preparation of canned vegetables as flavorings and in the production of flavored wines.



Fig.1. The collection of aromatic plants

The collection of aromatic plants from the “Alexandru Ciubotaru” National Botanical Garden (Institute) includes over 150 species and intraspecific units from 67 genera and 14 families. (Fig. 1) Taxonomically, they are representatives of families: Lamiaceae, Apiaceae and Asteraceae, Boraginaceae, Geraniaceae, Verbenaceae, Violaceae, Rosaceae, Rutaceae etc. The origin of most of the aromatic plant species in the collection is the Mediterranean region. More than 60% of the species are native to the Mediterranean and Eurasian areas. The main genera that include species with maximum essential oil content are: *Salvia* L., *Thymus* L., *Satureja* L., *Origanum* L., *Ocimum* L., *Lavandula* L., *Mentha* L., *Calamintha* Lam., *Helichrysum* L., *Ruta* L., *Nepeta* L., *Agastache* O.Kuntze., *Monarda* L., *Tagetis* L., *Teucrium* L., *Tanacetum* L., *Dracocephalum* L., *Elsholtzia* Willd., *Hyssopus* L., *Pyrethrum* L., etc. The strong fragrances and therapeutic properties of aromatic plants are due to the combination of several chemical compounds, which can be identified in different parts of a plant: in leaves, flowers, roots, bulbs, fruits and seeds. The most important components are the

essential oils, which give the plants their specific aromas and antimicrobial, antimycotic and antiseptic properties [3].

The collection itself proposes a multifunctional approach to the use of aromatic plants, which consists in their presentation in specialized exhibitions, the development of original phytocompositions, the selection of an assortment of plants for the creation of melliferous plantations.

Within the collection, aromatic species are highlighted, which contain essential oils and are widely used in aromatherapy (*Lavandula angustifolia* Mill*, Salvia officinalis* L.*, Melissa officinalis* L.*, Achillea odorata (*Lam.) Briq.*, Satureja hortensis* L*, Origanum vulgare* L., *Agastache foeniculum* L., *Hyssopus officinalis* L.), being also important sources of vitamins and minerals; species used over time in food, pastry, to flavor dishes, salads, vinegars or balsamic oils (*Thymus vulgaris* var. citriodorum, *Dracocephalum moldavica* L., *Mentha x piperita* L. 'Black' Mitcham., *Ocimum basilicum* var. citriodorum, *Artemisia dracunculus* L.). Some of them are found as natural remedies, being useful in the prevention and cure of many diseases, thanks to the exceptional antimicrobial, antiviral and antifungal properties scientifically proven in our research (*Koellia virginiana* (L.) Mac.M., *Monarda fistulosa* L., *Perovskia atriplicifolia* Benth.).

The species *Elsholtzia stautonii* Benth.*, Rosmarinus officinalis* L.*,Viola tricolor* L.*, Cephalophora aromatica* Schrad, *Artemisia abrotanum* L. Thunb are widely used in the perfume and cosmetic industry, but also in the biological protection of plants, as a bioinsecticide (*Chenopodium ambrosioides* L., *Pyrethrum cinerariaefolium* Trev.).

Aromatic species are also relevant sources of honey plants, which, due to the content of pollen, nectar and other plant secretions, are used by humans in beekeeping, for the production of honey, propolis and other secondary products. This group is represented by the species: *Nepeta transcaucasica* Grossch, *Ruta graveolens* L., *Agastache nepetoides* (L.) Kuntze, *Artemisia lavandulifolia, Calamintha mentifolia* Host., *Monarda punctata* L., *Prunella grandiflora* (L.) Turra., *Salvia sclarea* L., *Satureja subspicata* Bartl ex Vis., *Thymus praecox* Opiz.

In the collection, there are also species that can be used in the landscape design of green spaces: *Monarda didyma* L., var. Prarienach., *Perilla frutescens* (L.) Britton*., Thymus comosus* Heuff ex Griseb., *Echinacea tennessensis* (Beadle.) Small., *Ceratostigma plumbaginoides* Bunge, *Lavandula hybrida* L., *Hyssopus ambiguus* L. (Trautv*), Iris germanica* L.

The collection of aromatic plants plays an important role in the education of the general public, people who are interested in this group of plants due to their professional specialization or passion, those who want to know these plants, as well as in the didactic process, thus representing a special useful tool for students, a training school for students of the faculties of biology, pharmacy, concerning also the environmental protection, the introduction of new crops, as well as the dissemination of knowledge on the plant world.

The research conducted in recent years within the Plant Resources Laboratory, has been focused on the biomorphological, quantitative and qualitative phytochemical study

of some aromatic species promising for the national economy such as: *Elsholtzia stauntonii* Benth., *Agastache foeniculum* (Pursh) Kuntze, *Perovskia artiplicifolia* Benth., *Monarda fistulosa* L.,

Elsholtzia stauntonii Benth. Is an herbaceous, perennial plant, which develops under the conditions of our country as a typical shrub, consisting of branched stems. The leaves are oblong-ovate. The flowers are pink-purple with a showy appearance. The inflorescences are upright spikes. It blooms in August-September. The fruit – ellipsoid nutlet. The non-lignified aerial part, harvested in the flowering phase, is used. The essential oil is appreciated in the cosmetic and perfumery industry, as an ingredient in the formula of perfumes, cologne, deodorants, in the preparation of soaps. The aroma is subtle, reminding the smell of lemon. It has an antimicrobial, antifungal, hemostatic, diuretic effect. It is indicated in the treatment of bronchitis, jaundice. Buds and flowers are used as a spice [4].

Agastache foeniculum (Pursh) Kuntze is an herbaceous, perennial plant with a very strong fibrous root. The stem is erect, quadrangular, reddish-brown. The leaves are lanceolate with a pointed tip and evenly toothed margins, the basal ones elongated, and the upper ones heart-shaped. Small flowers, grouped in spiky inflorescences, purple-pink, rarely white or blue. Fruit - gray achene. Blooms in June-September. The flowers and non-lignified aerial part harvested during flowering are used. The biologically active substance, the essential oil has anti-inflammatory, cardiotonic, antitussive, carminative, stomachic, tonic, sedative action. It is an ingredient in anti-cellulite creams and balms, slimming preparations, in the manufacture of cosmetics, eye creams, toothpaste [5].

Perovskia artiplicifolia Benth., perennial plant, grows as a bush with whitish-grey stems. It grows numerous, straight, stable shoots. The leaves are opposite, lobed, deeply toothed silver-gray. The flowers are small, purple-blue arranged in branched panicles. It blooms in July-October. Fruit - ovoid nut, dark brown. The leaves and flowers harvested in the flowering phase are used. The essential oil has an antiparasitic, antimicrobial and analgesic effect. The decoction of flowers is considered a remedy for diabetes. Recent studies indicate an inhibitory action on the liver virus. It is used to flavor cocktails. The flowers are added as flavor and decoration in various salads [6].

Monarda fistulosa L. is an herbaceous perennial shrub-like plant with long rhizomes that grow in all directions. The stems are straight, hairy, reddish. The leaves are strongly fragrant, ovate-lanceolate, petiolate. The flowers are violet-lilac, clustered in terminal whorls. It blooms in June-August. The fruit is a nut. The aerial parts are used in the full flowering stage. The essential oil is used as an ingredient of cosmetic products for the care and treatment of skin, hair, nails, and as an antiviral, anti-inflammatory, immunomodulatory agent. It has an antisclerotic, antispasmodic, anti-stress effect. It is recommended externally in the treatment of burns, eczema and against hair loss [7].

Providing raw material of plant origin for economic purposes can only be possible after carrying out the respective scientific researche, followed by the industrial cultivation of aromatic plants, thus protecting the collections from the spontaneous flora, the

repatriation of plants in the natural areas and the foundation of the plantations of the requested assortment.

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CONCLUSIONS

Due to the amplitude of the theme of *ex situ* conservation of the rich gene pool of aromatic and medicinal plants, the Botanical Garden offers opportunities in addressing complex implementation issues in various fields. The collection of aromatic plants, created within the Botanical Garden, which counts over 150 taxa, is considered fundamental and aims at preserving the biological diversity of aromatic plant species from different habitats of our planet, both from taxonomic and environmental point of view.

The complex study of plants includes the systematic aspect, the pedoclimatic conditions of the area of spontaneous growth and introduction, the biomorphological features, the peculiarities of the accumulation of essential oil, the determination of the chemical composition, which allow the identification and multiplication of promising species and the development of primary cultivation technologies.

The more knowledge of the use of various medicinal and aromatic plants is accumulated, in the case of valuable but rare species from the spontaneous flora, it becomes easier to cultivate them and thus to protect the natural flora, which, when exploited irrationally, can lead to the extinction of species and the disruption of the ecological balance.

REFERENCES

1. Diversitatea plantelor în contextul strategiei europene de conservare a biodiversității. coordonator Anca Sârbu. București, Alo, 2001, 320 p. ISBN 973-99666-1-6
2. BODRUG, M., Дикорастущие эфирномасличные растения Молдавии. Кишинев, Штиинца, 1981. 142 с.
3. TELEUȚĂ, A., COLȚUN, M. et.al. Universul plantelor. Plante medicinale. Chișinău: Litera International, 2008, 336 p. ISBN 978-9975-74-009-8
4. ANDREA RASCH, BRIGITTE LOTZ. Plante aromatice. București, 2010. 300 p. ISBN 978-973-724-290-7
5. CAROLE, MINKER. 200 de plante care ne vor binele. București: RAO, 2016, 447 p. ISBN 978-606-776-027-9
6. COLȚUN, M., GILLE. E. Biological and chemical study of volatile oil *Perovskia artilplicifolia* Benth. Species. Journal of Botany, Chisinau 2013, Vol.V.nr.2 (7) . P.74-84.
7. COLȚUN, M. Plante aromatice (Ediția I), Chișinău: "Universul", 2021. 52 p. ISBN 978-9975-47-195-4