



## CHOROLOGY OF *SEDUM URVILLEI* (CRASSULACEAE) ALONG THE DANUBE SHORES IN ROMANIAN BANAT BETWEEN MOLDOVA NOUA AND SVINITA)

Niculae MARILENA

AGAVE HI-IQ Solutions, Bucharest, Romania  
E-mail: mari\_niculae@yahoo.com

Accepted November 7, 2020

*Sedum urvillei* DC. is a yellow-flowered perennial species in the *Crassulaceae* distributed in East-European regions. Its Romanian range comprises besides certain Dobrogean populations, several disputable populations in Romanian Banat. There, *Sedum urvillei* is found in significant populations, but precise data about its actual occurrence in this region are missing. Typical *Sedum urvillei* from Dobrogea prefers rocky habitats where shallow soil minimizes competition. This report enriches our botanical knowledge of the distribution range of *Sedum urvillei* in Romanian Banat, by presenting herein comprehensive more precise data about the actual occurrence sites of *Sedum urvillei* in Romanian Banat along Danube's shores as observed in fieldwork surveys during over 30 years and other published data. These results comprise more than 50 occurrence sites for *Sedum urvillei* in Romanian Banat in the studied region. I document herein for *Sedum urvillei* a significant density of distribution in this region. As in Dobrogea, the co-occurrence of *Sedum urvillei* with the more common and very similar species *Sedum acre*, *Sedum sexangulare* and *Sedum annuum* provokes its confusion among these three species complicating its misreporting. Like in Dobrogea, in Banat along the Danube *Sedum urvillei* is also important for biodiversity conservation by sustaining a stenophagous weevil species *Aizobius sedi*. The fieldwork observations support also the segregation of the populations in Southern-Banat from *Sedum urvillei* in the synonymised *Sedum hillebrandtii*.

**Keywords:** *Sedum urvillei* DC, Chorology, biodiversity conservation, *Sedum hillebrandtii* Fenzl, *Crassulaceae*.

### INTRODUCTION

*Sedum urvillei* DC. is a yellow-flowered perennial species of *Crassulaceae* with Balkano-Pontic and East-European sub-Mediterranean distribution, where it shows a distinct xerothermic character. It was described in 1828 by A. P. de Candolle and since then, according to *International Crassulaceae Network*, many taxa were synonymised with it<sup>1</sup>, of which I include herein the following which are more relevant to the more precise territory of my study<sup>1,2</sup>:

– *S. sibirnyi* Velenovsky (1892) and *Sedum acre* var. *sibirnyi* (Velenovsky) Stojanov & Stefanoff, *Sedum sexangulare* ssp. *sibirnyi* (Velenovsky) Fröderström (1932), *Sedum sartorianum* ssp. *sibirnyi* (Velenovsky) D. A. Webb (1963);

– *Sedum sartorianum* Boissier (1856) with its derivatives: *Sedum acre* ssp. *sartorianum* (Boissier) J. A. Huber (1936), *Sedum urvillei* ssp. *sartorianum* (Boissier) Byalt (1997);

– *Sedum hillebrandtii* Fenzl (1856) with its derivatives: *Sedum urvillei* ssp. *hillebrandtii* (Fenzl) D. A. Webb, *Sedum sexangulare* ssp. *hillebrandtii* (Fenzl) Nyman (1890), *Sedum sartorianum* ssp. *hillebrandtii* (Fenzl) D. A. Webb (1963) *Sedum acre* var. *hirsutum* Wierzbicki; and *Sedum novakii* Domin (1929).

Although the first taxa are correctly synonymised with *Sedum urvillei*, in my opinion there are arguments in the data available from Romanian populations, which question the validity of the synonymisation of *Sedum hillebrandtii* Fenzl (1856) which also is native to Romania, with *Sedum urvillei* as many characters are distinctive enough to warrant taxonomic placement at the level of species (see also<sup>3,4</sup>).

Morphologically it is clearly distinguishable from other species of the same general appearance by the spurs located at the base of the leaves on vegetative shoots, and the presence of older leaves vestiges on the red-brown lignified stems, where the dead leaves have the aspect of whitish-grey

contorsioned scales of an approximate triangular shape. For more detailed description of its habitat please see<sup>1</sup>.

Like its close relative *Sedum annuum* L, (see also<sup>5,6</sup>) *Sedum urvillei* has 3–20 flowers per individual plant and also shows a considerable variation in other characters as: shoot length, number of branches on the stem, the size and shape of floral parts and inflorescence, and general floral morphology. Most remarkably, it perennates through “sterile” lignified and apically densely foliated shoots<sup>1</sup>.

According to International Crassulaceae Network<sup>2</sup> (which includes data for the species *Sedum hillebrandtii* Fenzl which is synonymised with *S. urvillei*), its general distribution comprises Southeastern Europe, from Danube plains in Hungary and Serbia, Southern and Eastern Romania, Balkan Peninsula and Greece to Turkey, R. Moldova and Southern Ukraine including Crimea.

As stated previously<sup>1</sup>, in agreement with Barca V. (Barca V. 2016, pers. communication) I maintain my opinion that the two taxa *Sedum hillebrandtii* Fenzl and *S. urvillei* should be separated as bona species and I regard *S. urvillei* as a truly Ponto-euxinic species extending through the Balkans and Greece into Anatolia and probably the Caucasus. But, as the scope of the present report is mostly chorological and not taxonomical, I leave this discussion for another article.

The area covered by this study extends north of the Danube and comprises approximately the entire southern edge of province of Banat, along the shores Danube river in between Moldova Noua in the North-West and the right shore of the Tisovita river in the South-East. This region encompasses a relatively narrower variety of habitats from the Danube flooded shores to one of the highest peaks in the region (Mount Treskovet) (elevations ranging roughly between 60 m and about 600 m a.s.l.).

The climate in the studied region is mild continental-submediterranean, characterized by relatively less wide annual and diurnal variations in temperature and rainfall, with milder winters due to the damping effect of Danube water along its shore. The edaphic conditions are equally narrowly diverse, typically with a shallow but very fertile rendzinc topsoil covering limestones bedrock.

No botanical work describing the precise and complete range of distribution of *S. urvillei* D.C. in Romanian Banat is available since the only monographic treatment of Crassulaceae family in Romanian flora was published<sup>6</sup>. This fact, together with the increasing interest for the taxonomy, ecology, chorology and medicinal properties of

Crassulaceae from Romania<sup>7–17,18</sup>, prompted me to continue the comprehensive presentation of precise data about the actual occurrence sites of *Sedum urvillei* in Romanian Banat, along the Northern Danube shores.

## MATERIAL AND METHODS

This distribution study follows the procedures previously mentioned in<sup>1</sup> and includes data obtained by surveys performed mainly by me and dr. BÂRCĂ Valentin during fieldwork trips; and locations cited in unpublished personal communications by other researchers, that were verified by us ad-hoc.

The region surveyed in this study extends about 10Km inland from the waterline of the Danube River, along the Danube shores, and are limited upstream and downstream respectively between the Locality Moldova Noua and the right bank of the river Tisovita, close to the locality Svinita. The region was explored and surveyed during multiple trips between the years 1987–2019.

The procedures follow<sup>1</sup> and briefly are:

The geographical coordinates for the cited locations were derived from GPS coordinate readings from surveys done by the author or by dr. BÂRCĂ Valentin, using a handheld GPS with a reported error of less than 5m at best reception, and were later crosschecked in the lab using ACME MAP version 2.2. The older data for which GPS coordinates were not available were crosschecked with topomaps and ACME MAP version 2.2. to assure consistency and accuracy of coordinates with the data gathered using GPS during later years (after 2004).

The data are presented in tabular format in Table 1, with the actual sites grouped around the closest human settlement from where the sites could be reached by foot or with the help of motorized vehicles by the authors of the surveys.

The “locality” names for the collection sites were given when possible for the closest human permanent settlement available, without any toponyms. Because of the limited available space I omitted the collection dates but I included in the table some succinct habitat information.

To avoid any confusion, I mention the diagnostic criteria used to positively assign the individual plants to species, following<sup>1</sup>:

– **General habitus:** – plants with dark red lignified, erect or ascending sterile glabrous stems, 5–15 cm tall, Fresh leaves glaucous; with dried white/grey leaves persistent.

– **Flower habitus:** – (ob)diplostemonous, 5-merous flowers with pale-yellow petals, patent follicles, dark brown, with recurved margins inflorescence cime, with 7(3–25) flowers.

– **Leaf habitus:** – leaves oblong-elliptic acute small papillose, acute conical subacute, with the tip abruptly rounded of obtuse The leaf spur is broad and massive.

The morphological characters used as diagnostic features to distinguish other similar species locally sympatric are:

– from *S. acre* *S. urvillei* differs s in flower by the sepals basally fused with the receptacle, and

– from *S. annuum* *S. urvillei* differs by more uniform calyx with sepals more equal and shorter.

## RESULTS

In this paper I report the occurrence of *Sedum urvillei* D.C. in over 200 sites as observed during over 30 years of fieldwork, in a stretch of habitats along Danube River shores between the human settlements Moldova Noua and Svinita. The investigated region is spanning a considerable geographical length in a sparsely inhabited region of Banat, with a rugged terrain which is notoriously difficult to explore and survey. Due to this geographical complexity and to the considerable amount of data processed, in order to keep the article to reasonable length I have divided the report in two parts comprising approximately equal span of the explored region centred mainly along the DN57 road which accompanies the Danube river. Most of the locations presented herein are new or older locations where I positively confirmed the presence of *Sedum urvillei*. The data are presented below in a simplified tabular format (Table 1). The sites were sorted geographically downstream along the Danube, starting from Moldova Noua and extending to the right geographical side of Tisovita River valey in the vicinity of the village Svinita. Together with the local name closest human settlement (mostly village names), the geographical coordinates are given of the actual sites followed in the next column by some notes regarding the specific habitat at the sites of the surveyed populations.

## DISCUSSION

The data presented herein (Table 1) indicate that the range of *S. urvillei* D.C. populations in

Banat is larger than previously documented<sup>6,19,20,21,22</sup>, resembling the situation of other Crassulacean species examined, e.g. for *Sedum hispanicum* L<sup>8</sup> and *Sedum annuum* L in the Southern and Eastern Carpathians<sup>8,5</sup>, or for *Jovibarba heuffelii* Schott A. Love D. Love in Southern Carpatian Mountains<sup>10</sup> or for the species *Sempervivum marmoreum* Griseb. in Southern Carpatian Mountains<sup>11</sup>. Probably, also here in Banat, and similarly to *Sedum urvillei* D.C. in Dobrogea<sup>1</sup> or *S. annuum* in the Carpathians<sup>5</sup>, *S. urvillei* in the local populations was probably confounded by the botanists with *S. acre* L. and/or other 2 species from the same comparium of Ser. Alpestris A. Berger ('t Hart 1991) *Sedum sexangulare*, or *Sedum annuum*, and also probably often neglected and under-reported by previous authors, and similarly to *Sedum annuum* L. and *Sedum hispanicum* L its occurrence was probably considered unworthy of mentioning from all locations where it was found<sup>1</sup>.

From an ecological standpoint, typical populations of *Sedum urvillei* D.C. in Dobrogea prefer sunny, dryer or well drained slopes with shallow topsoil, and early successional stages with open canopy to avoid shading and competition<sup>1</sup>. In Dobrogea, typical populations of *Sedum urvillei* D.C. show calciphilous character, sometimes dominating the open xerothermophilic pioneer communities developing on shallow calcareous soils, without being restricted to calcareous bedrock (see figure 1 in ref.<sup>1</sup> for the aspect of the extreme habitat in situ near Cheile Dobrogei, Dobrogea, where *Sedum urvillei* grows on karstic pockets in reef limestone).

In Banat, *Sedum urvillei* D.C. shows a more balanced ecological preference for both xeric environments like in Dobrogea, but also for more humid places, on rocky ledges with good humidity, and even relatively often at the openings of caves and alveoles in limestone where there was constant higher humidity.

In contrast with the Dobrogean populations of *Sedum urvillei* D.C. which show less dense congregating individuals, the populations in Banat show a considerably higher density with individuals often densely packed in very dense clusters of sometimes quite large numbers, especially where there is constant good humidity and partial shade. Such densely packed clusters of individuals are very rare in Dobrogea and when they occur, the clusters comprise much fewer individuals.

Table 1

List of the sites of occurrence of *Sedum urvillei* in Romanian S-Banat along the North shore of Danube, between Moldova Noua, CS and Svinita, CS with their geographical coordinates, grouped around the closest human settlement

No.	Closest human settlement	Geographical coordinates of the sites of occurrence of <i>Sedum urvillei</i> situated close to this locality	Ecological notes
1	Moldovita CS	N 44.78483 E 21.70225; N 44.78538 E 21.70297; N 44.78593 E 21.70318; N 44.75361 E 21.70547	Rocky fragmented outcrop xeric/ roadside
2	Moldova Noua CS	N 44.69456 E 21.67274; N 44.69320 E 21.67289; N 44.69447 E 21.67558; N 44.69139 E 21.67854; N 44.69088 E 21.67964; N 44.68995 E 21.68173;	Degraded land w. xeric rocky outcrop
3	Coronini CS	N 44.68452 E 21.68511; N 44.68579 E 21.68676; N 44.68486 E 21.68746; N 44.68489 E 21.68923; N 44.68553 E 21.68963; N 44.68570 E 21.69084; N 44.68613 E 21.69167; N 44.68245 E 21.69072; N 44.68208 E 21.69168; N 44.68141 E 21.69079; N 44.68037 E 21.69228; N 44.67760 E 21.69542; N 44.67583 E 21.69755; N 44.67215 E 21.69359; N 44.67253 E 21.69353; N 44.67293 E 21.69478; N 44.67345 E 21.69516; N 44.67429 E 21.69607; N 44.66900 E 21.69140; N 44.66750 E 21.69234; N 44.66729 E 21.69327; N 44.66677 E 21.69403; N 44.66635 E 21.69484; N 44.66603 E 21.69601; N 44.66559 E 21.69617; N 44.66500 E 21.69677; N 44.66541 E 21.69776; N 44.66504 E 21.69915; N 44.66573 E 21.70036; N 44.66610 E 21.70143; N 44.66669 E 21.70201; N 44.66552 E 21.70226; N 44.66520 E 21.70088; N 44.66468 E 21.69982; N 44.66472 E 21.70154; N 44.66489 E 21.70312; N 44.66393 E 21.70221; N 44.66453 E 21.70342; N 44.66397 E 21.70426; N 44.66404 E 21.70566; N 44.66389 E 21.70672; N 44.66263 E 21.70485; N 44.66247 E 21.70561; N 44.66219 E 21.70770; N 44.66163 E 21.70697; N 44.65974 E 21.70892; N 44.65908 E 21.70981; N 44.65793 E 21.71163; N 44.65822 E 21.71469; N 44.65688 E 21.71549; N 44.65676 E 21.71706; N 44.65686 E 21.71810; N 44.65651 E 21.71892; N 44.65705 E 21.72033; N 44.65637 E 21.72034; N 44.65607 E 21.72149; N 44.65587 E 21.72237; N 44.65532 E 21.72290; N 44.65533 E 21.72526; N 44.65541 E 21.72644; N 44.65585 E 21.72797; N 44.65678 E 21.72767; N 44.65716 E 21.72847; N 44.65633 E 21.73059; N 44.65570 E 21.73361; N 44.65583 E 21.73496; N 44.65657 E 21.73718; N 44.65702 E 21.73774; N 44.65755 E 21.73685; N 44.65942 E 21.74253; N 44.66035 E 21.74296; N 44.66120 E 21.74200;	Xeric rocky fragmented outcrop
4	Liubcova CS	N 44.65064 E 21.90896; N 44.64995 E 21.91328; N 44.64977 E 21.91405; N 44.65003 E 21.91497; N 44.65001 E 21.91807; N 44.65072 E 21.92140;	Xeric degraded land w. stony substrate, rocky fragmented outcrops
	Berzasca CS	N 44.63822 E 21.97831; N 44.63895 E 21.98153; N 44.63938 E 21.98440; N 44.63938 E 21.98831;	Xeric degraded land w. stony substrate
	Cozla CS	N 44.63287 E 22.00116; N 44.63158 E 22.00416; N 44.63283 E 22.00818; N 44.63207 E 22.00415; N 44.62107 E 22.01122; N 44.62104 E 22.01186; N 44.61761 E 22.01742; N 44.61707 E 22.02052; N 44.61733 E 22.02092;	Xeric degraded land w. stony substrate, rocky outcrops on cliffsides
	S-Cozla CS	N 44.61802 E 22.00932; N 44.61763 E 22.00893; N 44.61723 E 22.00851; N 44.61660 E 22.00804; N 44.61623 E 22.00801; N 44.61552 E 22.00795; N 44.61477 E 22.00713; N 44.61415 E 22.00734; N 44.61383 E 22.00729; N 44.61246 E 22.00691; N 44.61120 E 22.00691; N 44.61093 E 22.00630; N 44.61063 E 22.00685; N 44.61095 E 22.00761; N 44.61105 E 22.00870; N	Rocky cliffsides, rocky ridges at the forest edges

Table 1 (continued)

		44.61093 E 22.00935; N 44.61045 E 22.00707; N 44.61000 E 22.00767; N 44.60991 E 22.00928; N 44.60965 E 22.00815; N 44.60769 E 22.01156; N 44.60726 E 22.01211; N 44.60637 E 22.01366; N 44.60640 E 22.01505; N 44.60623 E 22.01583; N 44.60700 E 22.01731; N 44.60780 E 22.01782; N 44.60632 E 22.01864; N 44.60556 E 22.02060; N 44.60501 E 22.02235; N 44.60385 E 22.02102; N 44.60305 E 22.02035; N 44.60187 E 22.01852; N 44.60195 E 22.01982; N 44.59985 E 22.02270; N 44.60197 E 22.02419;	
	E-Svinita MH	N 44.59670 E 22.02793; N 44.59506 E 22.02856; N 44.59342 E 22.03074; N 44.55051 E 22.03725; N 44.54100 E 22.06684; N 44.53340 E 22.07340; N 44.53083 E 22.07565; N 44.51959 E 22.07942; N 44.52222 E 22.08731; N 44.52188 E 22.08815; N 44.50617 E 22.08443; N 44.50279 E 22.08774; N 44.50204 E 22.08927; N 44.50163 E 22.09169; N 44.50449 E 22.09171; N 44.50535 E 22.09299; N 44.50666 E 22.09340; N 44.50616 E 22.09687;	Xeric degraded land w. stony substrate, roadsides, patchy rocky outcrops in the forest
	N-Svinita "Treskovet Mt"	N 44.50441 E 22.09992; N 44.50540 E 22.10017; N 44.50494 E 22.10159; N 44.50495 E 22.10226; N 44.50495 E 22.10312; N 44.50514 E 22.10430; N 44.50549 E 22.10562; N 44.50614 E 22.10648; N 44.50693 E 22.10770; N 44.50796 E 22.10727; N 44.50859 E 22.11118; N 44.51118 E 22.11341; N 44.51260 E 22.11532; N 44.51180 E 22.12149; N 44.51180 E 22.12149; N 44.50545 E 22.11265; N 44.50193 E 22.11082; N 44.50218 E 22.10359; N 44.50282 E 22.10556;	Rocky outcrops, rock cliffsides, rocky flat outcrops,
	S-Svinita-Tisovita Valey	N 44.49020 E 22.11342; N 44.48795 E 22.11729; N 44.48693 E 22.11874; N 44.48607 E 22.12071; N 44.48590 E 22.12203; N 44.48440 E 22.12254; N 44.48159 E 22.12748; N 44.48108 E 22.13138; N 44.48053 E 22.13645; N 44.48038 E 22.14037; N 44.48197 E 22.14778; N 44.48293 E 22.14721; N 44.48227 E 22.15391; N 44.48344 E 22.16472; N 44.48243 E 22.17148; N 44.48226 E 22.17357; N 44.48676 E 22.18014; N 44.48939 E 22.18207; N 44.49129 E 22.18301; N 44.50238 E 22.18716; N 44.50295 E 22.18564; N 44.50356 E 22.18411; N 44.50416 E 22.18272; N 44.50670 E 22.18860; N 44.50849 E 22.18962; N 44.51298 E 22.19219; N 44.51388 E 22.19270; N 44.51483 E 22.19205; N 44.51569 E 22.19300; N 44.51521 E 22.19356; N 44.51768 E 22.19422	Xeric degraded land w. stony substrate, roadsides, patchy rocky outcrops in the forest

Another contrasting element with the Dobrogean populations is the much greater frequency of large, very ramified individuals, occurring, likewise in more humid locations.

In the habitats surveyed in this region of Banat *Sedum caespitosum* (Cav) D.C. is missing, but along the Danube *S. urvillei* D.C. is sometimes accompanied by another more frequent Crassulacean species – *Sedum (Hylotelephium) telephium* L which is also important for conservation of the stenophagous insects feeding on it: – the weevil *Aizobius sedi* Germ. (Apionidae, Curculionoidae) which also feeds on *S. urvillei* D.C. – see also<sup>13</sup>; or<sup>14</sup> for the rare and localized blue butterfly *Scolitantides orion* (Pallas 1771) (Lepidoptera, Lycaenidae).

Interestingly, despite not being commonly associated, in 3 locations near Svinita, *S. urvillei* D.C. was growing together with *Aristolochia clematitis*, another species very important for the conservation of the rare stenophagous butterfly; – *Zerynthia polyxena* (Dennis et Schiffermuller, 1775) (Lepidoptera, Papilionidae)<sup>25, 26</sup>.

In several populations of *S. urvillei* in Banat adult weevils of the steno-monophagous *Aizobius sedi* Germ. (Apionidae, Coleoptera) were seen associated with plants, and plants showed characteristic bite-marks suggesting that the weevils are using *Sedum urvillei* as food plant like in Dobrogea<sup>14</sup>.

The ecological and morphological characteristics of *S. urvillei* from Banat, – which I believe should

be regarded as a separate bona species *Sedum hillebrandtii* Fenzl – warranted a more thorough study in comparison with those of the Dobrogean populations of genuine *Sedum urvillei* D.C. sensu stricto and form the substance of another article (NICULAE & BÂRCĂ in prep.)

## CONCLUSIONS

The number of new sites presented herein documents for *Sedum urvillei* D.C. a much larger than previously documented distribution in the Romanian Banat. The often co-occurrence in many of the sites of *S. urvillei* D.C. with the very similar species *Sedum acre* and/or *Sedum sexangulare*, produces confusions with these two species and probably lead to underreporting.

The ecological and morphological characteristics of *Sedum urvillei* from Banat, provide more arguments for the formal segregation into *Sedum hillebrandtii* Fenzl as a separate bona species and warranted a more thorough study.

*Acknowledgements.* I want to thank to Dr. Valentin BÂRCĂ for providing some data from his fieldwork and some useful advice.

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Title: SEDUM URVILLEI CHOROLOGY ALONG THE DANUBE IN  
ROMANIAN BANAT  
Subject:  
Author: Ana  
Keywords:  
Comments:  
Creation Date: 1/13/2021 10:24:00 AM  
Change Number: 14  
Last Saved On: 1/21/2021 1:20:00 PM  
Last Saved By: LUIZA  
Total Editing Time: 24 Minutes  
Last Printed On: 1/21/2021 1:21:00 PM  
As of Last Complete Printing  
Number of Pages: 8  
Number of Words: 4,098 (approx.)  
Number of Characters:23,363 (approx.)