

**INFESTATION OF THE MEDICINAL PLANT *Sedum telephium* L.
(CRASSULACEAE) BY THE WEEVIL *Aizobius sedi* GERM.
(COLEOPTERA: CURCULIONIDAE: APIONIDAE) IN THE KARST
REGION OF OLTENIA (SOUTH OF ROMANIA)**

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Abstract. *Sedum telephium* L. is a succulent medicinal plant widely used in traditional medicine in Europe. Investigating the opportunity of its intensive culture in the karst region of Oltenia, we gathered data about the frequency and range of this plant's infestation by one of its documented herbivores, *Aizobius sedi* (GERMAR) which is a steno-monophagous black weevil, feeding on Crassulacean leaves and stems. Its Romanian range has not been documented yet. We hereby present for the first time for Romania, a list of locations where *A. sedi* was found to inflict damage to native plants *S. telephium*, complemented by a gridmap in UTM projection system of the species infestation in Oltenia karst region. The region involved in our study comprises a variety of habitats based on limestone substrate spanning North of Danube between 22°30'E - 24°30'E meridians, and the 44°40'N - 45°40'N parallels; situated approximately between km 4900-5040N of the UTM projection zones 34 and 35. We also present some considerations about the chorology and ecology of the species with reference to biotic and abiotic factors involved in its distribution, its zoological status in Romania and its potential to become a pest of *S. telephium* in medicinal intensive cultures.

Keywords: *Sedum telephium*, *Aizobius sedi*, Infestation, Karst habitats, Oltenia, Romania.

Rezumat. Infestarea plantei medicinale *Sedum telephium* L. (Crassulaceae) de către gărgărița *Aizobius sedi* GERM. (Coleoptera: Curculionidae: Apionidae) în regiunea carstică a Olteniei (sudul României). *Sedum telephium* L. este o plantă medicinală succulentă larg folosită în medicinile tradiționale din Europa. Investigând posibilitatea și oportunitatea cultivării ei intensive în subcarpații Olteniei, am strâns date despre frecvența și aria infestării acestei plante de către unul din ierbivorii ei cunoscuți, *Aizobius sedi*, - o gărgăriță steno-monofagă, care se hrănește pe frunze și tulpini de crassulacee. Aria de răspândire în România nu a fost detaliată până acum. Prezentăm aici în premieră pentru România, o listă a localităților unde a fost găsită *A. sedi* producând pagube la plante spontane de *S. telephium*, completată de o hartă raster în proiecție UTM a infestării acestei specii în carstul Subcarpaților Olteniei. Regiunea cercetată cuprinde o varietate de habitate pe substrate calcaroase situate la nord de Dunăre, între meridianele 22°30'E - 24°30'E, și paralelele 44°40'N - 45°40'N; aproximativ între km 4900-5040N ai zonelor 34 and 35 ale sistemului de proiecție UTM. De asemenea prezentăm unele considerații despre corologia și ecologia speciei, referitoare la factorii biotici și abiotici implicați în distribuția ei, statutul ei zoologic în România și despre potențialul ei de a deveni un dăunător la *S. telephium* în culturi medicinale intensive.

Cuvinte cheie: *Sedum telephium*, *Aizobius sedi*, infestare, habitate carstice, Oltenia, România.

INTRODUCTION

Sedum telephium L. was widely used since immemorial times in temperate Eurasia in traditional medicine (as also other members of Crassulaceae family) as a therapeutic plant. The aerial parts of the plant are used as source for the active compounds, in contrast with *Rhodiola rosea*, for example, in which the drug is obtained from the (dried) roots. It was traditionally well appreciated for its local anti-inflammatory and analgesic effect. The fresh, instantly peeled leaves, or their juice, applied on wounds and burns promote wound healing and reduce inflammation and pain in local inflammatory skin diseases (DATNER, 2004; BALATRI, 1981; SENDL et al., 1993).

It has been convincingly argued that the therapeutic activity of *S. telephium* is due to its rich content of polysaccharides and flavonol glycosides (mainly quercetin and kaempferol) (MULINACCI et al., 1995; BONINA et al., 2000; ALTAVILLA, 2008). As a result of a larger body of work investigating the possibility and opportunity of intensive culture of this plant in the karst region of Oltenia, we gathered data about the frequency and range of infestation of this plant by one of its documented herbivores, *Aizobius sedi*.

Aizobius sedi is a small black weevil belonging to the family Apionidae (Curculionidae). The species, described by Germar in 1818, from leaves of *Sedum telephium* L., as *Apion (Perapion) sedi* it was first mentioned in 1912 in Romania by PETRI (leg. A. Ormay, from Salzburg, Transylvania).

To this date, there is no scientific paper describing the complete distribution range of *Aizobius sedi* in Romania. Our study is a first attempt to fill at least part of this knowledge gap by providing data about the infestation area of *S. telephium* by *A. sedi* in Oltenia.

The host plants reported in the available literature for *A. sedi* (Apionidae), is given below [with the number of sources for this interaction put in brackets], (for a list of references see BRC website; accessed march 2011) *Sedum anglicum* [1], *Sedum telephium* ssp. *purpurascens* [1], *Sedum telephium* [2], *Sedum reflexum* [2], *Sedum album* [3], *Sedum sexangulare* [2], *Sempervivum arachnoideum* [1], *Sedum forsterianum* [1], *Sempervivum tectorum* [1], *Sedum* [1], *Sedum acre* [3].

According to Fauna Europaea (2007), the general distribution spans from the United Kingdom and European Atlantic coast (except Luxembourg and Ireland) into Ukraine and from Scandinavia and Finland to the Mediterranean shores of Spain and Italy (though failing to be reported from the Mediterranean islands, Balkan Peninsula and offshore Greece).

S. telephium is a perennial Crassulacean species giving off every spring several erect annual shoots. The densely foliated annual shoots wither and die out that following autumn, after producing copious quantities of seeds. Morphologically, it is characterized by erect follicles, pentamerous sessile flowers with white, yellow-greenish petals, grouped in terminal and axillary inflorescences. The leaves are glaucous-green, subsessile, often subcordate to semi-amplexicaule. Inflated tuberiform roots, lacking leaf scales, also characterize it. *S. telephium* is a very polymorphic species, displaying a wide variation in many characters such as leaf contour, shape and phylotaxis, nectarial scales and floral morphology in general.

The taxonomy and systematics of *S. telephium* is complex and confuse, reflecting the two opposing tendencies, namely: segregation into several minor taxa, or conglomeration of highly variable taxa into (more) complex taxonomic units, -as viewed by Linne who described the species in 1753 (LINNAEUS, 1753).

Ravarut, the taxonomist of the genus in Romania treated it in the monumental work Flora R.P.R. (RĂVĂRUȚ, 1953) *S. telephium* L. as *S. maximum* (L.) HOFF.

To circumvent the contradicting opinions around the taxonomical ranking of the studied plants and as the taxonomical discussion of the Romanian *S. telephium* populations is beyond the scope of this paper and it will be discussed in more detail elsewhere (BÂRCĂ & NICULAE, in prep.).

S. telephium L has a wide, Palaearctic distribution, it is widely distributed throughout Romania, mainly at higher altitudes, the species inhabiting dryer habitats in stony places showing though a large ecological amplitude.

From an ecological point of view, in the locations of the studied region, *S. telephium* is a thermophilous saxicolous xerophyte, usually preferring fertile soils like rendzina rich in humus and calcium carbonate, that have developed over well-drained limestone bedrock, although it shows considerable ecological amplitude like *Sedum hispanicum* L., and *S. anuum* L. - other Crassulaceans with which it is often associated in the region (NICULAE & BÂRCĂ, 2005; NICULAE & BÂRCĂ, 2006). According to BORZA (see comments in BORZA A. FRE no2433b), is distributed ubiquitously, relatively often in humid, shady and densely wooded locations, but often found in very dry, sunny, south-exposed rocks, gravel, and stony places in scrubs, and southern open *Quercus* woods but also on stonewalls and on roadsides. Its altitudinal range spans from virtually sea level to over 2000 m *s.m.* According to our observations, in Romania, *S. telephium* L. shows wide ecological amplitude, flourishing in many habitats.

The region involved in our study extends North of Danube being limited to the South approximately by the 44°40'N parallel and the 45°40'N parallel to the North and spanning between 22°30' E meridian to the West and 24°30' E meridian towards East. It comprises the mountains situated approximately between km 4900-5040N of the UTM projection zones 34 and 35.

The studied region comprises a wide variety of habitats based on limestone substrate from the Danube flood plains towards the barren peaks in the Romanian Carpathian Mountains (an altitude ranging between 50-1550m asl.),

The climate is extreme continental characterized by wide annual and diurnal variations in temperature and rainfall, but with remarkable thermophilous habitats on the limestone substrates the region showing also similarly diverse ground cover and edaphic conditions.

The objective of this study was to provide a preliminary overall image of the actual infestation range of *A. sedi* on *S. telephium* in the Oltenia karst region of the Southern Carpathians. Our study presents a list of the localities where we have positively found *A. sedi* on *S. telephium*, complemented by a raster map in the UTM projection system of this species' distribution in Oltenia together with some considerations about the chorology and ecology of the species with regard to biotic and abiotic factors influencing this distribution.

MATERIAL AND METHODS

Host plant identification:

Due to its high morphological variability and its poorly defined taxonomy, *S. telephium* is a difficult species to positively identify. For practical reasons, to improve precision of fieldwork identification and because we have found the weevil on several species (see above and discussions), we have adopted the following diagnostic criteria to include individual plants in this study:

- Hermaphrodite, pentamerous flowers without red (ish) pigments in the petals;
- Flowers without red (ish) pigments in the petals;
- Leaves at least partially sessile to semi-amplexicaul and opposite;
- Inflated rhizomatous "roots", without persistent foliar scales.

At this stage, we have used these criteria, leaving for a later moment the task to ascertain beyond any doubt the assignment of the plant specimens or populations to *S. telephium* or to some other related taxa.

Infestation diagnosis:

The diagnostic criteria used to consider a positive infestation with *A. sedi* were the following:

- adults actually present on the plan;
- characteristic lesions present on the plan.

When the actual presence of *A. sedi* on the host plant could not be ascertained (for the herbarium specimens of *S. telephium* examined, as well as for 9 specimens in 5 locations seen by us), and the characteristic lesions were present on that individual, we used the absence of ceccidial swellings on the shoot stems as the distinguishing criterion to rule out the unlikely possibility of confusion with *Pericartiellus telephii* BEDEL, another weevil feeding on *S. telephium*

Although *P. telephii* adults produce similar lesions as *A. sedi*, the larvae produce characteristic ceccidial stems swellings in which the larvae develop and pupate, fact which we used as distinguishing element.

Geographical characteristics:

To establish the UTM geo-codes for the locations cited we have used when applicable Lehrer's work (LEHRER & LEHRER, 1990) on the cartography of Romanian fauna and flora using arealographic coordinates or geo-codes derived from GPS coordinate readings from surveys done by the authors. The UTM geo-codes were given when possible for the closest human settlement available.

For each location cited we have mentioned citation sources and the name under which the host plants were identified (for herbarium specimens) by each author when it differed from the species name accepted. Due to the limited space available and because this was not the objective of the present study, we do not give in this report data like collection dates, ecological and phyto-sociological information which will form the object of a future article.

RESULTS

Our results comprise a number of 44 locations from which plants of *S. telephium* were found infested by *A. sedi*. Out of these, a number of 6 locations are derived from herbarium plant specimens collected before 2010, that show clear, specific feeding lesions made by the adult *A. sedi* that could not be confirmed by our fieldwork (as shown in Fig. 2B), and a number of 38 are new locations or older locations in which the presence of *A. sedi* on *S. telephium* L., was positively confirmed by us. The data are presented below in tabular format (Table 1). The sites that could be positively located on the map are presented in figure 1, in a convenient format on a map with UTM quadrants and the hydrographic system. We have indicated the sites cited using different symbols for the two data subsets, of which the most important is the subset comprising the sites in which the presence of the species was positively confirmed by us. For reference, we have given in the table, the years when we have observed the plants in the mentioned sites, as follows in figure 1.

Table 1. Locations list where *S. telephium* L. plants were found infested by *Aizobius sedi*.
Tabel 1. Lista localităților unde au fost găsite plante de *S. telephium* L. infestate de *Aizobius sedi*.

No.	County	Location and Altitude (a.s.l.)	UTM Geo-code	Information Source**
1	CS	Ciorici near, Băile Herculane, limestone rocks	FQ16	(B 93)
2	CS	Pecinișca near Băile Herculane, limestone rocks	FQ16	(B 92-01)
3	CS	Băile Herculane (across from the old firestation, in the woods)	FQ17	(B 95)
4	CS	Mt. Domogled near, Băile Herculane 1060 m	FQ17	(B 93-99) (B&N 03)
5	CS	Cerna valley, left side	FQ18	(B 95)
6	CS	Valea Țesnei lower course	FQ18	(B&N 99, 00) (B 08)
7	CS	Jidostița	FQ25	(B 93)
8	CS	Gomenți	FQ27	(B 93)
9	GJ	Isverna, close to the entrance to "Isverna cave"	FQ28	(B 10)
10	GJ	Godeanu	FQ38	(B 95)
11	GJ	Cerna Sat	FQ39	(B95)
12	GJ	Țesna Valey, upper course	FQ39	(B 95)
13	GJ	Valea Găinii, near Baia de Aramă, alt cca 350 m a.s.l. Leg Prodan, Buia, et al 13 Aug 1954 sub <i>Sedum maximum</i> SUTER	FQ48	CRA
14	GJ	Cloșani	FQ49	(B 93)
15	GJ	Motru Sec on limestone rocks	FQ49	(B 92)
16	GJ	Bordul Dobriței/Runcu at the base of limestone cliffs	FQ69	(B 92)
17	GJ	Cantonul Dragomanu/Runcu, in the woods	FQ69	(B 92)
18	GJ	Cheile Sohodolului/Runcu on limestone rocks, near "la Nări" caves	FQ69	(B 92)
19	GJ	Cheile Oltețului close to peștera Polovragi (Polovragi cave)	GR00	(B 04)
20	GJ	Polovragi, Cheile Țiriei	GR10	(B 04)
21	MH	Insula Ada-Kaleh, Tr. Severin, alt cca. 210 m asl. Leg Buia, Olaru, Cârțu, Popescu Sept. 30, 1965 sub <i>Sedum maximum</i> SUTER	FQ----	CRA
22	MH	Orșova, behind the railway station, in the woods	FQ05	(B 93)
23	MH	Cazanele Dunării, alt 150-200m asl. Leg Buia, Păun et Maloș, 9 Jul 1959 sub <i>Sedum maximum</i> SUTER	FQ15	CRA, (B 03)
24	MH	Vârciorova dry woods, on schistose bedrock, alt cca. 100m a.s.l. leg. Borza et Buia Sept. 19, 1941 [sub <i>S. maximum</i> (L.) SUTER]	FQ15	CRA
25	MH	Vârciorova dry woods, on schistous bedrock, alt cca. 100m a.s.l. leg. Borza et Beldie Sept. 19, 1941 sub <i>Sedum maximum</i> SUTER	FQ15	FRE 2433b. in HTgMs, in HBV, HCJ (B 93)
26	MH	Pecinișca	FQ16	(B 93)
27	MH	Balta Cerbului	FQ18	(B 93)
28	MH	Gura Văii	FQ24	(B 93)
29	VL	Râmnicu Vâlcea	KK99	(B 04, B 09)

30	VL	Valea Bistriței on Mt. Govora, alt cca. 1700m a.s.l. Leg. et det. Gh Popescu, sub <i>Sedum maximum</i> SUTER	KL60	CRA
31	VL	Valea Cheii, (between [schitul] Iezer and the canyon) Oct. 4, 1951 leg. D. Tătăranu [sub. <i>S. maximum</i> SUTER]	KL70	HBV
32	VL	Buila Mts., Claiă Strâmbă-Livada cu Mesteceni	KL71	(B 88, B 89, B 91), (B&N 97)
33	VL	Buila Mts., in Valea Cheii, by the lower exit of the canyon	KL71	(B 91)
34	VL	Buila Mts., Mt. Stogșoare, on “Scocul Ursului”	KL71	(B 88, B 89, B 1), (B&N 97)
35	VL	Buila Mts., Mt. Stogșoare, on the stonewalls by the tunnel	KL71	(B 88, B 89, B 1), (B&N 97)
36	VL	Buila Mts, near “Cuptorul de var”, by the lower exit of the canyon	KL71	(B 91)
37	VL	Buila Mts., Santinela Cheii	KL71	(B 88, B 89, B 91)
38	VL	Buila Mts., Valea Cheii, Brâna Caprei	KL71	(B 91)
39	VL	Olănești Băi, around the baths, Sept 25 1952, leg. Buia et Păun	KL80	CRA
40	VL	Cozia Monastery on the ramparts towards River Olt	KL81	(B 01)
41	VL	Turnu Monastery on the rock “La chilie”	KL81	(B 97), (B 02-05), (B 09-10)
42	VL	Brezoi, up the valley, on rocks and by the fall	KL82	(B 07)
43	VL	Valea Oltului, left shore, above Turnu Monastery on the railway tunnels roof and on the cliffs	KL82	(B 93, B 04)
44	VL	Cascada Stânișoara, on rocks by the fall Stânișoara Monastery, Towards Cozia Peak, on rocks	KL91	(B 97)

Symbols/Legend: * UTM geo-codes were given when possible for the closest human settlement available, when the locations could not be precisely located, we have only indicated the 100 km square geocodes / **Codurile UTM** au fost date pentru cele mai apropiate așezări umane, în lipsă am indicat doar geocodul pătratului de 100 km.

County acronyms/prescurtările județelor: CS = Caraș-Severin, GJ = Gorj, MH = Mehedinti, VL = Vâlcea

**collector’s name and observation year of *A. sedi* on *S. telephium* L. are mentioned. / Sunt menționate numele colecătorului și anul (sau anii) în care *A. sedi* a fost observat pe *S. telephium* L. (BN + XX) = (Bârcă & Niculae + the last 2 digits of the year when the weevil was found on the plant) e.g. (BN 04) = (BÂRCĂ & NICULAE, 2004) (B + XX) = (Bârcă + the last 2 digits of the year when the weevil was found on the plant *in situ*)

HBV = Herbarium of Univ. Brașov; HCJ = Herbarium of Univ. Cluj-Napoca; HTgMs = Herbarium of Univ. Med Pharm Tg. Mureș;

CRA = Herbarium of Univ. Craiova.

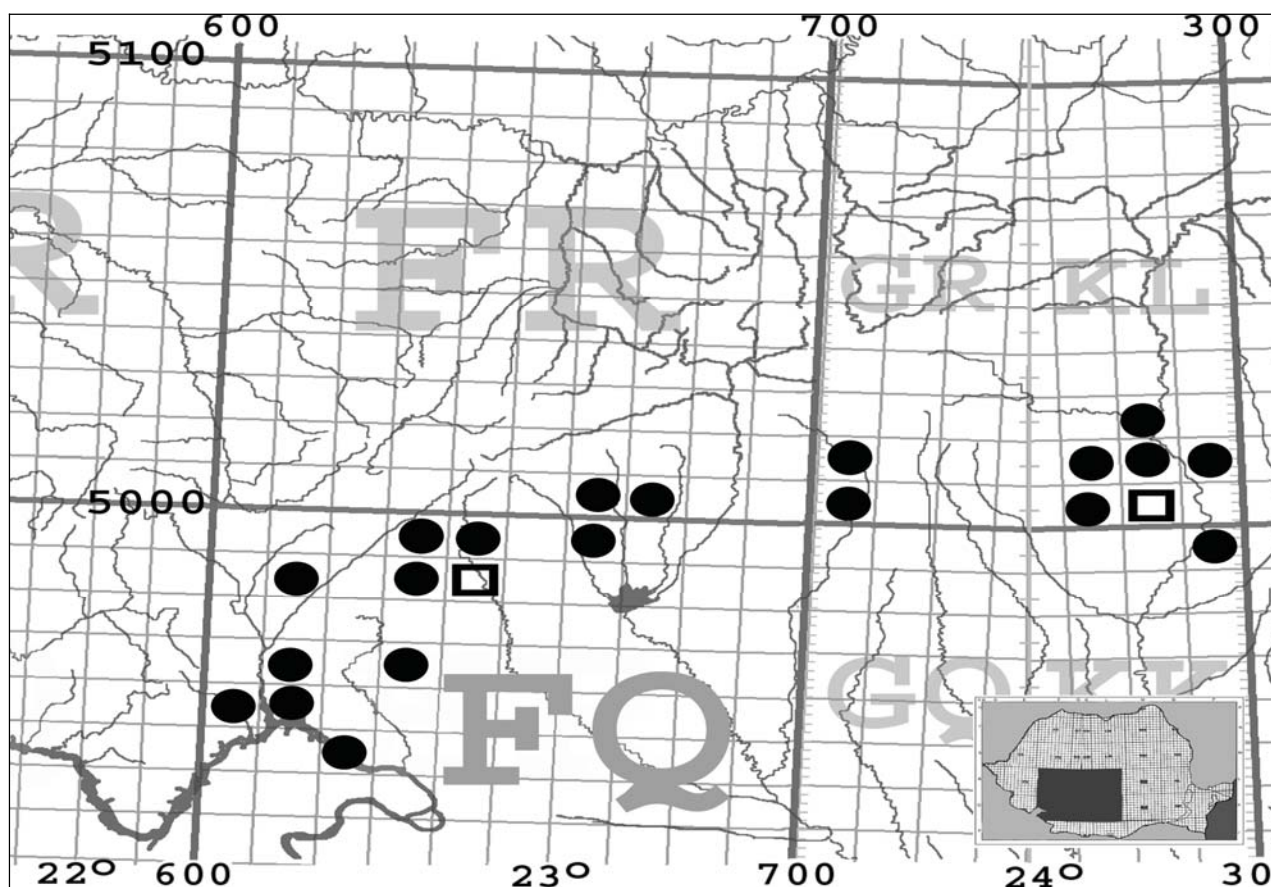


Figure 1. Distribution map in UTM projection system with 100 km quadrants of the sites where plants of *S. telephium* L. were positively found infested by *Aizobius sedi*: Full circles designate sites where we positively confirmed *S. telephium* L. plants infested by *Aizobius sedi* and empty squares designate sites cited after herbarium specimens, where we could not confirm the infestation.

Figura 1. Harta distribuției în sistem de proiecție UTM cu cvadrantși de 100 km ale locurilor unde am găsit plante de *S. telephium* L. infestate cu *Aizobius sedi*: cercurile pline desemnează locuri unde am confirmat infestarea *S. telephium* L. cu *Aizobius sedi* și pătratele goale desemnează locuri citate după exemplare de herbar, unde nu am confirmat infestarea.

DISCUSSIONS

The infestation range of *S. telephium* by *A. sedi*, in karst habitats of Oltenia, is quite large, and matches well the overall distribution of these habitats. Comparing the distribution of *A. sedi* reported herein by us north of Danube, with the distribution of *S. telephium* in the same region as found by us and as documented by herbarium specimens we can readily notice a good match in occurrence, as practically we have found the insect almost everywhere *S. telephium* was present. The actual range of infestation seems to be limited not by climatic factors but simply by the actual availability of the host plant. This belief is also supported by the fact we have found the insect on *Rhodiola rosea* at higher altitudes in places where *S. telephium* was not available (BÂRCĂ et al., in prep).

It appears and produces (non lethal) lesions (Fig. 2) all over the locations where *S. telephium* was found by us, so the infestation range coincides quite closely with the distribution of the plant.

Both the adults and the preimaginal stages of *A. sedi* are closely associated with relatively few species belonging to the genera *Sedum*, *Rhodiola*, *Sempervivum* of the family of Crassulaceae, which compose its very narrow group of reported host plants. On *S. telephium*, the larvae live as leaf miners and stem borers, feeding on the leaf mesophyll and eventually boring galleries in the midrib of the leaves and sometimes reaching as far deep as the stems.

In Oltenia, the larval stages appear in the leaf by the end of May lasting into July - August, (in June - July according to SCHERF (1964) and make relatively narrow galleries maintaining appreciatively the same diameter or slightly inflating towards the midrib where the older larvae are located. The gallery is not very tortuous and sometimes is branched. The excrements are initially scattered and later more grouped in the chamber in the midrib where the pupation takes place in a small expansion of the gallery containing the loose, ellipsoidal cocoon, visible by transparency when it is located in the midrib. (see also SCHERF, 1964 for more data about the preimaginal stages). According to SCHERF (1964), *A. sedi* also produces mines in *Sedum* - species with terrete and semiterrete leaves, in which cases the insect probably acts mainly as a stem borer.

The adults also feed on the leaves, remaining on the plant as long as the leaves are green and fleshy. The adults feed on the surface of the leaf, making small crateriform lesions 0.9 to 1.8 mm in diameter with sclerified, raised rim of scarification tissue. Usually, the holes do not penetrate the leaf, but sometimes they appear as true holes piercing the leaves (Fig. 2). Although the weevil is listed in several red lists throughout Europe, in the region involved in our study there are no indications of serious threats yet. The vulnerability of the insect is though closely related to that of its host plants.

CONCLUSIONS

This study reports findings of both herbarium specimens survey and previously unpublished data from personal fieldwork of the authors. This picture, although still incomplete, will help scholars studying this species to better understand the biological, ecological and chorological features of this taxon. This study will also form the basis of a complete distribution map of *A. sedi* in Romania and will provide arguments for the treatment of *A. sedi* as a (potential) pest for *S. telephium*.

Our preliminary results indicate that indeed the range occupied by *A. sedi* is probably larger than previously believed. We found it in almost all locations where we searched for it, usually in small numbers of few individuals per plant cluster. Therefore, taking into account the relatively wide ecological amplitude of this weevil species, we believe that the actual distribution range of *A. sedi* includes the whole country, and will probably broaden considerably after further research in other locations and also on other hosts will be reported. The lesions inflicted by *A. sedi* to *S. telephium* are not lethal but in the most severe cases, as the larvae developing in leaves and stems do not destroy the shoots infested. The adults may possibly pose a significant threat only when massive attacks occur in dense, intensive cultures.

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Figure 2. Aspect of nonperforating lesions produced by *Aizobius sedi* to *Sedum telephium* L. infested “in vivo” – 2A; in herbarium specimens - 2B, and also of perforating lesions together with the weevil – 2C.

Figura 2. Aspectul leziunilor neperforante produse de *Aizobius sedi* pe plantele de *Sedum telephium* L. infestate in „vivo”:- 2A; pe exemplare de herbar - 2B și de leziuni perforante împreună cu gărgărița - 2C.