

CENOLOGY, ECOLOGY AND DISTRIBUTION OF POPULATIONS OF *VIOLA HYMETTIA* BOISS. & HELDR. (*VIOLA*, SECT. *MELANIUM*) ON THE SANDS OF SOUTHERN OLTENIA, ROMANIA

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Abstract

The thematic area is located between Tâmburești and Sadova localities, in the southern part of Oltenia, south-east of Dolj County, in an area with sandy soil, also called "Sahara of Oltenia". The relief consists in plains and meadows covered by sand dunes. During the geobotanical research carried out in this area in the 2023-2024 period, several populations of *Viola hymettia* Boiss. & Heldr. (*Viola*, sect. *Melanium*) were identified. As a result of field studies, the presence of this rare species was found in the floristic structure of the plant communities specific to the sandy soils from south Oltenia. These populations were analyzed from a chorological, ecological and phytocenotic point of view in close correlation with the climatic changes of recent years and the degree of expansion of the surface of sandy soils in this part of Romania. Also, the species under study itself edify a community of plants *Violaeto hymettiae*-*Cynodontetum* Cîrțu 1973. The importance of this association lies in the fact that the participating species contribute to the stabilization of the sands and the enrichment of their humus content.

Key words: coenology, chorology, ecology, sandy soil, *Viola hymettia*.

INTRODUCTION

The floristic and faunal biodiversity of the sandy area of the Oltenia Plain, called the "Sahara of Oltenia", has been very little researched in the last 30 years. The growth and development of spontaneous and cultivated plants on sandy soils, unlike other lands, presents something specific to them (Buia & Păun, 1964). On the sandy soils of Oltenia, the specific biotic conditions allow the establishment of special plant communities (Păun et al., 1971; Păun & Popescu, 1972, 1983, 1985). Also, the natural habitats present a specific structure and shelter a special fauna (Niculescu, 2014). Large areas of forest vegetation, especially acacia, have been deforested, the area of sandy lands have expanded, the desertification phenomenon in Oltenia has taken on an even greater scale compared to the last century, a series of invasive species have appeared, especially in agricultural crops. The latter cause great damage and are very difficult to combat, as not much is known about their biology and ecology.

Viola hymettia, a flowering plant species in the violet family (*Violaceae*) is an annual pansy widespread in the South and East Europe to Caucasus, southern Balkans and the Aegean Islands, quite rare in central and southern Italy and Sicily, and in central-oriental part of Portugal, linked to stony pastures, dry open habitats and shrub fringes, mostly on sub-acid soils (Scoppola & Magrini 2019).

The *Viola* genus is represented, in the European Flora, by 123 species, among which 24 species are to be found in the Romanian Flora. *Viola hymettia* has the following synonymies: *Viola kitaibeliana* f. *hymettia* (Boiss. & Heldr.) W. Becker in Beih. Bot. Centralbl. 26(2): 339 (1910); *Viola tricolor* subvar. *hymettia* (Boiss. & Heldr.) Gams in G. Hegi, Ill. Fl. Mitt.-Eur. 5: 601 (1926); *Viola tricolor* var. *hymettia* (Boiss. & Heldr.) Boiss. in Fl. Orient. 1: 466 (1867).

Viola hymettia is a therophyte species that blooms in spring from March to June whose habitat includes: grasslands, rocky terrains, river gorges. Due to its limited habitat and threats such as overgrazing and illegal collection, this species is classified as vulnerable on the IUCN Red List.

Information about the distribution of the species *Viola hymettia* in Romania is limited. However, this species is known to prefer mountainous habitat and is found especially in hilly and mountainous regions of the country, such as the Carpathians. *Viola hymettia* is found in forests and wet meadows at higher altitudes where moisture conditions and soil rich in organic matter are favorable. The Apuseni region and other mountainous areas in the west of the country are also places where this species can be frequently encountered. It is also found in the hilly areas of Maramureş and Bucovina, where the ecological conditions are favorable for its development. *Viola hymettia* is often found in rich plant communities that include herbaceous and shrubby species adapted to moist and shady conditions. Association with other species may vary depending on habitat specifics such as altitude, soil type and humidity.

Among the mentions related to the presence of the species *Viola hymettia*: GL: Hanu Conachi, 21.06.1993, leg. A. Oprea [I 97444]; Hanu Conachi, 14.05.1994, leg. A. Oprea [I 97451, 97455]; Hanu Conachi, 30.04.1995, leg. A. Oprea [I 97445, 97449]; Hanu Conachi, 12.06.1995, leg. A. Oprea [I 97446-97448]; Hanu Conachi, 19.05.1996, leg. A. Oprea [I 97454]; Şerbăneşti, 13.05.1994, leg. A. Oprea [I 97450]; Şerbăneşti, 14.05.1994, leg. A. Oprea [I 97453] (Irimia & Bartok, 2017).

Niculescu et al., 2014, identified this specie in the sandy soils from Dăbuleni surroundings placed in the southern part of Oltenia, Dolj County. Few years later, Simeanu et al., 2019 declared numerous modifications regarding the reduction of the area or the disappearance of some species or vegetal associations, the identification of some new places for some rare psamphilous taxa in Romania's flora (ex. *Silene borystenica*, *Achillea ochroleuca*) or by disappearance of some plant association (ex. *Viola hymettiae*-*Cynodontetum*). This species is also adapted to higher altitudes, where the climate is colder and humidity is higher.

The diversity of climatic, relief and soil conditions of Oltenia region has led to high phytodiversity and allow to many of the spontaneous plants to vegetate among Fam. Molluginaceae: *Mollugo cerviana* (L.) Ser. or Fam. Violaceae, with *Viola tricolor* L., *V.*

canina L., *V. odorata* L., *V. alba* Bess. (Răduţoiu, 2020) and others.

This study presents a chorological, ecological and cenotic analysis of the species *Viola hymettia* in the southern area of Romania.

MATERIALS AND METHODS

Study area

The thematic area is located between Tâmbureşti and Sadova, in the southern part of Oltenia, southeast of Dolj County, in an area with sandy soil, also called "Sahara of Oltenia". The relief of the thematic area consists of plains and meadows covered by sand dunes (Figure 1).

The total area of sands in southern Oltenia exceeds 140,000 ha, being represented by strips of different widths along the Danube and on the left bank of the Jiu. Sandy soils in southern Oltenia have different origins and occupy the largest area in the country. Thus, in the studied territory the soils belong to the Luvisols class, with coarse sandy, sandy-loamy or sandy-loamy texture.

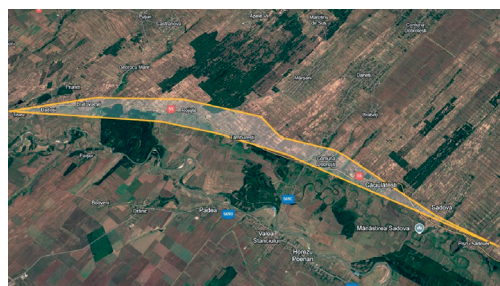


Figure 1. Map of the researched territory (source: Google Earth, modified)

From a climatic point of view, according to the Köppen climate classification, based on the natural distribution of plants native to an area, on annual and specific temperatures, on the precipitation regime, on local fluctuations and on seasonality, the psamosoils area in southern Oltenia is included in the Cfx climatic province, having a pronounced temperate continental character, with a slight Mediterranean influence, characterized by a pronounced dryness in the months of July - September and a surplus of precipitation in the months of May and June. This plain area has a climate with high annual thermal averages

(11.67°C), being included in the area with the highest values in the country, but with low precipitation (556.77 mm/year) and frequent droughts. In southwestern Romania, the air temperature has increased progressively, the increase becoming more pronounced after 1995. Many monthly and daily temperature records have been broken in all months of the year. Summers have become frequently hot with long intervals of heat and sweltering heat, accentuating the drought. The hottest area of Oltenia is the Oltenia Plain and especially Dolj County (Marinică et al., 2024). In terms of the evolution of precipitation recorded in the area, these are variable depending on the year and unevenly distributed, being insufficient for plant consumption, especially in the summer months.

For the identification of the taxa, we have used the *Romanian Flora*, vol. III, and *Flora Europaea*, vol. I. Regarding the nomenclature, we have adopted the classified list solutions which are considered correct, according to the *International Code of Botanic Nomenclature*.

For coenological studies, we would use the working method of the Central European phytocenological school.

For the identification of the plant communities and the coenotaxonomic classification, synthesis works of Păun & Popescu, 1983, 1985, Coldea, 1991, Sanda et al., 1998, Sanda, 2002, as well as Oberdorfer, 1992, Mucina et al., 2016, Mucina, 1997, Rodwell, 2002 were used.

For the cenological studies, samples were taken in which the surface, altitude, degree of vegetation cover were noted. For each species within the plant community, we provide the abundance-dominance values, as well as their constancy within the sampling. Due to the variability of vegetation and dominant species, all samples were included in a single synthetic table. Surveys were carried out in each locality, the surface of each survey being 25 m².

In order to identify the habitats, we looked into: *Natura 2000 in Romania habitat fact sheets* (2008); *Habitats from Romania* (Doniță et al., 2005); *Manual interpretation of Natura 2000 habitats in Romania* (Gafta & Mountford - coord., 2008).

RESULTS AND DISCUSSIONS

Chorological studies:

Viola hymettia is widespread in the southern part of Oltenia, on the sands on the left bank of the Jiu River, and grows in uncultivated places, on the sand dunes in the area, but also in the inter-dune areas, on the edge of the pea crops, vineyards, vegetable gardens, melons as well as on the edge of the acacia groves, in the forest patches or at the edge of the meadow forest from Bratovoiești. The species forms populations with a number of individuals ranging between 4-17/m² in the localities of Teasc, Tâmburești, Rojiște, Dobrești, Piscul Sadovei, Dolj County.

Phytosociological studies

On the sandy soils of Oltenia, the specific biotic conditions allow the establishment of special plant communities. Likewise, the natural habitats built by these plant communities have a specific structure and shelter a special fauna.

As a result of the research carried out, it was found that on the sandy soils from southern Oltenia, *Viola hymettia* is one of the edifying species of the plant community: *Violaeto hymettiae-Cynodontetum* Cîrțu 1973. Studies in this research were carried out in the localities of Tâmburești, Teasc, Rojiște, Dobrești, Piscul Sadovei, Sadova.

The plant community *Violaeto hymettiae-Cynodontetum* Cîrțu 1973 does not occupy very large areas, but develops well in the rainiest springs.

This plant community species presents a special importance both from a conservative and pedogenetic point of view, through the species in the floristic structure. The conservative role of this plant community is given by the presence in the floristic structure of other rare, endemic, vulnerable species, characteristic of the desertified lands of the "Sahara of Oltenia": *Centaurea arenaria* ssp. *borysthenea*, *Achillea ochroleuca* Ehrh. (*A. kitaibiana* Soó), *Bassia laniflora* (S.G. Gmelin) A. J. Scott (*Kochia laniflora* (S.G. Gmelin) Borbas), *Jasione montana* L., *Viola kitaibeliana* Schultes, *Polygonum arenarium* Waldst. et Kit, *Silene borysthenea* (Gruner) Walters., (*S. otites* (L.) Wib ssp. *parviflora*

(Ehrh.) Hayek), *Tragopogon floccosus* Waldst. et Kit., *Mollugo cerviana* (L.) Ser., *Ceratocarpus arenarius* L., *Potentilla arenaria* Borkh. (*P. cinerea* auct. non. Chaix.), *Corispermum nitidum* Kit. in Schultes., *Silene borysthena* (Gruner) Walters., (*S. otites* (L.) Wib ssp. *parviflora* (Ehrh.) Hayek), *Euphorbia seguieriana* Necker (*E. gerardiana* Jacq.). The plant community has a vegetation coverage of between 80-90%. In the floristic structure of the phytocenoses, the predominant bioforms are represented by therophyte species. Taking into account the forest elements, the species that dominate in these phytocenoses built by

Viola hymettia are the Eurasian and cosmopolitan ones. In some phytocenoses, *Conyza canadensis* as an invasive plant has a high abundance-dominance, influencing the conservation status of the plant community. From a syndynamic point of view, it can evolve towards the following plant communities: *Mollugo cervianae-olteniae* Borza 61, *Plantagetum indicae* Păun 1964, *Setario-Digitarietum* 1942 em. Soó 1943, *Digitario-Portulacetum* (Timár 1953) Bodrogh 1955, especially in dry years, with excessive temperatures characteristic in recent years in southern Oltenia.

Table 1. *Violaeto hymettiae-Cynodontetum* Cîrțu 1973 plant community

Number of relevée	1	2	3	4	5	K
Area (m ²)	25	25	25	25	25	2
Altitude (m.s.m)	65	67	76	74	61	
Coverage (%)	90	80	80	90	90	
Char. Ass.						
<i>Viola hymettia</i>	1	1-2	+1	+1	+	V
<i>Cynodon dactylon</i>	4-5	4	4	4-5	4-5	V
Festuco-Mollugion						
<i>Achillea ochroleuca</i>	+	+	+	+	+	V
<i>Tragus racemosus</i>	+	+	-	-	+	III
<i>Alyssum desertorum</i>	+	+	+	+	+	V
<i>Anthemis ruthenica</i>	+	+	+	+	+	V
<i>Chondrilla juncea</i>	+	+	+	+	+	V
<i>Tragopogon floccosus</i>	+	-	+	-	-	II
<i>Jasione montana</i>	+	+	+	+	+	V
<i>Ceratocarpus arenarius</i>	+	-	-	+	+	III
<i>Potentilla arenaria</i>	+	+	+	+	+	V
<i>Centaurea arenaria</i> ssp. <i>borysthena</i>	-	+	-	+	+	III
<i>Corispermum nitidum</i>	+	+	+	+	+	V
<i>Polygonum arenarium</i>	+	+	+	+	+	V
<i>Silene borysthena</i>	+	+	+	+	+	V
Festucetalia vaginatae						
<i>Festuca vaginata</i>	-	-	+	-	+	II
<i>Euphorbia seguierana</i>	+	+	+	+	+	V
<i>Erysimum diffusum</i>	+	+	+	+	+	V
<i>Viola arvensis</i>	+	+	+	+	+	V
<i>Allium rotundum</i>						
Festucetalia et Festuco-Brometea (incl. Festucetalia vaginatae)						
<i>Kochia laniflora</i>	+	+	+	+	+	V
<i>Holosteum umbellatum</i>	+	+	+	+	+	V
<i>Veronica verna</i>	1	1	+	1	+1	V
<i>Arenaria serpyllifolia</i>	+	+	+	+	+	V
<i>Bassia laniflora</i>	+	-	+	1	+1	IV
<i>Plantago indica</i>	-	-	+	-	+	II
<i>Tribulus terrestris</i>	+1	+1	1	1	1	V
<i>Helichrysum arenarium</i>	+	+	+	+	+	V
<i>Apera spica-venti</i>	+	+	+	+	+	V
<i>Linum hirsutum</i>	+	+	+	+	+	V
<i>Poa bulbosa</i> ssp. <i>vivipara</i>	+1	1	1	+1	+1	V
<i>Chondrilla juncea</i>	+	+	+	+	+	V
<i>Centaurea diffusa</i>	+	+	+	+	+	V
<i>Anthemis tinctoria</i>	+	+	+	+	+	V
<i>Linaria genistifolia</i>	+	-	-	+	-	II

<i>Potentilla argentea</i>	+	+	+	+	+	V
<i>Anchusa officinalis</i>	+	+	+	+	+	V
<i>Bromus hordeaceus</i>	+1	1	+	1	+	V
<i>Dianthus armeria</i>	-	-	+	+	-	II
<i>Eryngium planum</i>	+	+	+	+	+	V
<i>Stachys germanica</i>	+	+	+	+	+	V
<i>Xeranthemum annuum</i>	-	+	-	+	+	IV
<i>Picris hieracioides</i>	+	+	+	+	+	V
<i>Salvia verticillata</i>	+	+	+	+	+	V
<i>Achillea setacea</i>	+	+	+	+	+	V
<i>Medicago lupulina</i>	+	+	+	+	+	V
<i>Myosotis stricta</i>	+	+	-	-	+	III
<i>Erodium cicutarium</i>	+	+	+	+	+	V
<i>Dichanthium ischaemum</i>	+	+1	+	+1	+	V
Variae Syntaxa	+	+	+	+	+	V
<i>Veronica persica</i>	+	+	+	+	+	V
<i>Torilis arvensis</i>	+	-	+	-	-	II
<i>Sagina procumbens</i>	+	+	+	+	+	V
<i>Gagea lutea</i>	+	-	-	-	+	III
<i>Viola tricolor</i>	-	-	-	+	+	II
<i>Veronica polita</i>	+	+	+	+	+	V
<i>Lactuca serriola</i>	+	+	+	+	+	V
<i>Sonchus arvensis</i>	+	+	+	+	+	V
<i>Convolvulus arvensis</i>	-	+	+	-	-	II
<i>Scleranthus perennis</i>	1	+1	+	+	+	V
<i>Cerastium glomeratum</i>	+	+	+	+	+	V
<i>Conyza canadensis</i>	2	2	1	+	+	V
<i>Stachys recta</i>	-	-	-	+	+	II
<i>Cynoglossum officinale</i>	+	-	+	-	+	III
<i>Lappula squarrosa</i>	+	-	+	+	+	IV

Place and data of relevés: 1 - 20.06.2023, Tâmburești; 2 - 15.05.2023, Tease; 3 - 4.05.2024, Rojiște; 4 - 28.05.2024, Dobrești; 5 - 12.05.2024, Piscul Sadovei.

Viola hymettia species was also identified within other plant communities specific to sandy lands in the researched area, between the localities of Tâmburești and Sadova: *Mollugo cervianae-olteniae* Borza 61, *Plantaginietum indicae* Buia et al., 1960; Păun 1964, *Brometum tectorum* (Kern. 1863) Soó (1939) 1957, *Setario-Digitarietum* 1942 em. Soó 1943, *Digitario-Portulacetum* (Timár 1953) Bodrogh 1955, *Vicio-Polygonetum arenarii* Timar (1953) 1957, *Tribulo-Tragetum* Soó et Timat 1964, *Poetum (bulbosae) – Cynodontetum dactyloni* Res., Spîrchez et Csüros 1967, *Festucetum vaginatae oltenicum* Păun and Popescu 1972, 1983, 1985 and *Bromo sterilis-robinietum* (Pócs 1954) Soó 1964.

The species takes part of the floristic composition of plant communities that edify natural habitats of community or priority importance:

1. **Habitat 2110 Embryonic shifting dunes; Ro habitat type code: R1602, R1605**, vegetation adapted to ecological special conditions: high temperatures during the summer, xerophite and xerotherm key species due to powerful insolation, more in July and

August, the poor in humus soil and lack of humidity (Gafta & Mountford, coord., 2008; Niculescu et al., 2014).

2. **Habitat 6120* Xeric sand calcareous grasslands; Ro habitat type code: R3502, R6402, R6403** - plant communities which are made on sandy soil with hydric lack from the summer season Here are some rare species such as: *Tragopogon floccosus*, *Silene conica*, *Viola kitaibeliana*, *Viola hymettia*, *Centaurea arenaria* (Gafta & Mountford, coord., 2008; Niculescu et al., 2014).

3. **Habitat 6260* Pannonic sand-steppes; Ro habitat type code: R6405** - characterized by continental sandy vegetation and represented by the followings: *Plantaginietum arenariae* (Buia et al., 1956, Popescu & Sanda 1987; *Brometum tectorum* Bojko 1934; *Potentillo arenariae-Festucetum pseudodalmaticae* (Domin, 1933) Majovsky 1954; *Bassio laniflorae-Brometum tectorum* (Soo 1938) Borhidi 1996 (Gafta & Mountford, coord., 2008, Niculescu et al., 2014).

CONCLUSIONS

Viola hymettia is a valuable species for the Oltenia region, having a pedogenetic but also conservative role, being an edifying species of a plant community rarely found in Romania, specific to sandy soils: *Mollugo cervianae-olteniae* Borza 61, *Plantagetum indicae* Păun 1964, *Vicio-Polygonetum arenarii* Timar (1953) 1957, *Festucetum vaginatae oltenicum* Păun and Popescu 1973.

We believe that phytocenotic studies on this vascular species characteristic of sandy lands in southern Oltenia are particularly important given the current climate changes and the aridification and even desertification character of this area.

Although *Viola hymettia* is not considered a threatened species in Romania, we believe that in Oltenia this species occurs on restricted areas, populations have a relatively small number of individuals, and the protection of natural habitats is essential for maintaining its populations. Human activities, to which current climate change is added, may negatively affect the distribution and conservation status of this species.

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