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THYMUS LONGICAULIS C. PRESL - A PROMISING AROMATIC SPECIES INTRODUCED AND RESEARCHED IN THE BOTANICAL GARDEN

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This paper investigates the biological development characteristics of *Thymus longicaulis* C. Presl, introduced to the pedoclimatic conditions of the Republic of Moldova. The study focuses on the ability of this species to adapt to these new environmental conditions, as well as the primary techniques of mobilization and propagation. *Thymus longicaulis* is evaluated as a promising aromatic species due to its high essential oil content, present in all aerial parts of the plant, which is characterized by a strong, pleasant aroma with distinctive notes. The chemical composition of the oil and its pronounced fragrance provide significant biological properties, including antiseptic, antioxidant and anti-inflammatory effects. Furthermore, the oil is widely used in gastronomy to enhance the flavour and aroma of culinary preparations. The species also shows potential in the cosmetic and aromatherapy industries. In addition to its aromatic and therapeutic value, *Thymus longicaulis* is recognized for its high potential as a nectar-producing plant and ornamental species. Based on these attributes, the species is recommended for the expansion of the range of promising aromatic plants.

Keywords: *introduction, adaptation, biology, aromatic plants, aromatherapy, phytotherapy, cultivation, essential oil.*

THYMUS LONGICAULIS C. PRESL - SPECIE AROMATICĂ DE PERSPECTIVĂ INTRODUSĂ ȘI CERCETATĂ ÎN GRĂDINA BOTANICĂ

Prezenta lucrare este consacrată cercetării particularităților biologice de dezvoltare ale speciei *Thymus longicaulis* C. Presl, introdusă în condițiile pedoclimatice ale Republicii Moldova. Sunt reliefate capacitatea de adaptare a speciei la noile condiții de mediu, precum și principalele modalități de mobilizare și înmulțire. *T. longicaulis* este evaluată ca specie aromatică promițătoare, datorită conținutului ridicat de ulei volatil prezent în toate organele aeriene, ulei caracterizat printr-un miros intens, plăcut, cu note distincte. Compoziția chimică valoroasă și aroma pronunțată conferă uleiului volatil proprietăți biologice importante, în special acțiuni antiseptice, antioxidante *și antiinflamatori*i, fiind totodată utilizat pe scară largă în gastronomie pentru îmbogățirea gustului și aromei preparatelor alimentare. De asemenea, specia prezintă interes pentru industria cosmetică și aromaterapie. Pe lângă valoarea sa aromatică și terapeutică, T. longicaulis se remarcă printr-un potențial melifer și ornamental ridicat. În acest context, specia poate fi recomandată pentru extinderea sortimentului de plante aromatice de perspectivă.

Cuvinte-cheie: *introducere, adaptare, biologie, plante aromatice, aromaterapie, fitoterapie, cultură, ulei volatil.*

Introduction

The growing global interest in natural medicine, with aromatherapy and phytotherapy playing a prominent role, is likely to place significant pressure on the conservation of certain plant species from the wild flora. In this context, the cultivation of new aromatic species with therapeutic properties, along with the scientific development of primary cultivation techniques, represents a critical approach for the protection and sustainable utilization of these plant resources. By introducing therapeutic species into cultivation, it is possible to mitigate the negative impact on wild populations and help preserve plant biodiversity [5]. Natural substances derived from plants, particularly medicinal and aromatic species, have been utilized for therapeutic purposes since ancient times. Aromatic and medicinal plants have played a foundational role in traditional medicine, with historical evidence tracing their use for over 5,000 years across Indian, Chinese, Egyptian, Greek, Roman and Persian civilizations. Additionally, plant-based traditional medicine has been integral to the medical practices of American, Arabic and Japanese cultures [11].

Due to its potential applications in various fields, including medicine, the cosmetic industry, and as food additives, the *Thymus* L. genus has garnered significant attention. Recent floristic research conducted on the flora of Bessarabia has confirmed the presence of six species of the *Thymus* L. genus: T. *moldavicus* Klokov & Des.-Shost, *T. coldei* Pînzaru, *T. pannonicus* All., *T. marschallianus* Willd., *T. glabrescens* Willd. and *T. pulegioides* L. [8].

Species of the *Thymus* L. genus are widely distributed worldwide [6, 7] and have been utilized in traditional medicine for centuries due to their antiseptic, carminative, antiviral and antioxidant properties [13]. Additionally, they are of interest as a source of pentacyclic triterpenoids, which exhibit a range of biological activities, including anti-inflammatory, hepatoprotective, antimicrobial, anti-HIV-1, anti-ulcer, gastroprotective, hypoglycemic, antihyperlipidemic and cytotoxic effects against various tumour cell lines [4]. One notable species introduced into the aromatic plant collection for investigation is *Thymus longicaulis* C. Presl. This species was obtained through collaboration with the coordinating researcher, Dr. Pavel Pânzaru, who brought it from Italy and introduced it to the collection in 2022 for further study.

Thymus longicaulis C. Presl. is native to southern Central and Southeastern Europe, extending to Sicily, Turkey, France and North Africa. It thrives in open habitats such as meadows, rocky areas, mountain pastures and clearings within European beech forests. The species is widely cultivated around the world for its medicinal and culinary applications [9]. According to literature data, the GC analysis of the essential oil has revealed the presence of 34 well-separated components, which account for 98.86% of the total oil. The primary constituents are α-terpineol acetate (67.52%), thymol (4.47%), limonene (3.58%), α-terpineol (3.43%) and γ-terpinene (2.07%). The essential oil of *T. longicaulis* consists of monoterpene hydrocarbons (11.20%), oxygenated monoterpenes (80.07%), sesquiterpenes (2.94%), oxygenated sesquiterpenes (0.79%) and 4.86% of other compounds. The oil is low in sesquiterpene hydrocarbons (3.66%), with only trace amounts of β-caryophyllene (1.54%), β-bisabolene (0.70%) and germacrene D (0.50%) [3].

The essential oil demonstrates antioxidant activity in the β-carotene/linoleic acid system, as observed in the conducted experiments. Additionally, the reducing power of the water extract was found to be superior to that of synthetic antioxidants [10].

Research has shown that the essential oil of *Th. longicaulis*, obtained from plants grown in Croatia, exhibits antimicrobial activity against common respiratory pathogens. The yield of essential oil, extracted by hydrodistillation from the aerial parts of the plant, was 1.2%. The analysis revealed a total of 41 compounds (99% of the oil's composition). The main constituents were thymol (46.3%), γ-terpinene (16.2%), methylthymol ether (11.4%) and p-cymene (9.4%). The essential oil demonstrated antimicrobial activity against all tested respiratory pathogens. The most sensitive strains were *Haemophilus influenzae* and *Streptococcus pneumoniae*, while *Staphylococcus aureus* showed the greatest resistance. These results suggest that the essential oil of *Th. longicaulis* is effective against clinically relevant respiratory pathogens that may develop resistance to conventional antimicrobial drugs [14]. *Th. longicaulis* C. Presl. is a small, perennial aromatic plant typical of the Illyrian-Mediterranean flora, traditionally used as a remedy for colds, flu, cough, nephritis and abdominal pain. The essential oil extracted from the plant is utilized in aromatherapy for its calming and relaxing effects. Additionally, it serves as a nectar-producing and ornamental plant, with high ground-covering potential, making it suitable for landscaping and gardening due to its attractive appearance [5].

Material and Methods Applied

The research conducted spanned from 2023 to 2025, with experiments carried out in the experimental field of the Plant Resources Laboratory. The plants were obtained from Italy in 2022 and are part of the aromatic plant collection of the Botanical Garden. They were cultivated in a partially shaded area with a southern exposure, following a general agro-technical background. Phenological observations and biometric measurements were performed throughout the growing season [12]. The essential oil content was determined based on the plant organ and its developmental stage [2]. Various methods of vegetative propagation were investigated, including division at the beginning of the growing season, layering, and generative propagation through seedling production from seeds and direct sowing in open fields.

Obtained Results and Discussions

The experimental results of the study demonstrated that *Thymus longicaulis* C. Presl., introduced from Italy and cultivated under local pedoclimatic conditions, behaves as a perennial plant, adapting favourably to its environment. The plants reach a height of 5 to 25 cm and exhibit the biological form of a chamaephyte, characterized by regeneration buds located 2 to 10 cm above the ground, which are protected by the snow layer during winter. The herbaceous parts of the plant die back annually, while the lignified basal portions remain dormant but viable. The stem is creeping, partially lignified, and has a tetragonal cross-section, determined by collenchyma bundles located at the four edges. The stem surface is covered with simple, deformed hairs, oriented downward, reaching a length of approximately 0.3 mm (Fig. 1.1).

1 **2** **3**

Figure 1. The species Thymus longicaulis C. Presl: 1. General aspect; 2. Inflorescence; 3. Essential oil extraction

The leaves are subsessile and arranged oppositely, with each pair oriented perpendicularly to the preceding one. The leaf blade varies in shape from narrowly elliptical to linear-spatulate. The upper surface is glabrous, while the lower surface shows weakly pronounced venation, with slightly anastomosing veins. Basal leaves are clustered at the base of the stems, typically consisting of 4 to 6 pairs per cluster, while the upper leaves progressively broaden toward the tips of the shoots. Stipules are absent.

The inflorescences consist of flowers grouped in erect whorls, with a variable shape ranging from spherical to ovoid. These inflorescences may be terminal or axillary and are distributed along the stem at irregular intervals. The bracts of the inflorescence are morphologically similar to the leaves. The flowers are hermaphroditic, zygomorphic and predominantly tetramerous or pentamerous, measuring 4 to 6 mm in length. The calyx is gamosepalous, distinctly bilabiate, campanulate, with five unequal sharp teeth – three corresponding to the upper lip and two to the lower lip. The surface of the calyx is pubescent and traversed by approximately 10 to 12 longitudinal veins. Its length ranges from 3 to 5 mm. The corolla is gamopetalous, bilabiate, and symmetric, with petals fused into a cylindrical-campanulate tube, partially enclosed by the calyx. The upper lip is elevated and slightly folded, while the lower lip is trilobate with oblong lobes. The colour of the corolla varies from light pink to violet and it reaches a length of 5 to 6 mm. Flowering occurs from May to August (Fig. 1.2). The bilabiate corolla represents a morpho-functional adaptation specific to entomophilous pollination. The upper lip protects the stamens and stigma, while the lower lip, through its colour and striations, attracts pollinating insects and serves as a landing platform while they visit the flowers. The fruit is a schizocarp composed of four dry, ovoid to oblong nutlets. The seeds fall to the ground by gravitational drop, and secondary dispersal predominantly occurs through insects, particularly ants (myrmecochory).

The perennial plants of *Th. longicaulis* entered the phase of vegetative regrowth in 2025 due to the high temperatures recorded in March, when daily average temperatures reached 8-9 °C, and the maximum air temperature on March 7 rose to +20 °C. Under these favorable thermal conditions, the growing season began between April 5 and 10. The last atmospheric frosts, with temperatures ranging from -1 to -3 °C, were recorded between April 27 and 29, affecting only a small percentage of the plants. In 2023 and 2024, the plants had already reached the budding phase by this time. Consequently, peak flowering occurred at the beginning of May and lasted for approximately 60 days. The fruits reached physiological maturity by mid-July.

The underground part of the plant consists of fasciculate roots and secondary adventitious roots, which develop from the nodes. Lignified taproots with a twisted appearance are also present. Numerous thin adventitious roots of variable length form along the underground portions of the aerial shoots. Together, these structures form a well-developed, robust fascicular root system, providing strong plant anchorage and high efficiency in the absorption of water and nutrients.

A distinctive feature of the species is the early resumption of vegetative growth, which is associated with a slow growth rate and compact size of the aerial shoots. During the first growing season, the plants complete the entire preparatory phase, with the immature phase lasting approximately 80 to 95 days.

At the end of the peak flowering phase, coinciding with the elongation of the main shoot, the formation of lateral shoots becomes more pronounced. The main shoot exhibits monopodial branching, a characteristic not maintained by the lateral shoots. Toward the end of the growing season, the plants enter the virginal age stage. By the beginning of winter, first-order lateral shoots become fully lignified, while second-order lateral shoots continue to grow, with internode length progressively decreasing from base to tip. Due to their compact arrangement and increased leaf density in the terminal area, the plants achieve full ground cover.

Th. longicaulis is a low-growing species with a compact habit and slow growth, valued for both its ornamental qualities and the aromatic properties of its leaves. Its small size makes it particularly suitable for use as a ground cover in ornamental or functional plantings. The leaves are small, narrow, dark green and highly aromatic due to the high essential oil content. During the summer, the plants produce abundant, small pink-lilac flowers arranged in dense inflorescences, playing a significant role in nectar production by attracting bees and other beneficial pollinating insects. *Th. longicaulis* thrives best under full sunlight, which enhances both flowering and the accumulation of aromatic compounds in the leaves.

For the first time, under the pedoclimatic conditions of the Republic of Moldova, the essential oil content in *Th. longicaulis* plants was determined at different phenological stages. In 2025, the highest essential oil content was observed during the peak flowering phase, with values ranging from 0.22-0.25% in fresh mass and 1.10-1.23% relative to dry mass. The maximum content in plant organs was recorded in the inflorescences, with 0.66-0.68% in fresh mass and 2.30-2.33% relative to dry mass (Fig. 1.3). Therefore, the optimal time for harvesting raw material is during the peak flowering phase, when essential oil concentration reaches its highest values.

Th. longicaulis prefers well-drained soils but demonstrates high ecological plasticity, thriving on a variety of soil types, including sandy and stony soils. Effective drainage is crucial to prevent water stagnation around the root system. Once fully established, the plant exhibits good drought tolerance, requiring irrigation only during prolonged heat periods or severe water shortages. The species develops optimally under intense light, with direct sun exposure promoting both enhanced flowering and the accumulation of aromatic compounds in the leaves. The plant's low water requirements and minimal maintenance needs make *Thymus longicaulis* an ideal choice for resource-efficient gardens and a viable option for cultivation in the context of climate change. Due to its high drought resistance, it can be cultivated on south-facing slopes. Pruning after the flowering period helps maintain a compact habit and stimulates the growth of new shoots. Removing aged or discolored parts is recommended to preserve plant vigor and health. With its dense ground cover, the species is ideal for filling spaces between stones or decorative slabs. Additionally, the aromatic leaves can be used as a culinary herb in gastronomy.

Propagation of *Th. longicaulis* can be achieved through direct sowing in the field, with the optimal sowing period being late autumn or early spring. Seeds should be sown approximately 50 cm apart in rows, at a depth of up to 1.0 cm. High yields can also be obtained by first growing seedlings in protected environments and then transplanting them into the field in May. Vegetative propagation is also effective, particularly by dividing mature clumps when their productivity becomes unprofitable. A section of the clump is removed, and the well-rooted outer parts are collected and replanted. Each clump can be divided into 7-12 vegetative units, each with a substantial number of well-developed adventitious roots at the base, ensuring a high success rate. *Thymus* can easily regenerate through stolons, providing an efficient, simple and cost-effective propagation method. The layering technique involves securing a creeping stem to the ground and covering it with a small amount of soil. After 6-8 weeks, roots will form, and the rooted portion can be cut and

transplanted. Additionally, propagation by cuttings was investigated. From June to August, shoot tips of 5-7 cm were collected, with the lower leaves removed, and planted in trays containing a sand-perlite mixture. Placed in light shade and kept slightly moist, rooting occurred in 3-5 weeks, with a high rooting success rate of 75-85%. The vegetative material is then planted in late autumn or early spring, depending on local pedoclimatic conditions.

Conclusions

The pedoclimatic conditions of the Republic of Moldova are favourable to the growth and development of *Thymus longicaulis* C. Presl., introduced as a promising aromatic species.

It completes its entire ontogenetic cycle, demonstrating a high adaptive potential. The plants are notable for their exceptional drought resistance, making them a viable alternative in the context of climate change.

The species propagates efficiently both vegetatively – through division of perennial clumps, layering and cuttings, as well as generatively, through direct sowing in the field or by using seedlings grown in a greenhouse. Flowering and fruiting occur in the first year of growth and continue for 5-6 years, with plants being monitored for long-term sustainability and productivity. The maximum essential oil content is produced during the peak flowering phase, beginning in the second year of vegetation, with values ranging from 0.22 to 0.25% in fresh mass and 1.10-1.23% in dry mass.

The main therapeutic activities of *Thymus longicaulis* include antiseptic, expectorant and spasmolytic effects, which are attributed to its essential oils and flavonoids. The major component of the essential oil is α-terpineol acetate, followed by thymol and limonene. *Th. longicaulis* stands out as a sustainable, attractive and cost-effective solution for garden landscaping in dry areas. This creeping species forms dense, low, aromatic carpets, making it an excellent alternative to traditional lawns, particularly in areas with intense sun exposure, such as rock gardens. The species is well-suited for cultivation under local pedoclimatic conditions and offers multiple uses as an aromatic, medicinal, melliferous and ornamental plant. However, *Th. longicaulis* requires further studies to optimize cultivation techniques, ensure the sustainable use of its resources and identify the key components of its essential oil.

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