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BIOLOGICAL STUDY AND ESSENTIAL OIL CONTENT IN SOME SPECIES OF THE GENUS ARTEMISIA INTRODUCED IN THE BOTANICAL GARDEN

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The article presents important aspects of the biomorphological features and essential oil content of 2 allochthonous species of the genus *Artemisia* L., Asteraceae family, introduced under the pedoclimatic conditions of the Republic of Moldova: *Artemisia abrotanum* L. Thunb and *Artemisia stelleriana* Besser, which behave as herbaceous, perennial plants. The species have been investigated as high value aromatic, medicinal and ornamental plants. The biologically active substance in the plants is the essential oil, which is appreciated in phytotherapy, cosmetology and aromatherapy. The experimental results of the study demonstrate that *Artemisia* species, introduced into new pedoclimatic conditions, have good adaptive potential and do not demonstrate special requirements for local factors, go through the entire development cycle, thus they can be successfully recommended as promising species to increase the assortment of aromatic plants and with potential possibilities of being implemented in various branches of the national economy.

Keywords: *plant, Artemisia, introduction, content, oil, cultivation, cosmetics.*

STUDIUL BIOLOGIC ȘI CONȚINUTUL ÎN ULEI VOLATIL LA UNELE SPECII DIN GENUL ARTEMISIA, INTRODUSE ÎN GRĂDINA BOTANICĂ

Lucrarea prezintă aspecte importante privind particularitățile biomorfologice și conținutul în ulei volatil la două specii alohtone din genul *Artemisia* L., familia *Asteraceae,* introduse în condițiile pedoclimatice ale R. Moldova: A*rtemisia abrotanum* L. Thunb și *Artemisia stelleriana* Besser, care se comportă ca plante erbacee, perene. Speciile sunt investigate în calitate de plante aromatice, medicinale și decorative deosebit de valoroase. Substanța biologic activă din plante este uleiul volatil, fiind apreciat în fitoterapie, cosmetologie și aromoterapie. Rezultatele experimentale ale studiului efectuat demonstrează, că speciile de *Artemisia,* introduse în noi condiții pedoclimatice, au un bun potențial adaptiv, nu necesită cerințe deosebite față de factorii locali, parcurg întreg ciclu de dezvoltare, astfel pot fi recomandate cu succes ca specii de perspectivă în vederea măririi sortimentului sectorului de plante aromatice și cu o eventuală posibilitate de a fi valorificate în diverse ramuri ale economiei naționale.

Cuvinte-cheie: *plantă, artemisia, introducere, conținut, ulei, cultivare, cosmetică.*

Introduction

Artemisia L. is a genus in the Asteraceae family and includes approximately 400 species of perennial plants of particular importance, having numerous therapeutic properties due to the presence of essential oil and various chemical compounds, therefore they have a wide range of applications, including medicinal, aromatic and culinary uses [1]. The genus is named after Artemis, who in Greek mythology is the goddess of the moon, wild animals and hunting [2]. It occurs in Europe, Asia, North and Central America. Ten species are recorded in the flora of Bessarabia [3]. In the collection of aromatic plants of the National Botanical Garden, 5 species have been mobilized, researched and preserved as aromatic and medicinal plants (*Artemisia absinthium* L., *Artemisia balchanorum* Krasch., *Artemisia lavandulifolia* DC., *Artemisia abrotannum* L., *Artemisia stelleriana* Besser, *Artemisia dracunculus* L) [4].

Artemisia species are well known for the presence of essential oil which has applications in the food and pharmaceutical industries, as well as in the folk medicine. Some data from the literature indicate that the essential oil content of *A. abrotanum* is 0.51% of fresh plant material and 2.1% of dry matter. The main compound of the essential oil is eucalyptol (1,8-cineole) [5]. The essential oil has a stomachic, general

tonic, stimulating action with a therapeutic effect. *Artemisia stelleriana* is a plant with similar properties and uses due to the presence of essential oil, but which is also cultivated for decorative purposes. Some studies show that the essential oil from these plants is a rich source of mono-terpenoids along with sesquiterpenoids, linoleic acid and eucalyptol – a compound with promising anti-inflammatory and antioxidant properties [6].

Taking into account the research previously conducted on some species of wormwood, we considered it important to investigate 2 allochthonous species of *Artemisia* (*Artemisia abrotanum* L. Thunb, *Artemisia stelleriana* Besser), which are less researched and rather promising from the point of view of acclimatization, biological features, dynamics of the essential oil content, with the aim of implementing them in various fields, as well as for expanding the assortment of aromatic plants.

Artemisia abrotanum is a promising aromatic species – a perennial shrub that in its native habitat reaches up to 1.4 m in height, native to southern Europe, namely Spain and Italy [7]. It is cultivated in many countries on large areas, usually in private gardens. It is also cultivated in our country, but on very small areas, by amateurs, as a medicinal and aromatic plant, as well as an ornamental plant, highly appreciated for its attractive foliage and its pleasant smell, similar to that of lemon [8]. In the northern areas of its growing range, seeds often do not reach maturity because flowering occurs too late in the season. It grows best in organically rich, dry to medium moist, well-drained soils and in full sun [9]. *Artemisia stelleriana* is another species, recently introduced in the Botanical Garden, considered as a subject of study. It is native to Asia, the far east of Russia and western Canada. It is an herbaceous, perennial species that reaches a maximum height of 40-45 cm under natural growing conditions and is recognized for its light green to silvery white leaves, which are covered on both sides with thick trichomes. The foliage is present throughout the growing season, with an attractive appearance. In the wild, it blooms from July to September [10]. The flowers are yellow and grow in tall clusters [11].

Applied materials and methods

The research conducted spans the period 2022-2024, and focuses on the comparative study of the species *Artemisia abrotanum* L. Thunb and *Artemisia stelleriana* Besser., the experiments being set on the territory of the Collection of Aromatic Plants, within the "Plant Resources" Laboratory.

The species *A. abrotanum* was obtained through the International Seed Exchange (*Index Seminum*), from the Botanical Garden in Zielona Góra, Poland. The species *A. stelleriana* was received through the International Seed Exchange from the Botanical Garden Karlsruhe, Germany. Both species were grown in a sunny plot, under favorable climatic conditions to support their growth and development.

The seed quality for both species, *A. abrotanum* and *A. stelleriana*, was analyzed and tested by determining the germination capacity of seeds obtained after 2 years of cultivation. Phenological observations and biometric measurements were performed on the plants grown in the experimental plots, during the growing season [12].

The essential oil content was determined by steam distillation of the aerial parts of the plants, harvested at full bloom, in collaboration with the Institute of Genetics, Physiology and Plant Protection [13].

Obtained results and discussions

Artemisia abrotanum L., also known by the common names: southernwood, lad's love, or southern wormwood, behaves as a perennial plant under the local pedoclimatic conditions. It develops a richly branched root system and an erect stem, 0.3–1.2 meters tall, which is paniculately branched. The leaves are hairy on the underside and petiolate; the lower leaves are twice pinnately divided, measuring 4–8 cm long and 3–6 cm wide. The flowers are grouped into small, gray, pedicellate anthodia arranged in racemes in the axils of long, yellow bracts (fig. 1).

Perennial *A. abrotanum* plants, under the conditions of the reference year (2024), began growing at the end of April, developing 6-8 stems, with 6-8 pairs of leaves. By early June, the plants had reached a height of 50–60 cm, by this time the bushes took on a more compact and decorative appearance.

a) b) c) d)

Figure 1. *Artemisia abrotanum* L. Thunb plants. a) general appearance; b) leaf; c) flower; d) root system

Plant growth and development intensified up to the budding phase, which began at the end of June and lasted 30-32 days. The full flowering phase started at the end of July and lasted approximately 35-45 days. In early September, the leaves started to turn yellow, signaling the start of the seed ripening phase. Thus, the species completed all the phenological phases of the seasonal cycle. The growing season lasts 176-180 days. Throughout this period, the plants require care such as weed removal and soil loosening to better withstand arid summer conditions. The plant is resistant to low temperatures (fig. 2).

	April			May			June			July			August			September			October
																			123
A.abrotanum																	●	●	●

Figure 2. The development of phenological stages in the species *A. abrotanu*m L. Thunb
Legend: ◎ *– beginning of vegetative growth;* ◎ *– budding;* ◎ *– full flowering;* ● *– seed ripening*

Artemisia stelleriana Besser is commonly known as hoary mugwort, Dusty Miller, beach wormwood, or oldwoman. It develops a creeping, moderately thick rhizome in the soil. The stems are branched, densely covered with pubescent silver-gray leaves with rounded, deeply divided lobes. This is an introduced species in Moldova, and under the local conditions it reaches 20-25 cm in height and spreads over 45-60 cm in width, forming an attractive ground cover. Although this plant does not flower conspicuously, it is valued for its contrasting foliage, which adds interesting texture and visual appeal to landscape designs. The small, yellowish flowers appear and become noticeable in midsummer. The marginal flowers are soft yellow in color; the corolla is hollow and tubular-conical in shape. The fruits are small achenes (fig. 3).

a) b) c) d)

Figure 3. Artemisia stelleriana Besser plants. a) general appearance; b) leaf; c) flower; d) root system

Under the climatic conditions of the reference year, perennial perennial *A. stelleriana* plants in their second year of development were characterized by the presence of 8–12 annual shoots, which began to grow in early April (03.04.2024). The stems are erect, robust, and densely covered with hairs. The leaves are strongly fragrant, silvery green, deeply lobed and densely pubescent on both sides. The number of leaves on the central axis is on average 28-34, reaching a length of 8.0-8.5 cm and a width of 3.0-3.5 cm. By early June, the plants reach a height of 30-40 cm. At the end of June, the *A. stelleriana* plants enter the budding phase. The full flowering phase is noted in the mid-August and lasts approximately 45-50 days. During this period, the fragrant flowers attract pollinating insects. As a result, the species is considered melliferous, offering a long and late-season flowering period. In the second half of September, some leaves begin to turn yellow, marking the start of the seed ripening phase, which continues until the first frosts. The plants then enter dormancy. The fruits are small achenes. The growing season lasts about 210-220 days. The species is winter-hardy (fig. 4).

	April	May	June	July	August	September	October
							123
	April	May	June	July	August	September	October
A. stelleriana					◎	◎ ●	●●●

Figure 4. The development of phenological stages in the species *A. stelleriana* Besser
Legend: ◎ – beginning of vegetative growth; ◎ – budding; ◎ – full flowering; ● –

The value of aromatic plants lies in the presence of essential oil, which gives them aromatic and therapeutic potential. In the case of *Artemisia* species, the basic biologically active substance is the essential oil. The investigations carried out show that the essential oil is synthesized in all above-ground organs, starting from the budding phase and continuing through the beginning of flowering, reaching peak levels during full flowering. Accordingly, in the reference year the essential oil content of the *A. abrotanum* species was determined in the full flowering phase, on 05.08.24, which was noted as 0.20-0.22% in the green mass and 0.70-0.72% dry matter. In the *A. stelleriana* species, in the full flowering phase, the essential oil content is lower, constituting 0.055-0.057% in green mass and 0.155-0.160% in dry matter, which was determined on 05.09.2024. The species typically can grow and remain productive in the same location for 3-4 years (fig. 5).

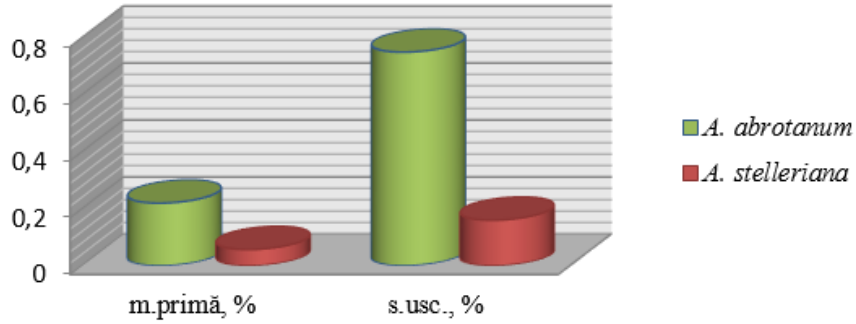

Figure 5. The essential oil content in *Artemisia* species

A review of the literature on the composition of the essential oils of both wormwood species shows that they are characterized by a high content of eucalyptol and camphor, which are associated with anti-inflammatory, antitoxic, and analgesic properties. However, in *A. stelleriana*, linoleic acid is also present, known for its ability to support metabolic balance in the human body.

Conclusions

The study shows that the species *A. abrotanum* and *A. stelleriana* can be successfully introduced into the pedoclimatic conditions of the Republic of Moldova, as both species demonstrate a high adaptive potential. It is important to note that these plants complete all phenological phases of the ontogenetic cycle, with

differences only in the timing of these phases. In the species *A. stelleriana*, the growing season is longer – approximately 220-230 days, while in the species *A. abrotanum* it lasts 176-183 days. In both species, the biologically active substance is the essential oil, but its content determined in the full flowering phase varies. In the species *A. abrotanum,* the essential oil content is 0.22% green mass and 0.72% dry matter, the oil having a slight analgesic effect on the human body. In contrast, *A. stelleriana* contains a lower amount of essential oil – 0.057% in green mass and 0.160% in dry matter – and is considered more promising as a species for landscape design. Eucalyptol is present in the essential oil of both species. Additionally, they are valued as honey plants due to their extended flowering periods. Further research is needed to determine the full chemical composition of the essential oils in both species, supporting their potential as new local sources of raw material recommended for use in various industries.

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