Scientific Papers. Series B, Horticulture. Vol. LXX, No. 1, 2026
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

NEPETA TRANSCAUCASICA GROSSCH. – A PROMISING AROMATIC PLANT

Maricica COLTUN, Alina BOGDAN

"Alexandru Ciubotaru" National Botanical Garden (Institute), MSU
18 Padurii Street, Chisinau, Republic of Moldova

Corresponding author emails: maricicacoltun@gmail.com, alinkabog90@gmail.com

Abstract

This article presents the results of botanical, ecological, and biochemical research on the aromatic species Nepeta transcaucasica Grossch., introduced and studied under the pedoclimatic conditions of the Republic of Moldova. The study aims to highlight the particularities of propagation and to develop the primary elements of its cultivation, thereby contributing to the expansion of knowledge about regional aromatic plants and to the establishment of sustainable crops integrated into modern agricultural practices in the country. Nepeta transcaucasica Grossch. is a perennial herbaceous plant studied at the National Botanical Garden as an aromatic, medicinal, ornamental, and melliferous species. The main biologically active component is the essential oil, which contains citronellol, geraniol, citral, eucalyptol, nepetalactone isomer A, and carvacrol - compounds that confer diuretic, analgesic, antitussive, and antimicrobial properties. This essential oil is used in the perfume and cosmetics industries, as well as in soap manufacturing. In gastronomy, the leaves and young shoot tops are used as a spice during the budding and full flowering stages. The plant is also notable for its high ornamental value, drought resistance, and long flowering period, making it an important nectar source for pollinators.

Key words*: aromatic plant, cosmetics, essential oil, introduced plants, medicine.*

INTRODUCTION

Aromatic plants have always played a vital role in human life, valued not only for their pleasant fragrance and taste but also for their therapeutic properties. Rich in essential oils and other bioactive compounds, these plants are used across numerous fields - from gastronomy and medicine to cosmetics, agriculture, and industry. Throughout history, they have been regarded as symbols of health and purity, forming an integral part of cultural traditions and customs. Their significance extends beyond practical applications, contributing to the promotion of a natural and balanced lifestyle and reflecting the deep connection between humans and nature.

In this context, expanding the raw material base derived from aromatic plants with a high and qualitative essential oil content, studying the biochemical characteristics of new promising essential oil-bearing species, and investigating the seasonal dynamics of biologically active substances depending on the plant organ, phenological phase, and age remain current and relevant research objectives. The study of native aromatic and medicinal plants, as well as the introduction of species from other geographical regions under the pedoclimatic conditions of the Republic of Moldova, represents a priority area of scientific research within the National Botanical Garden. When introducing new species to an area, interactions among vegetation factors are carefully considered to balance pedoclimatic conditions with the plants' biological requirements. This prevents situations where natural factors enhance biomass at the expense of active compound content. Cultivating new species and expanding the range of available essential oils creates opportunities to discover effective natural agents for health promotion and disease prevention. The genus *Nepeta* L. is one of the largest within the family Lamiaceae, comprising approximately 300 species distributed across temperate regions of the world - particularly in Central and Southern Europe, the Middle East, Central and Southern Asia, and certain areas of Africa and North America. Most *Nepeta* species are endemic, especially in Southwest Asia (Turkey and Iran). Plants of this genus are well known for their medicinal properties and are widely used in traditional medicine to treat various health issues (Formisano, 2011).

Among the numerous genera of aromatic plants represented and studied in the collection, a particularly important role is played by the genus *Nepeta* L., which is represented in the spontaneous flora of the Republic of Moldova by three species: *N. parviflora* Bieb., *N. pannonica* L., and *N. cataria* L. Within the collection of the National Botanical Garden, the following species have been introduced and studied: *Nepeta cataria* L., *Nepeta transcaucasica* Grossch., *Nepeta melissifolia* Lam., *Nepeta grandiflora* M. Bieb., and *Nepeta kokanica* Regel. The subject of this research is the allochthonous species *Nepeta transcaucasica* Grossch., which belongs to the kingdom Plantae, phylum Tracheophyta, class Magnoliopsida, order Lamiales, family Lamiaceae, and genus *Nepeta* (Lawalrée, 1980). This species is native to the Caucasus region - an area characterized by diverse climatic conditions that have favoured the evolution of forms adapted to both high altitudes and specific soil types.

According to specialized literature, this species represents an important natural source of compounds with antimicrobial activity (Öztürk, 2009). The plant exhibits diuretic, analgesic, anti-inflammatory, anxiolytic, sedative, hypnotic, antispasmodic, astringent, antitussive, and antimicrobial effects (Raboteagov, 2014).

Characterized by a high content of nepetalactone and other aromatic compounds, this species offers significant potential for utilization across multiple economic sectors. According to recent analyses, 51 constituents have been identified in the essential oil of *N. transcaucasica*, among which the major components are β-citronellol (52.05%), eucalyptol (7.34%), β-citronellal (6.06%), germacrene D (5.45%), β-ocimene (5.14%), β-caryophyllene (3.06%), neral (2.42%), geranial (1.51%), geraniol (1.44%), limonene (0.35%), and β-linalool (0.07%) (Mollova, 2023).

In recent years, interest in aromatic and medicinal plants has increased considerably due to the growing demand for natural, organic, and sustainable products. In this context, the study of the species *Nepeta transcaucasica* Grossch., as a promising aromatic plant under the pedoclimatic conditions of the Republic of Moldova, is particularly relevant for assessing its therapeutic, aromatic, and agronomic potential. The production of medicines derived from non-toxic plant material provides complex healing effects and supports the body's natural immunity. The cultivation of medicinal and aromatic plants is favoured by the pedoclimatic conditions of the country. The diversity of natural conditions determines a wide range of species that serve as valuable sources of plant material for the pharmaceutical, cosmetic, and food industries (Teleuță, 2008).

The collection of aromatic plants at the "Alexandru Ciubotaru" National Botanical Garden (Institute) comprises over 170 native and allochthonous aromatic taxa, distinguished by their intense fragrance and rich, well-developed flavour.

MATERIALS AND METHODS

The research was conducted over the period 2018-2024, with experiments carried out in the "Aromatic Plants" collection of the "Plant Resources" Laboratory. The species *Nepeta transcaucasica* was introduced and preserved as a promising species under local pedoclimatic conditions. Seed material was obtained through the International Seed Exchange from Crimea. Subsequent stages involved the study of the bioecological and morphological characteristics of the plants under the new growing conditions. Phenological observations were conducted according to established methodologies and recorded once every three days throughout the entire growing season (Sparks, 2009). Harvesting was performed during the period of peak flowering, following standard experimental field procedures (Dospehov, 2011). The study examined propagation methods, seasonal dynamics, and the biological potential of plant growth and development. The influence of phenological phase, plant organ, age, and seasonal dynamics on the accumulation of raw material and essential oil was investigated, and the optimal harvesting period was determined. Plants were cultivated under open-field conditions using ecologically balanced management and standard agrotechnical practices.

The essential oil content of the plants was determined using the steam distillation method, specifically the Ginzberg method, with a Clevenger-type apparatus, and calculated

relative to the absolute dry mass of the plant material (Gosud. Farm., 1968). The chemical composition of the essential oil was analyzed by gas chromatography-mass spectrometry (GC-MS) using an Agilent Technologies 6890N gas chromatograph coupled with a 5975 inert XL Mass Selective Detector. Phytochemical analyses were conducted in collaboration with the "Stejarul" Biological Research Center, Piatra Neamț, Romania.

RESULTS AND DISCUSSIONS

For several years, the genus *Nepeta* has been studied in the experimental field of the Plant Resources Laboratory at the Botanical Garden. Systematic, ecological, biomorphological, and technological studies have assessed the effects of climate and soil on plant development, stem height, flower size, and flowering period to select the best specimens for essential oil extraction. Of particular interest is the allochthonous aromatic species *Nepeta transcaucasica* Grossch., commonly known as catmint, from the Lamiaceae family, introduced to the Botanical Garden in 2018, and studied as both an aromatic and medicinal plant. Nepeta *N. transcaucasica* originates from mountain regions of the Caucasus, where it naturally grows at altitudes between 1,600 and 3,500 m. It is adapted to cold winters and moderate summers and prefers well-drained, neutral to slightly alkaline soils. In the Republic of Moldova, the temperate climate and sandy-clay soils allow excellent adaptation, provided that excessive moisture is avoided, as it can damage the roots. The plant demonstrates good drought resistance due to its pubescence, tolerates low temperatures, and responds favourably to repeated cuttings, which stimulate re-flowering. Under the conditions of the Republic of Moldova, *Nepeta transcaucasica* develops as a perennial herbaceous plant with semi-woody stems; in the first year of development reach a height of 30-40 cm and a diameter of 40-50 cm. Fifteen to eighteen lateral branches arise from the central stem, measuring 51-54 cm long (the lower branches) and up to 30 cm long (the upper ones). The stems are erect, branched, and densely covered with glandular and simple hairs that secrete an aromatic essential oil. Their surface is slightly pubescent, giving them a fine, velvety texture.

The leaves are opposite, with slightly serrated margins, and range from ovate-lanceolate to elliptical in shape. Leaf size varies along the stem, measuring 3.5 cm long and 2.5 cm wide on the lower branches, and 2.3 cm long and 1.4 cm wide on the upper branches. The leaf surface is covered with short hairs, and coloration ranges from light green on the upper side to pale green or grey on the lower side, due to pronounced pubescence. The veins are well defined, giving the leaves a slightly rough texture to the touch. Leaf petioles are 0.5-1.2 cm long, and the central stem has a diameter of 0.3-0.4 cm. Inflorescences are terminal spikes, composed of hermaphroditic, pentamerous, bilabiate flowers arranged in compound whorls. Flower colour is predominantly lilac, with purple or violet spots on the lower lip. The corolla is tubular and bilabiate, with a slightly concave upper lip and a lower lip formed by three lobes, the central lobe being more prominent. The calyx is pubescent, 0.7 cm long, tubular-campanulate, with acute teeth, and is covered with glandular hairs. The flowers are arranged in multifloral false whorls, each consisting of 18-20 flowers, which emit a strong, pleasant fragrance characteristic of species in the genus *Nepeta*. The fruit is a small, brown, smooth nutlet, approximately 1-2 mm in size, containing fine seeds with good germination capacity. Laboratory research indicates that the weight of 1,000 seeds is 0.70 g. The root system is well developed, comprising a taproot and numerous lateral roots that grow deeply into the soil, providing the plant with stability and increased resistance to drought and low temperatures. Overall, *Nepeta transcaucasica* exhibits a compact habit, characterized by a dense crown resulting from abundant branching and foliage (Figure 1).



Figure 1. The overall appearance of the species *Nepeta transcaucasica* Grossch.
1. budding phase; 2. peak flowering phase; 3. pollination process

This characteristic gives the plant value not only for its aromatic properties but also for its ornamental appeal, making it highly appreciated in landscaping and garden design.

In the first year of growth, when flower buds begin to develop, the plants are cut to a height of 8-10 cm above the ground. This pruning promotes the development of new shoots and encourages lateral expansion of the bushes. In the second year and in subsequent years, active vegetation typically begins at the end of April, when temperatures reach 7-8 °C. Each plant produces 100-150 perennial shoots, forming low, bushy structures with a diameter of 70-80 cm, with the most vigorous growth occurring in May. The complete shoot development cycle, from emergence to peak flowering, lasts 50-60 days under conditions of sufficient rainfall or on irrigated land, and 70-80 days under non-irrigated conditions or in periods of water deficit. The yield of floral biomass in the first year is 80-150 g of fresh mass per stem, corresponding to 27-34 g of dry matter. In the second year, the yield per stem increases to 180-210 g of fresh mass and 70-83 g of dry matter.

The study showed that in *Nepeta transcaucasica*, the essential oil content during the peak flowering phase ranged from 0.19% to 0.23%, with an average of 0.20% relative to the green mass of the plant material, or 0.6-0.8% of the absolute dry matter. Among the plant organs, the highest concentration of essential oil was found in the inflorescences, where it reached 1.10-1.22% of the absolute dry matter. The greatest accumulation of essential oil was observed in plants aged 2-5 years. A total of 25 components were identified in the essential oil, the major constituents being citronellol (34.04%), geraniol (11.67%), citral (10.79%), eucalyptol (9.12%), nepetalactone isomer A (8.32%), nepetalactone isomer B (6.33%), carvacrol (4.21%), linalool (2.22%), β-caryophyllene (1.31%) and thymol (0.92%) (Figure 2).

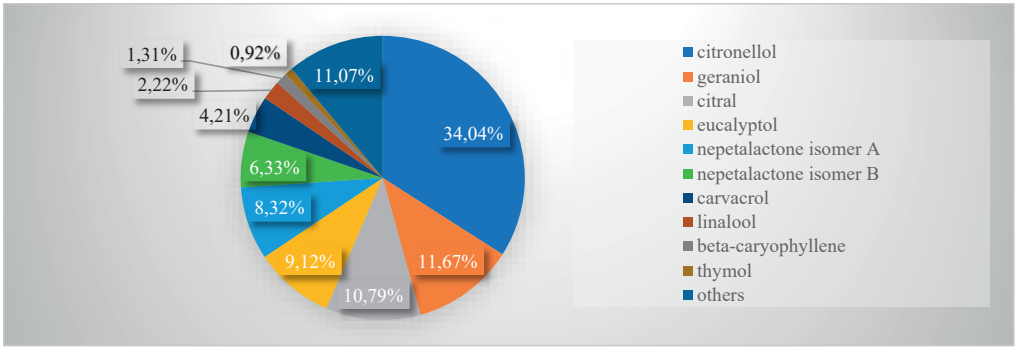

Figure 2. The chemical composition of the essential oil of *Nepeta transcaucasica* Grossch. Determined by GC-MS

Nepeta transcaucasica grows on a wide range of soils, from chernozems to calcareous and stony types. Under cultivation, it performs best on calcareous, humus-rich, well-structured soils with a light to medium texture. During winter, the species tolerates temperatures as low as –25 to –30°C. Although generally undemanding, *N. transcaucasica* responds positively to irrigation under drought and high-temperature conditions. In Moldova, up to three harvests can be obtained annually under irrigated conditions, whereas on non-irrigated land only one, and occasionally two, harvests are possible, with lower productivity.

For the establishment of pilot and industrial plantations, propagation methods have been investigated. The species propagates effectively both vegetatively (by division of mature plants or by cuttings) and generatively (by direct sowing of seeds into the soil in late winter or early spring, or by growing seedlings in greenhouses).

The planting material obtained from cuttings of green annual shoots is rooted in unheated plant nurseries. The cuttings are collected in spring, from the sprouting stage to the budding phase. The optimal length of the cuttings is 8-10 cm, each containing 3-4 internodes. To achieve a high rooting percentage, a temperature of 26-28°C should be maintained. For this reason, rooting is recommended to be carried out in film-covered greenhouses, where temperature, as well as air and substrate humidity, can be controlled. Under these conditions, the rooting success rate ranges from 73% to 80%. Once the root system is formed, the seedlings are transplanted into open fields, following a planting scheme of 25-30 cm between plants and 35-40 cm between rows. The obtained cuttings are planted deeply enough for the root collar to be covered with 3-4 cm of soil, after which the soil around the plants is gently compacted. In subsequent years, crop maintenance consists of mechanical loosening of the soil between and along the rows. Under irrigated conditions, the yield forms within 50-60 days. By the end of May, the plants reach the peak flowering stage, which also corresponds to the optimal harvesting period. The freshly harvested green biomass is immediately transported to processing facilities for distillation or other processing.

Generative propagation is achieved by direct sowing in the field, either in early spring (March-April) or in autumn (September-October). For seedling production, seeds are sown under greenhouse conditions on a suitable substrate composed of sand, perlite, and soil. To ensure uniform and vigorous germination, seeds are recommended to be stored at 20-25°C for 4-6 days. Germination occurs within 2-3 weeks at temperatures of 18-22°C. Seedlings are transplanted into the field after the risk of frost has passed.

In conclusion, the allochthonous species *Nepeta transcaucasica* Grossch., introduced and studied at the National Botanical Garden, can be recommended for cultivation as an aromatic and medicinal plant with valuable biochemical and therapeutic potential. Although current studies have demonstrated multiple possible uses, the species remains insufficiently explored, offering promising prospects for further research and the development of new organic products.

CONCLUSIONS

The pedoclimatic conditions of the Republic of Moldova have proven favourable for the growth and development of the allochthonous aromatic species *Nepeta transcaucasica* Grossch., which completes its full ontogenetic cycle and is characterized by high frost resistance, tolerating temperatures down to -25 to -30°C.

The species exhibits a strong capacity for reproduction, both vegetative – by division and by cuttings – and generative – through direct sowing of seeds into the soil in late autumn or early spring, or by growing seedlings under protected cultivation.

Studies on essential oil accumulation have demonstrated that this process depends on plant age, phenological stage, and plant organ. The maximum essential oil content is recorded during the peak flowering phase, ranging from 0.6% to 0.8% of the absolute dry matter, and reaching 1.10-1.22% in inflorescences. Plants aged 2-5 years contain the highest levels of essential oil.

Under irrigated conditions, the crop can produce up to three harvests per year, whereas under non-irrigated conditions only one or, occasionally, two harvests are obtained, with lower productivity.

The chemical analysis of the essential oil of *Nepeta transcaucasica* Grossch. identified 25 components, the major ones being citronellol, geraniol, citral, eucalyptol, and nepetalactone isomer A.

The high biomass yield and valuable essential oil content confirm the potential of this species as a raw material for the cosmetic industry, where it can be used as an active ingredient in perfumes, moisturizers, and fragrances. These findings justify the need to develop primary cultivation practices for this aromatic plant.

Due to its high melliferous value, attractive ornamental appearance, compact habit, and dense foliage, *N. transcaucasica* can also be recommended as an ornamental species for gardens, borders, and landscape design.

Its adaptability to local conditions, rich content of aromatic compounds, and multiple potential applications further support its inclusion in the economic circuit, contributing to the diversification of aromatic and medicinal plant crops cultivated in the Republic of Moldova.

The research was carried out within the Subprogram 010101 "Ex situ and in situ research and conservation of plant diversity in the Republic of Moldova".

REFERENCES

Formisano, C., Rigano, D., Senatore, F. (2011). Chemical constituents and biological activities of *Nepeta* species. Chem. Biodiversity, 8, 1783–1818. 10.1002/cbdv.201000191. [DOI] [PubMed]

Gosudarstevennaia farmacopeia SSSR. 1968, Moscva, 993 c.

Lavallee, A., Wolffia, H. ex Schleiden. Flora Europaea. Ed. I. Cambridge University Press (1980), vol. 5, p. 273.

Öztürk, A. (2009). *In vitro* Antibacterial Activities of *Nepeta transcaucasica*. *Asian Journal of Chemistry*, Vol. 21, N. 8 6440-6444

Silviya, M., Anatoli, D., Hafize, F., Dimitar, B. Stanimir, M., Ivayla, D., Stanko, S., Albena, S., Sezai, A., Ercissou, As., Marc, R., A., Riaz, U., Ahmed, B. (2023). Chemical Composition of Essential Oils from *Nepeta transcaucasica* Grossch. And *Nepeta cataria* L. Cultivated in Bulgaria and Their Antimicrobial and Antioxidant Activity, Apr 19; 8(17): 15441–15449. doi: 10.1021/acsomega.3c00704

Sparks,T., H., Menzel, A., Stenseth N.C. (2009). European Cooperation in Plant Phenology. *Climate Research*, vol. 39, 12 p. ISSN: 2413-2241https://www.researchgate.net/publication/242676714_European_cooperation_in_plant_phenology

Teleuță, A., Colțun, M., Mihăilescu, C., Ciocârlan, N. (2008). *Plante medicinale*. Editura Litera Internațional, 335 pag. ISBN 978-9975-74-009-8

Dospehov, B. A. (2011). Metodica polevova opâta s osnovami statisticescoi obrabotchi rezulitatov issledovanii., ISBN: 978-5-903034-96-3

Raboteagov, V.D., Acsenov, Iu. V. (2014). Componentnâi sostav ăfirnovo masla vidov roda *Nepeta* L. Farmația i farmacologhia, N. 6 (7), c. 25-28.

Timciuc, C.S., Celovschaia L.N. (1982). Izmencivosti himiceschix priznacov cotovnica limonnnovo pri semennom razmnojenii. IV – siezd vsesoiuznogo obscestvo gheneticov i selecționerov im. N.I. Vavilova.), Chișinev: Știința, str. 159.