

SOME ASPECTS REGARDING THE CULTIVATION OF SPECIES WITH DECORATIVE VALUE *ACONITUM DEGENII* Gáyer

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Abstract: *Ex situ* conservation is the most important way through a Botanic Garden contributes to biodiversity conservation. One of the multiple directions of *ex situ* conservation is the diversification of the collections with spontaneous cormophytes presenting decorative value. *Aconitum degenii* Gáyer is an herbaceous, perennial and toxic species with the areal in Alps and Carpathian Mountains, sporadically met at forest's margins. This species has been studied in 2009-2011 period in order to observe its behavior in the environmental conditions characteristic to the Botanic Garden of Iași. To accomplish this aim seeds, rhizomes and individuals have been collected from the wild and introduced in experimental fields. Comparisons between flowering periods, qualitative (color of the flowers) and quantitative (number of the flowers, leaves and ramifications, plants height, rhizomes length) decorative characters of both cultivated and spontaneous individuals have been realized. It was observed that *Aconitum degenii* Gáyer individuals are keeping (almost the same quantitative characteristics) and even improve (longer flowering period) their decorative characteristics without being deteriorated or diminished. From the morpho – anatomical perspective none significant differences have been observed.

Key words: decorative species, conventional cultivation

Introduction

The *Aconitum* genus includes approximately 300 species distributed mainly in the Northern Hemisphere [LUO & al. 2005]. In Romania, there were identified 10 species with 5 atypical subspecies [CIOCĂRLAN, 2000] and it seems that the richest areas in *Aconitum* species are represented by the Northern half of the Oriental Carpathians and the Eastern part of the Southern Carpathians; in the Apuseni Mountains, *Aconitum* species appears less frequently [MIHOK & al. 2005]. These are herbaceous perennial plants, mainly cultivated for their tubers, used in medicinal and pharmaceutical purposes. Various active constituents produced from the roots of various species of *Aconitum* are used to cure a wide range of diseases [NIDHI & al. 2010]. Some species are also cultivated in ornamental purposes.

Aconitum degenii Gáyer (syn. *Aconitum paniculatum* Lam. nom. illeg.) is a species presenting a cylindrical, branched rhizome and tall stems (60-150 cm). The leaves are alternately arranged, palmate divided and the flowers are blue-purple colored, with long pedicels and arranged in wide, thinned and richly branched inflorescences. It grows at the mountain forests edges. It is an herbaceous, perennial species (hemicryptophyte), with areal in Alps and Carpathians Mountains. It prefers full light, cool mountain areas, relative humid, neutral and rich in nitrogen soils (L₆T₂C₄U₆R₇N₇) [ELLENBERG, 1992]. It can be found in 6430 – Hydrophilous tall-herb fringe communities of plains and of the montane to

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alpine levels habitat type [GAFTA & MOUNTFORD, 2008], growing on fertile soils (*Betulo – Adenostyletea*) [CHIFU & al. 2006]. It is a diplo-polyploid species, spread sporadically in Romania (beech – fir vegetation levels) [CIOCĂRLAN, 2000].

The species is known and used for medicinal purposes since antiquity. It is a toxic species that can be grown either alone or in groups in parks and gardens, being decorative by flowers.

Material and methods

In order to set up the experimental fields and to favor the growth, flowering and fructification of *Aconitum degenii* individuals, a flat, sunny and protected from strong currents of air land located between the greenhouses of the Botanical Garden of Iasi has been chosen. Soil preparation was done in the preceding autumn of planting and consisted of weed removal and destruction of their roots [CIREAȘĂ, 1993]. Before planting, in the spring, the land was worked with a cultivator. Fertilizers were not applied in advance.

Multiplication has been realized by seeds (Fig. 1) presenting good germination, about 80%, of which seedlings are produced (autumn sowing in pots, in November, because seeds lose germination capacity) and rhizomes (vegetative). Seedlings were obtained in pots using a mixture of earth, organic natural fertilizer, neutral peat and sand (1 : 2 : 1 : 1). The planting was done in spring, at the end of April. The plants were subjected to the process of mud and planted at 70 cm between rows and 50 cm distance from each other. The vegetative propagation by rhizomes has been tried. To do this, only the young and healthy rhizomes were used. Rhizomes were planted with the buds facing up, at the same distance intervals as the seedlings. The seeds collection has been realized after the fruit maturation (the second half of September). The harvesting of rhizomes has been made both during flowering period (June-August) and after the flowering period (September). Only young rhizomes have been collected. Waterings were applied each day (the first month after planting) to maintain soil moisture continuously. Weeds removal had a very important role because weeds absorbed the moisture and food of *Aconitum* plants and, in the early stages of development overshadowed the seedlings, with negative effects on their development. In culture conditions, *Aconitum degenii* plants grow well, vigorous, but do not tolerate the presence of weeds.

Results and discussions

Natural populations from Eastern Carpathians (Stânișoarei, Ceahlău, Bistriței, Călimani and Nemira Mountains) of *Aconitum degenii* have been studied in areas with altitudes varying between 750 and 900m, characterized by a relative cold climate (2-4 °C yearly average), abundant precipitations (750-1000 mm/m²/year), increased relative humidity of atmosphere (≈ 80-85%) and neutral-weak acid soils (pH 6-7). From the natural habitats (*Vaccinio – Piceetea* forests edges) seeds and individuals have been collected in order to cultivate them in the Botanic Garden from Iasi (characterized by a temperate continental climate with annual precipitations average of approximate 518 mm, annual temperatures average by 9,6 °C, relative humidity of the atmosphere ≈ 70% and neutral soils – pH ≈ 7).

The seeds have initiated the germination process after 3 weeks. The cultivated plants produced flowers and viable seed in the first year of growth. Cultivated plants, grown from seeds and tubers in Botanic Garden from Iasi, generally produced one to two daughter tubers

by the end of the growing season. The transplanted seedlings collected from the wild and grown at low altitude presented a decrease of the plants characteristics (Fig. 3).

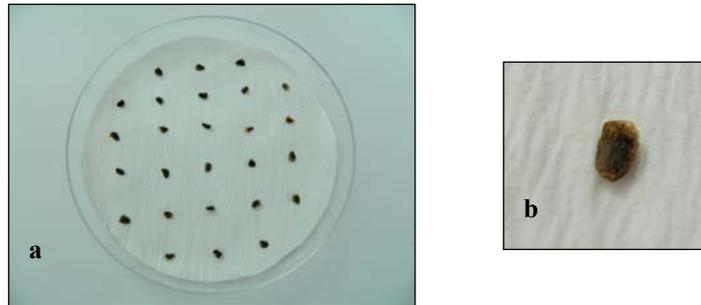


Fig. 1. a) Seeds of *Aconitum degenii* – germination capacity determination
b) seed – detail

In culture conditions the *Aconitum degenii* individuals present cylindrical, branched rhizomes, with an average length of 8.21 cm, less with approximate 2 cm on average comparing with the specimens studied in natural habitats. Individuals average height is 77.28 cm, lower than the height of the individuals from spontaneous flora (average 86.46 cm).

The leaves of *Aconitum degenii* are palmate divided (Fig. 2b), are alternately arranged and are less in the cultivated plants comparing to the specimens studied in natural habitats (an average of 19.83 leaves on a stem compared to 27.9) which is correlated with height decrease under culture conditions (Tab. 1).

The flowers are numerous and are arranged in branched rich inflorescences (average 12.32 branches / plant). The flowers (Fig. 2a) are light blue - purple (size, color and intensity are kept) and presents long pedicels. Regarding the flowering period it was observed that the most of the cultivated individuals bloom at the same time as in natural habitats (July - September).

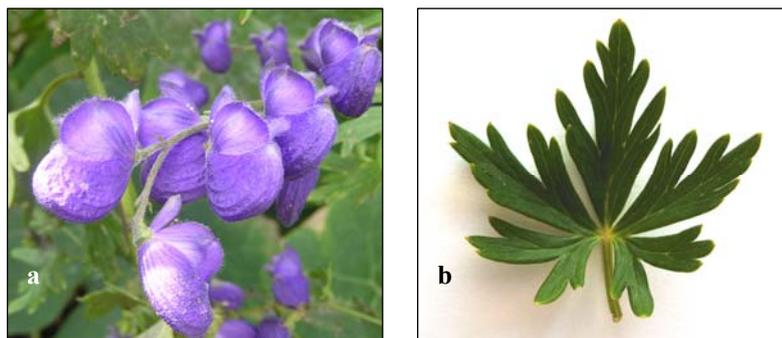


Fig. 2. The main ornamental characteristics of *Aconitum degenii* Gáyer
a – flowers
b – leaf

Tab. 1. Comparison of the morphometric characteristics of *Aconitum degenii* in natural habitats and culture conditions

POPULATION	ECOLOGIC CONDITIONS	COENOTIC AMBIANCE	MORPHOMETRIC CHARACTERS	NATURAL HABITATS AVERAGE	TRANSPLANTATION PLACE / ECOLOGIC CONDITIONS	MORPHOMETRIC CHARACTERS (2009-2011)
Stănișoarei Mountains	Altitude: 750 m. pH soil: ≈ 6.5 . Annual precipitations average: 800 mm. Annual temperatures average: 4 °C. Relative humidity of the atmosphere: $\approx 85\%$.	<i>Leucanthemo waldsteinii-Piceetum</i> : <i>Leucanthemum waldsteinii</i> , <i>Picea abies</i> , <i>Hypericum maculatum</i> , <i>Digitalis grandiflora</i> , <i>Veronica urticifolia</i> etc.	Plant height: 90,1 cm. Rhizomes length: $\approx 10,3$ cm. Ramifications number: 10,6. Leaves number/plant: 26,4. Flowers number/plant: 38,6.	Plant height: 86,46 cm. Rhizomes length: 10,12 cm. Leaves number/plant: 27,9. Ramifications number: 12,375. Flowers number/plant: 30,25.	Iasi Botanical Garden Altitude: 150 m. pH soil: ≈ 7 . Annual precipitations average: 518 mm. Annual temperatures average: 9,6 °C. Relative humidity of the atmosphere: $\approx 70\%$.	Plant height: 77,28 cm. Rhizomes length: 8,21 cm. Leaves number/plant: 19,83. Ramifications number: 12,32. Flowers number/plant: 35,55.
Bistriței Mountains	Altitude: 810 m. pH soil: ≈ 7 . Annual precipitations average: 900 mm. Annual temperatures average: 4 °C. Relative humidity of the atmosphere: $\approx 85\%$.	<i>Hieracio transsilvanici-Piceetum</i> : <i>Picea abies</i> , <i>Luzula luzuloides</i> , <i>Brachypodium sylvaticum</i> , <i>Samicula europaea</i> , <i>Epipactis helleborine</i> etc.	Plant height: 84,94 cm. Rhizomes length: 9,6 cm. Leaves number/plant: 26,48. Ramifications number: 14,1. Flowers number/plant: 31,2.			
Călimani Mountains	Altitude: 900 m. pH soil: ≈ 6 . Annual precipitations average: 1000 mm. Annual temperatures average: 2 °C. Relative humidity of the atmosphere: $\approx 80\%$.	<i>Hieracio transsilvanici-Piceetum</i> : <i>Picea abies</i> , <i>Oxalis acetosella</i> , <i>Lilium martagon</i> , <i>Streptopus amplexifolius</i> , <i>Dryopteris filix-mas</i> etc.	Plant height: 90,50 cm. Rhizomes length: 11,22 cm. Leaves number/plant: 30,2. Ramifications number: 10,8. Flowers number/plant: 24,4.			
Nemira Mountains	Altitude: 780 m. pH soil: ≈ 7 . Annual precipitations average: 750 mm. Annual temperatures average: 4 °C. Relative humidity of the atmosphere: $\approx 85\%$.	<i>Hieracio transsilvanici-Abietetum</i> : <i>Abies alba</i> , <i>Picea abies</i> , <i>Lonicera xylosteum</i> , <i>Viola reichenbachiana</i> , <i>Geranium robertianum</i> etc.	Plant height: 80,3 cm. Rhizomes length: 9,36 cm. Leaves number/plant: 28,54. Ramifications number: 14. Flowers number/plant: 26,8.			

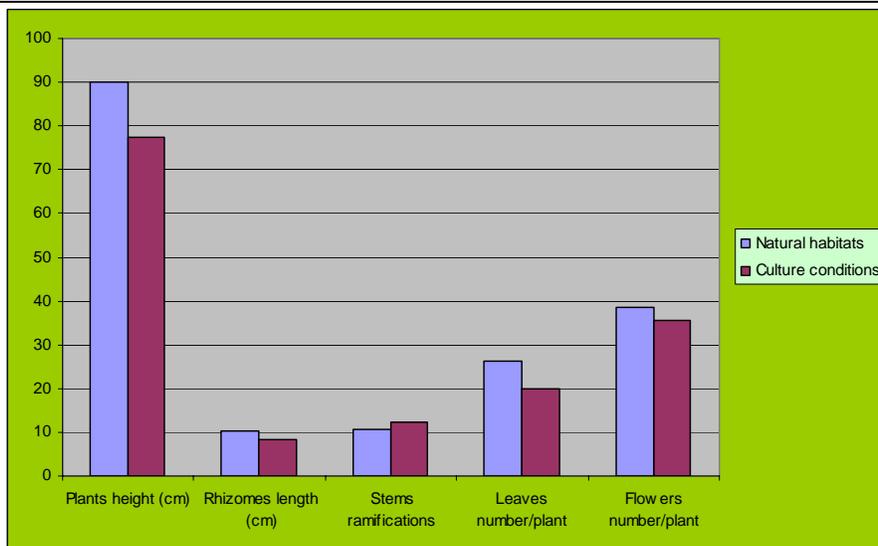


Fig. 3. Comparison between of some morphometric characters of *Aconitum degenii* individuals in natural habitats and under culture conditions

In the ecological conditions of the Botanic Garden of Iasi the plants have developed well both in partially shaded areas and full sunned areas as long as the soil was kept moist. The vegetation period of the *Aconitum degenii* individuals is about 160 days per year. The growth and the development of the plants in the first year of culture is slower but in the next years (the second and third) is more intense.

This species does not raise special issues of growth in the ecological conditions from Iași. It can be easy replicated by seedlings (from seeds) and rhizomes. Also, there have been not recorded any diseases or other pests during those three years of cultivation.

The *Aconitum degenii* inflorescences can be used as cut flowers (with caution because the species is toxic) or they can add a blue color to a shaded garden. These plants grow well in damp, rich soils and the beautiful blue or blooms is very attractive from the early to late summer in the garden. To determine the plant to form another round of flowers in the late summer or early autumn, the first inflorescences must be cut in order to not allow the plant to make seeds. Also, the flowers of *Aconitum degenii* resist a relative long time as cut flowers (about 10 days) during which the flowers continue to open.

The species could be planted under trees, in near wild gardens, among shrubs and in borders. It can fill vacant spaces in the garden when the earlier flowering plants have past. The *Aconitum degenii* individuals should be planted in masses (spots with numerous individuals). All species of *Aconitum* are very toxic (they contain aconitine, other alkaloids etc.), and,

consequently, they should never be planted in or too close to the vegetable gardens or the playing places of the children.

Conclusions

In the studied species (*Aconitum degenii*) the main decorative element is the flower. Secondly, the plant height, the number of stem's branches, the size, the shape and the arrangement of leaves and number of flowers (or inflorescences) are other characters that justifies the introduction of this species in culture.

Comparisons between the flowering periods, between a series of qualitative characters (such as flower color) and quantitative (number of flowers, leaves and stems branches, plant height, length of rhizomes) both in individuals obtained in culture or from the natural habitats showed that, under culture conditions, plants remains (approximately the same quantitative characters) and even improve (a longer period of flowering) decorative characters without to be deteriorated or diminished.

We consider that *Aconitum degenii* is well suited to the purpose of introducing in the culture because it proves to be adapted quite well (even acclimatized, because they produced flowers and fruits) in the environmental conditions from the Botanical Garden of Iași.

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References

1. CHIFU T., MÂNZU C. & ZAMFIRESCU O. 2006. *Flora & Vegetația Moldovei (România)*. Iași: Edit. Universității „Alexandru Ioan Cuza”, 2, 698 pp.
2. CIOCĂRLAN V. 2000. *Flora ilustrată a României*. București: Edit. Ceres, 1138 pp.
3. CIREAȘĂ E. 1993. *Floricultură specială*. Universitatea Agronomică „Ion Ionescu de la Brad” Iași, 355 pp.
4. ELLENBERG H. 1992. Indicator values of vascular plants in Central Europe. *Scripta Geobotanica*, 18: 78.
5. GAFTA D. & MOUNTFORD O. (eds.). 2008. *Manual de interpretare a habitatelor Natura 2000 din România*. Cluj-Napoca: Edit. Risoprint, 101 pp.
6. LUO Y., ZHANG F. & YANG Q. 2005. Phylogeny of *Aconitum* subgenus *Aconitum* (Ranunculaceae) inferred from ITS sequences. *Plant Syst. Evol.*, 252: 11-25.
7. MIHOK C., ANTAL D. S. & CSEDŐ C. 2005. The repartition of *Aconitum* species throughout the Romanian Carpathians. *Gyepgazdálkodási Közlemények*, 3: 26-28.
8. NIDHI S., VIKAS S., BARKHA K., DOBRIYAL A. K. & VIKASH S. J. 2010. Advancement in Research on *Aconitum* sp. (Ranunculaceae) under Different Area: A Review. *Biotechnology*, 9: 411-427.