



***Sedum caespitosum* (Cav.) DC. – a study concerning the presence of this plant in Oltenia**

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Abstract. The article indicates the presence on the territory of Oltenia of a rare species from Romanian flora - *Sedum caespitosum*. The species has been identified in the outskirts of Ciupercenii Vechi, in the flooded area of the Danube meadow, in the northeast of Bogdan Island, in the Natura 2000 site ROSCI0039 Ciuperceni-Desa, in April 23 2017. The plant occurs in the beaten and intensely grazed areas, of *Cynodonti-Poetum angustifoliae* Rapaics ex Soó – subas. *medicaginetosum minima* Sanda et al (2001), together with *Cynodon dactylon*, *Erodium cicutarium*, *Medicago minima*, *Plantago lanceolata*, *Scleranthus perennis*, *Veronica hederifolia*. It is an annual species, therefore reveals the xerophytic character of the vegetable association in which it is present, but has no role in diagnosis of the association.

Key Words: flora, rare plants, ecology, phytocoenology, Oltenia, Romania.

Introduction. *Sedum caespitosum* (Cav.) DC., species of the Crassulaceae family, is a rare plant in Romania's flora, found in the Red list of vascular plants of Romania as rare (R) (Oltean et al 1994).

It was described for the first time in 1971 (Cavanilles 1971), a Spanish botanist, under the name *Crassula caespitosa*, which later became homotypic synonym (Marhold 2011).

Augustin Pyramus de Candolle made description under the name *Sedum caespitosum* in 1828: 405.

The most important synonyms of the species are the following: *Sedum erythrocarpum* Pau, *Sedum rubrum* (L.) Thell., *Tillaea rubra* L. (Marhold 2011); *Sedum rubro* (L.) Thell., *Sedum deserti-hungarici* Simonkai (Răvăruț 1956).

References to the species have also been made under the following names, which also went into synonyms: *Aithales caespitosa* (Cav.) Webb & Berth., *Crassula diffusa* Lam., *Crassula magnolii* DC., *Crassula verticillaris* Linné, *Procrassula caespitosa* (Cav.) Fourr., *Procrassula magnolii* (DC.) Griseb., *Sedum cespitosum* Boiss., *Sedum louisii* (Thieb. & Gomb.) Fröder., *Sedum magnolii* Bubani, *Sedum melanoleucum* Schlecht. ex Ledeb., *Sedum rubens* subsp. *caespitosum* (Cav.) Bonnier & Layens, *Sedum rubrum* var. *louisii* Thieb. & Gomb., *Sedum stellatum* Friv. ex Nyman, *Tillaea erecta* DC. (The Plant List 2013).

Species description, according to the literature (Răvăruț 1956) – annual plant, stems with heights of 2-6 cm, usually reddish, glabrous, simple or slightly branched. Small leaves are succulent, wide elliptical to oval, obtuse, nested, fleshy, alternate, imbricate, with entire edges, of 2.5-5 mm long, with whole edges. Few-flowered inflorescence, with 2-3 branches and unilateral spike. Flowers almost sessile, 4- or 5-merous. Bracts almost oval, 3-4 mm long. Triangular sepals, 1-1.5 mm long, slightly wider than long, hairless, basal concrescent, sharp peak. Petals 3-mm, narrow mucronate, 2-3 times longer than sepals, uninerved, pink-carnelian or white, red-ribbed, free until to base. Stamens 5 or 4, alternating with petals, shorter they, less frequently and with 5 (4) staminodes, opposed to petals. Secreting-nectar scales are linearly spatulate. Follicles stellate widely divergent, glabrous, of about 5 mm long, concrescent towards the base, narrow lanceolate, furrowed and ribbed, polyspermy. Seeds glabrous, ovate, obtuse. Flowering time: April-May.

It occurs in the Mediterranean and sub-Mediterranean area, from Portugal to Syria and Israel, including the most of islands. From the Balkans it extends to Hungary and Romania, it grows in Crimea and from Turkey, it extends to western Iran. In Africa, the species has been signaled only from Morocco (Duchon 2012).

According to Euro+Med (2006), it grows in the following countries (areas): AE, AI, BI (M N), Bu, Cg, Co, Cr, Ct, Cy, Ga (F), Gr, Hs (S), Hu, IJ, It, LS, Lu, Ma, Mk, Rm, Sa, Si (M S) Sr, Tu (A E), Uk (K).

According to Oprea (2005), in Romanian flora the geographical distribution of this species includes the next counties: AB: Zlatna on Piatra Caprei (Răvăruț 1956); Abrud on Mt. Vulcan (Răvăruț 1956); BH: Mădăraș (Răvăruț 1956); AR: Șimand (Răvăruț 1956); Chișineu-Criș (Răvăruț 1956), Mâșca (Răvăruț 1956), Adea (Răvăruț 1956); Pîlu (Răvăruț 1956); Socodor (Răvăruț 1956); Pecica (Răvăruț 1956); Grăniceri (Răvăruț 1956); Arad (Răvăruț 1956); Vulcan (Răvăruț 1956); Rubicioara (Răvăruț 1956); TM: Foeni (Răvăruț 1956); Dinaș (Stere 1977); Distr. Timiș-Torontal (Borza 1944); BC: Fântânele (Mititelu et al 1993); Tepoia (Mititelu et al 1993), Vladnic (Mititelu et al 1993); TL: Babadag (Ștefureac 1970), Denis Tepe Hill (Andrei 1963), Beștepe (Sârbu & Ștefan 2005).

From an ecological point of view, the plant occurs naturally in skeletal soils, in rocky or stony areas; edges of roads, disturbed roadsides, grasslands, mostly between 0-1000 m above sea level (Duchon 2012; PlanNET-NSW Flora Online 2014). In Romania, this species has quoted from the silvosteppe to the forest beech area, on sandy or rocky soils (Sârbu et al 2013).

From the phytocoenological point of view, the plant grows in xerophytic communities, with salinity higher or lower (Fehér 2007; Knežević et al 2008; Molnár et al 2012).

In Slovakia, it is considered a component species of primordial halophilic vegetation in the pannonic basin, alongside *Camphorosma annua*, *Oenanthe silaifolia*, *Phlomis tuberosa*, *Pholiurus pannonicus*, *Puccinellia distans* ssp. *limosa*, *Plantago schwarzenbergiana*, *Rorippa sylvestris* ssp. *kernerii*, *Suaeda pannonica*, and *Thalictrum minus* (Marhold & Hindák 1998, in Fehér 2007).

In Hungary, it is found in the Red list of the vascular flora of Hungary (Király 2007). It grows only on the slopes of the South Tisza region (Jakab & Tóth 2003; Tóth 2003; Jakab 2005). Jakab (2005) recorded the plant from South Tisza, region II, from the *Artemisia santonici-Festucetum pseudovinae* Soó in Máthé 1933 corr. Borhidi 1996 association. In the Csomorkány and Fecskés area, in the spring, *S. caespitosum* dominates the salty vegetation communities alongside *Poa bulbosa* (Molnar et al 2012). The authors identified the plant in the salty area, where autumn typical species appear: *Aster tripolium*, *Atriplex tatarica*, *A. littoralis*, *Camphorosma annua*, *Carex stenophylla*, *Oxybasis chenopodioides*, *Oxybasis glauca*, *Crypsis alopecuroides*, *Lepidium perfoliatum*, *L. ruderales*, *Myosurus minimus*, *Pholiurus pannonicus*, *Plantago maritima*, *P. tenuiflora*, *Poa bulbosa*, *Podospermum canum*, *Polygonum aviculare*, *Puccinellia distans* ssp. *limosa*, *Rorippa sylvestris* ssp. *kernerii*, *Salsola soda*, *Suaeda pannonica*. The area is in decline, very grazing, with increasing salinity. In another plot, the species is associated with *Artemisia santonicum*, *Trifolium angulatum*, *T. retusum*, *Festuca valesiaca* ssp. *parviflora*, *Gypsophila muralis*, *Matricaria chamomilla*, *Lepidium ruderales*, and *Poa bulbosa*. Bátori et al (2014) identified *S. caespitosum* on 29.05.2013, in a plot of 4 m², on a salty meadow, with a 90% coverage, alongside: *Allium vineale*, *Artemisia santonicum*, *Bromus hordeaceus*, *Carex caryophylla*, *Cerastium dubium*, *Cynodon dactylon*, *Festuca valesiaca* ssp. *parviflora*, *Geranium dissectum*, *Limonium hungaricum*, *Matricaria recutita*, *Mentha pulegium*, *Muscari neglectum*, *Plantago lanceolata*, *P. tenuiflora*, *Podospermum canum*, *Trifolium angulatum*, *T. retusum*, *T. striatum*, *Valerianella dentata*, *Veronica arvensis*.

In Bulgaria, the species is recorded from the Komatinski rocks, located in the floristic area of the Western Frontier Mountains – Vlahina Mountain in particular, situated north-west above the village of Brestovo, Simitli district (Vutov & Dimitrov 2014). Pavlova et al (2003) recorded the plant on the serpentine of Mt Rodopi. Delcheva et al (2007) recorded the plant on Rodopi Mountains, from the Tchelkov Rid area.

In Romania, the species has been recorded in:

- Constanța County: on the limestone at Palazu Mic and even the Casimcea Plateau, in the Festucetum callierii Șerbănescu 1965 apud Dihoru (1969) 1970 (sin. Sedo hillebrandtii-Festucetum callieri Sârbu et al 1997, Sclerantho-Festucetum callierii Burduja et Horeanu 1976) association. The diagnostic species of the association, identified by Dihoru in 1970 (Dihoru & Doniță 1970), are *Festuca callieri*, *Stachys angustifolia*, *Achillea kitaibeliana* and *Silene compacta*. Horeanu (1976) added *Arenaria rigida*, *Sedum caespitosum*, *Scleranthus perennis* (Sanda et al 2008).

In the Casimcea Plateau, at Călugăreni, in xerophilic meadows (?Festucion rupicolae), the species has been recorded alongside *Centaurea gracilentata*, *Allium flavum* ssp. *tauricum*, *A. vineale*, *Arenaria rigida*, *Asplenium ceterach*, *Astragalus corniculatus*, *Campanula romanica*, *C. sibirica*, *Centaurea ovina* ssp. *besseriana*, *C. tenuiflora*, *Convolvulus cantabrica*, *Dianthus nardiformis*, *Festuca callieri*, *Fraxinus ornus*, *Galium verticillatum*, *G. volhynicum*, *Haplophyllum suaveolens*, *Iris pumila*, *I. variegata*, *Linum tenuifolium*, *Moehringia grisebachii*, *M. jankae*, *Ornithogalum sibthorpii*, *Saxifraga tridactylites*, *Scleranthus perennis*, *Thymus pannonicus*, *T. zygioides*, *Stachys angustifolia*, etc. (Negrean & Dihoru 2009b, c).

- Tulcea County: in the Babadag Plateau the species has been recorded in the Agropyro – Thymetum zygoidi Dihoru 1970 association, alongside: *Bufonia tenuifolia*, *Agropyron cristatum* ssp. *brandzae*, *Allium saxatile*, *Alyssum hirsutum*, *A. linifolium*, *Artemisia lerchiana*, *Convolvulus cantabrica*, *Dianthus nardiformis*, *D. pseudarmeria*, *Festuca callieri*, *Goniolimon besserianum*, *Koeleria lobata*, *Minuartia adenotricha*, *M. glomerata*, *Ornithogalum amphibolum*, *Paronychia cephalotes*, *Pimpinella tragioides* ssp. *lithophila*, *Satureja coerulea*, *Scutellaria orientalis*, *Sempervivum zebeborii*, *Thymus zygioides*, etc. (Negrean & Dihoru 2009a).

In Beidaud, from:

- 34.92 Ponto-Sarmatic steppes, in Medicagini minimae - Festucetum valesiacaе Wagner 1941, and Artemisio austriacaе - Poëtum bulbosae Pop 1970 associations (Petrescu et al 2014).

- 34.9211 Western Pontic thyme steppes, in Sedo hillebrandtii – Polytrichetum pilliferi Horeanu & Mihai 1974 association (Petrescu et al 2014).

- Arad County: in the ROSCI0231 Nădab - Socodor - Vârșad Natura 2000 site, on the soil of salinity from Socodor: few specimens, some of them off-site. Indicator of the primary character of halophilic vegetation (Dărăban 2013).

This article signals a new species for the historical province of Oltenia and is a first note that contribute to determining the coenological membership of the species in Oltenia.

Material and Method. The species *S. caespitosum* has been identified in the outskirts of Ciupercenii Vechi, in the flooded area of the Danube meadow, in the northeast of Bogdan Island, in the Natura 2000 site ROSCI0039 Ciuperceni-Desa, in April 23 2017.

The perimeter in which we identified the species lies in the western part of a connecting road between Ciupercenii Vechi and the exploitation of sand and gravel SUCCPI, on the left Danube's shore. In the perimeter analyzed is arranged a sheepfold, so the area is intensely grazed (Figure 1). The coordinates of the center point of the perimeter are: 43°55'55.7"N, 22°52'19.1"E.

Subsequent to the date of species identification, during the year 2017, trips were made in June, July, August, but the plant was not recovered.

On the occasion of the field trips, the floristic composition of the phytocenosis installed in the analyzed perimeter and neighborhoods was identified.

Determination and identification of the taxa has been done on fresh material using the binocular magnifier and the following "floras": Răvăruț (1956), Ciocârlan (2009) and Sârbu et al (2013). There have been comparisons with the original description (Cavanilles 1971) and with description of De Candolle (1828).

Species names follow Săvulescu (1952-1976), Tutin et al (1964-1980), Tutin et al (1996) and The Euro+Med PlantBase (ww2.bgbm.org).

The plant was photographed in situ. The collected material was registered and stored in the Herbarium of Botanical Garden "Alexandru Buia" from Craiova [CRAI]. Herbarium acronyms follow Holmgren et al (1990).



Figure 1. The identification area for *Sedum caespitosum* (source: <https://www.arcgis.com/home/webmap/viewer.html?useExisting=1>).

Results and Discussion. In the analyzed area, the land is sandy, dry, and windy.

On the edge of roads, located in higher areas, the vegetation is of the type Tribulo-Eragrostion minoris Soó et Timár in Timár 1957. Meet here phytocenosis of the type Tribulo-Tragetum Soó et Timár 1954 (Trago-Anthemietum ruthenicae Puşcaru et al 1963, Eragrostio poaeoides-Tribuletum terrestris Oprea 1998, Trago racemosi-Eragrostietum poaeoides Oprea 1997), with characteristic species *Tribulus terrestris* and *Tragus racemosus*; other species: *Anthemis arvensis*, *Arenaria serpyllifolia*, *Crepis tectorum*, *Cynodon dactylon*, *Digitaria sanguinalis*, *Eragrostis poaeoides*, *Medicago monspeliaca*, *Portulaca oleracea*, *Viola hitaibeliana*, *Xeranthemum annuum* and the *Syntrichia ruralis* moss.

The greater part of the perimeter of the analyzed field is covered with vegetation of the type Cynodonti-Poetum angustifoliae Rapaics ex Soó – subas. medicaginetosum minima Sanda et al (2001) (Cynodonti-Medicaginetum minima Popescu et Sanda 1975), with characteristic and dominant species: *Cynodon dactylon*, *Medicago minima*, *Poa bulbosa* var. *vivipara*. Other species identified in these phytocoenoses are: *Achillea setacea*, *Anthemis arvensis*, *Arenaria serpyllifolia*, *Berteroa incana*, *Bothriochloa ischaemum*, *Bromus tectorum*, *Carduus nutans* s. l., *Carthamus lanatus*, *Centaurea stoebe* ssp. *australis*, *Chondrilla juncea*, *Erigeron canadensis*, *Erodium cicutarium*, *Eryngium campestre*, *Festuca valesiaca*, *Marrubium peregrinum*, *Medicago lupulina*, *Senecio jacobaea*, *S. vernalis*, *Plantago arenaria*, *Poa angustifolia*, *Potentilla argentea*, *Tragus racemosus*, *Verbascum speciosum*. In intense grazing areas, *Poa bulbosa* is almost missing. In these phytocoenoses, develop well *Portulaca oleracea*, *Tribulus terrestris* and *Syntrichia ruralis*.

These phytocoenoses intertwine with those of the Bassio laniflorae-Brometum tectorii (Soó 1929) Borhidi 1996 (Bromo-Cynodontetum I. Pop 1970; Poëto bulbosae-Cynodontetum Resm. et al 1967, Plantaginetum indicae Păun 1964) association, which is widespread in the studied area, with species like: *Agrostis capillaris*, *Anthemis ruthenica*, *Apera spica-venti*, *Berteroa incana*, *Bromus hordeaceus*, *B. tectorum*, *Centaurea stoebe*

ssp. *australis*, *Chondrilla juncea*, *Cynodon dactylon*, *Erodium neilreichii*, *Erophila verna*, *Filago arvensis*, *Galium verum*, *Gypsophila muralis*, *Lamium amplexicaule*, *Medicago minima*, *Petrorhagia prolifera*, *Plantago arenaria*, *Polygonum aviculare*, *Potentilla argentea*, *Silene conica*, *Taeniatherum caput-medusae*, *Tragus racemosus*, *Tribulus terrestris*, *Trifolium arvense*, *Vulpia myuros*. Association Bassio laniflorae-Brometum tectorii is part of ord. *Festucetalia vaginatae* Soó 1957 which includes primary arenicol phytocenoses that inhabit the continental sands with weak basic reaction (Vicherek 1972 in Borhidi 2003).

In this context vegetal, general, in the beaten and intensely grazed areas, of Cynodonti-Poetum angustifoliae association, where *Poa bulbosa* is almost missing, we identified the species *S. caespitosum* on 23.04.2017 (Figures 2 and 3). On the date of identification, the following cohabitants were listed in the plot where the species was present, and they have been *Cynodon dactylon*, *Erodium cicutarium*, *Medicago minima*, *Plantago lanceolata*, *Scleranthus perennis*, *Veronica hederifolia*. On these surfaces, it grows abundantly *Syntrichia ruralis*.



Figure 2. *S. caespitosum* in situ (original).



Figure 3. *S. caespitosum* detail (original).

In the perimeter analyzed the soil is sandy, slightly loessoid. The species *S. caespitosum* was identified in pastures much degraded by grazing, in the association Cynodonti-Poetum angustifoliae Rapaics ex Soó – subas. medicaginetosum minimae, in road edge, where, *Scleranthus perennis* and *Sedum caespitosum* achieves a coverage of about 95% in the spring season. In autumn, in these areas grow *Portulaca oleracea*, *Tribulus terrestris* and *Syntrichia ruralis*.

Analyzing the presence of the species in the vegetal communities in Romania and in the neighboring countries (Slovakia, Hungary, Serbia, and Bulgaria), can draw the following conclusion:

- the species proceeds from the North West to the South East, from salinized areas (Slovakia) to desalinated areas (Serbia, Romania-Ciuperceni), then in Bulgaria (where it have quoted from the mountainous area, even the serpentines) and Romania-Dobrogea where has been found in xerophilous meadows, in the Babadag and Casimcea plateaus as well as on the limestone at Palazul Mic. Dărăban et al (2013) notes the following fact: "Of the confirmed species (1952-2010 vs 2011-2013) we note the rarity of the populations of halophilic species such as: *Aster tripolium*, *Beckmannia eruciformis*, *Sedum caespitosum*, *Spergularia marina* and *Trifolium ornithopodioides* (...). This

denotes either a natural evolution towards desalination, anthropogenic desalination, or a combination of these two categories of factors (most likely)."

This finding, that small populations of *S. caespitosum* occur on low salinity soils, is consistent with its results Knežević et al (2008), which analyzed ecologically 410 taxa from the flora of saline sites in northern Banat, province of Vojvodina, Serbia. Ecological indexes used in the analysis of organic basic environmental factors (humidity - F, chemical reaction - R, content of nitrogen and nitrogen compounds - N, content of humus (organomineral substances) - H, dispersion (aeration) of the substrate - D, salinity - S, light - L, temperature - T, and continentality - K) were those in Landolt (1977). For *S. caespitosum* the result was as follows: F = 1, R = 4, N = 1, H = 2, D = 4, S = +, L = 5, T = 4, K = 3.

It is noticed that the salinity of the soil has the lowest value (+), this means that *S. caespitosum* is not a good indicator of salinity, but rather, it is a pioneer species on sandy, rocky soils, which explains its presence in such a diverse ecological and coenological context.

Conclusions. This article signals a new species for the historical province of Oltenia.

The analyzed area is flooded periodically by Danube waters. The soil is not salty or in process of salting, but it is arid in dry periods due to the fact that it is alluvial and drains the meteoric water very well. The meadow habitat from the analyzed area has a partially natural origin and partly determined by the distinct influence of sheep grazing. Therefore, we consider that the species *Sedum caespitosum* is the pioneer of skeletal soils, not necessarily related to a high concentration of sodium and potassium salt.

It is an annual species, therefore reveals the xerophytic character of the vegetable association in which it is present, but has no role in diagnosis of the association.

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