

Salix herbacea L. (Salicaceae) in the Maramures massif of the Ukrainian Carpathians

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Abstract

Salix herbacea is a relict plant species related to the circumpolar arctic-alpine element of the Holarctic group. The aim of the study was to clarify the data on the distribution of *S. herbacea* within the Maramures massif of the Ukrainian Carpathians since this species is reported by different authors for the massif without specific geographical and habitats descriptions. Field studies were conducted in the Maramures massif on the slopes of Pip Ivan Marmarosky (1936 m a.s.l.) and Rapa (1872 m a.s.l.) mountains in 2017–2019. The *S. herbacea* distribution chorology was analyzed based on the inventory of UU, KW, KWHA, LW, Herbarium of the Carpathian Biosphere Reserve, and Herbarium of the Biology and Ecology Department of the Vasyl Stefanyk Precarpathian National University collections. We have found *S. herbacea* confined to cliffs on a rocky tourist path between the peaks of Pip Ivan Marmarosky and Rapa mountains in the Rakhiv district of the Transcarpathian region (Zakarpattia oblast). Recently, these rocky formations were occupied by tall grasses such as *Calamagrostis villosa*, *Poa pratensis* and *Festuca picturata*. Meanwhile, the occurrence of Holarctic and Alpine-Carpathian species *Vaccinium uliginosum*, *Potentilla aurea*, *Pulsatilla alba*, *Thamnolia vermicularis* and *Cetraria islandica* substantially decreased. These changes were probably caused by a decrease in livestock grazing intensity during the past years in this area, as well as more favorable climate conditions for tall grass species. The exact location and phytocoenological conditions of the site, which is endangered and requires additional conservation measures, were outlined. The necessity of these measures to preserve the habitat of *S. herbacea* on the Maramures massif was stressed out.

Keywords: *Salix herbacea*, Ukrainian Carpathians, Maramures, herbarium collections, distribution, protection

Introduction

The genus *Salix* L. comprises about 450 species in the world flora (Argus et al., 2010), with 24 species represented in the flora of Ukraine (Gorelov, 2002; Fuchylo & Sbytna, 2009). There are 18 *Salix* species distributed in the Ukrainian Carpathians and Transcarpathia, including 15 species distributed on the territory of the Carpathian Biosphere Reserve. Six *Salix* species are listed in the Red Book of Ukraine: *S. alpina* Scop., *S. lapponum* L.,

S. myrtilloides L., *S. starkeana* Willd., *S. herbacea* L., and *S. retusa* L. (Didukh, 2009).

Salix herbacea is a relict species related to the circumpolar arctic-alpine element of the Holarctic group (Meusel et al., 1965; Malynovskyi, 1980; Didukh, 2009). It is common in the Arctic as well in North America, whereas in Central and Southern Europe, it becomes progressively less frequent (Tralau, 1963; Jalas & Suominen, 1976; Elven & Karlsson, 2000). It is a perennial shrub, chamaephyte, 10–30 cm tall, with

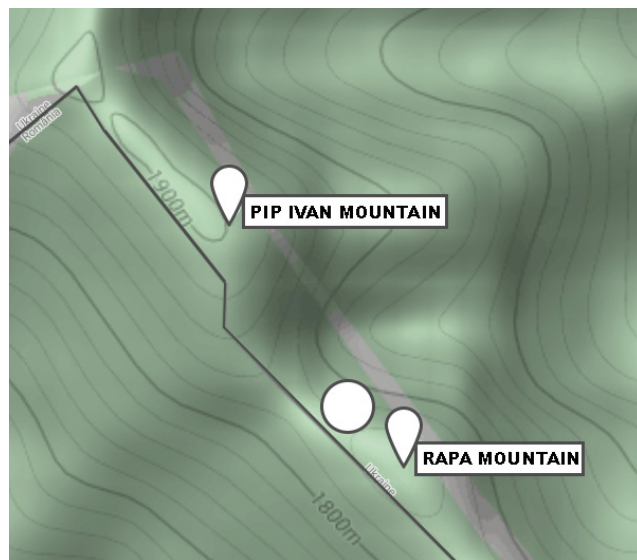


Figure 1. The location of the discovered *Salix herbacea* population (white circle) on the Maramures massif.

well developed underground stolons. In the Ukrainian Carpathians *S. herbacea*, habitats are limited to rocky outcrops and sites in the alpine and subalpine vegetation belts. The only few known populations of *S. herbacea* occur in the summit areas of Chornohora, Svydovets, and Maramures, where they cover relatively small areas (Didukh, 2009; Prokopiv & Volgin, 2009; Kobiv, 2010). Populations of *S. herbacea* in the Ukrainian Carpathians are endangered due to the growing anthropogenic pressure and obviously could be under the impact of climate change in the future (Kobiv, 2009). At present, detailed information about localities, habitat preferences, and floristic composition of communities with *S. herbacea* in the Maramures Mts. is absent. Hence, this investigation aimed to clarify it.

Material and methods

Field studies were conducted in the Maramures massif on the slopes of the Pip Ivan Marmarosky (1936 m a.s.l.) and Rapa (1872 m a.s.l.) mountains in 2017–2019 (Fig. 1). This territory is a part of the Carpathian Biosphere Reserve. The location of the habitat was determined using a GPS navigator Garmin eTrex 30x with an accuracy of up to 10 meters.

The names of the plant taxa are given according to The Plant List (2013), the names of the lichen taxa are given according to MycoBank (2020).

Vegetation description was performed using the Braun-Blanquet approach (Yaroshenko, 1961; Braun-Blanquet, 1964). Herbarium collections were transferred to the herbarium of the Carpathian Biosphere Reserve and the herbarium of the M.M. Gryshko National Botanical Garden, National Academy of Sciences of Ukraine (KWA). The *S. herbacea* distribution was analyzed based on the inventory of vouchers preserved in the UU, KW, KWA, LW (see Index Herbariorum (Thiers, 2020) for acronyms), Herbarium of the Carpathian Biosphere Reserve and Herbarium of the Biology and Ecology Department of the Vasyl Stefanyk Precarpathian National University.

Results

Different authors provided data on the present occurrence of *S. herbacea* in the Maramures massif (Dobrochaeva et al., 1987; Kricsfalusy, 1982, 1999; Didukh, 2009; Kobiv et al., 2017). Malynovskyi (1980) reported *S. herbacea* from the *Polytrichetum sexangularis* Br.-Bl. 1926 basing on Deyl (1940), who was the first to describe this association for the Maramures massif. However, neither Malynovskyi (1980) nor Deyl (1940) provided details about the presence of *S. herbacea* here. Moreover, the dwarf willow is mentioned for Maramures in the Flora of the USSR (Nazarov et al., 1952), but also there without providing precise locations and without the support of observed herbarium vouchers.

Specimens of *S. herbacea* from the Maramures massif were found only in the National Herbarium of Ukraine at the M.G. Kholodny Institute of Botany of the National Academy of Sciences of Ukraine, Kyiv (KW): 1) Zakarpattia Region, Rakhiv's'kyi District, Pip Ivan Marmarosky mountain, 1890 m a.s.l., Hryn' F., 07.07.1948; 2) 1900 m a.s.l., Bradis E., Zapjatova A., 21.07.1948; 3) 1960 m a.s.l., Bradis E., Zapjatova A. 21.07.1948; 4) 1857 m a.s.l. (N 47° 55' 15.6", E 24° 19' 48.7") Nachychko V.O., Kobiv Y.Y., Borsukevych L.M., 28.07.2016.

All mentions of the occurrence of *S. herbacea* in the Maramures massif probably concerned the only population. It is located between the peaks of Pip Ivan Marmarosky and Rapa mountains of

the Maramures massif (Rakhiv district of Transcarpathian region, at the border of Ukraine and Romania), which also we have observed and investigated close to a rocky tourist path (Fig. 1). The population covers an area of about 200 m² at an elevation of about 1860 m a.s.l. The upper points of the population are: 1 – N 47° 55' 15.6", E 024° 19' 49.4" and 2 – N 47° 55' 15.9", E 024° 19' 48.4", and the lower points are 3 – N 47° 55' 16.89", E 024° 19' 49.76" and 4 – N 47° 55' 16.96", E 024° 19' 48.47" (Figs. 2 & 3).

The shrub layer is represented predominantly by the following species: *Vaccinium myrtillus* L., *V. uliginosum* L., *Rhododendron myrtifolium* Schott & Kotschy, and *S. herbacea* (Table 1). Vascular plants cover from 40 to 90% of the surface. The rest of the surface is occupied by lichens and mosses (i.e., *Thamnolia vermicularis* (Sw.) Ach. ex Schaer., *Cetraria islandica* (L.) Ach., *Cladonia rangiferina* (L.) Weber ex F.H. Wigg., *Dicranum scoparium* Hedw. *Polytrichastrum alpinum* (Hedw.) G.L. Sm. *Polytrichum commune* Hedw., and *P. strictum* Menzies ex Brid.), by bare soil and by soil eroded by the passage of tourists, and by the rocky limestone outcrops of. *S. herbacea* covers approximately 7–20% of the habitat area. The prevailing species are: *Soldanella hungarica* Simonk., *Vaccinium myrtillus*, *Rhododendron myrtifolium*, *Ligusticum mutellina* (L.) Crantz, *Carex sempervirens* Vill., and *Juncus trifidus* L. The base of the rocky outcrops is colonized by tall-grasses such as *Calamagrostis villosa* (Chaix) J.F. Gmel., *Poa pratensis* L., *Festuca picturata* Pils. Moreover, the occurrence of the holarctic and Alpine-Carpathian species *Vaccinium uliginosum* L., *Potentilla aurea* L., *Pulsatilla alba* Reichenb., *Thamnolia vermicularis*, and *Cetraria islandica* was particularly relevant (Fig. 3). The occurrence of tall grasses and forbs resulted from the decrease of livestock grazing intensity in this area in the past years.

Conclusions

As a result of an inventory of certain herbarium collections, it was found that vouchers of *S. herbacea* hosted at the KW are the only known from the Maramures massif, and all of them referenced to the Pip Ivan



Figure 2. The site where *Salix herbacea* was sampled on the Maramures massif.

Marmarosky. However, all these reports of *S. herbacea* most probably concerned the only population between the peaks of Pip Ivan Marmarosky and Rapa mountains of the Maramures massif.

The area of the identified habitat of *S. herbacea* on the rocky tourist path between the peaks of Pip Ivan Marmarosky and Rapa mountains in the Maramures massif is about 200 m². The cover of the species in the habitat ranges from 7 to 20%.

Recently, the site was partially occupied by tall grasses such as *Calamagrostis villosa*, *Calamagrostis arundinacea*, *Poa pratensis*, *Festuca picturata*, and the occurrence of Holarctic and Alpine-Carpathian species substantially decreased. It is probably caused by a decrease in livestock grazing in the area and more favorable climate conditions for tall grass species.

Taking into account observed transformations, it is necessary to develop and implement urgent conservation measures to save the population of *S. herbacea* on the Maramures massif.



Figure 3. *Salix herbacea* on the Maramures massif: **A** – general habitat view, **B** – the lower overgrown part, **C** – the upper part.

Table 1. Floristic composition of the plant community with *Salix herbacea* on the Maramures massif.

Date	27.07.2017; 22.07.2019	<i>Homogyne alpina</i> (L.) Cass.	1
Area, m ²	200	<i>Hypericum richeri</i> Vill.	2
Elevation (m a.s.l.)	1853–1853	<i>Luzula alpinopilosa</i> (Chaix) Breistr.	2
Aspect	NE	<i>Poa pratensis</i> L.	2
Inclination (°)	10–65	<i>Campanula alpina</i> Jacq.	+
Cover of shrub layer (%)	30	<i>Solidago virgaurea</i> L. subsp. <i>minuta</i> (L.) Arcang.	1
<i>Rhododendron myrtifolium</i> Schott & Kotschy	2	<i>Veratrum lobelianum</i> Bernh.	1
<i>Salix herbacea</i> L.	2	<i>Veronica fruticans</i> Jacq.	+
<i>Vaccinium myrtillus</i> L.	1	<i>Deschampsia cespitosa</i> (L.) P. Beauv.	1
<i>Vaccinium uliginosum</i> L.	1	<i>Potentilla aurea</i> L.	1
Cover of herb layer (%)	60	<i>Hieracium alpinum</i> L.	1
<i>Agrostis</i> sp.	2	<i>Carex sempervirens</i> Vill.	1
<i>Calamagrostis arundinacea</i> (L.) Roth	2	<i>Huperzia selago</i> (L.) Bernh. ex Schrank & Mart.	+
<i>Calamagrostis villosa</i> (Chaix) J.F. Gmel.	2	<i>Campanula polymorpha</i> Witasek	1
<i>Ligusticum mutellina</i> (L.) Crantz	2	<i>Pulsatilla alba</i> Reichenb.	+
<i>Soldanella hungarica</i> Simonk.	2	<i>Picea abies</i> (L.) H. Karst. (juv.)	+
<i>Nardus stricta</i> L.	2	Cover of moss-lichen layer (%)	10
<i>Festuca airoides</i> Lam.	1	<i>Cetraria islandica</i> (L.) Ach.	1
<i>Juncus trifidus</i> L.	2	<i>Cladonia rangiferina</i> (L.) Weber ex F.H. Wigg.	+
<i>Primula minima</i> L.	1	<i>Dicranum scoparium</i> Hedw.	+
<i>Veronica baumgartenii</i> Roem. & Schult.	2	<i>Polytrichastrum alpinum</i> (Hedw.) G.L. Sm.	+
<i>Anthoxanthum odoratum</i> L.	2	<i>Polytrichum commune</i> Hedw.	1
<i>Festuca picturata</i> Pils	2	<i>Polytrichum strictum</i> Menzies ex Brid.	+
<i>Gentiana punctata</i> L.	1	<i>Thamnolia vermicularis</i> (Sw.) Ach. ex Schaer.	1

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Salix herbacea L. (Salicaceae) на Мармароському масиві в Українських Карпатах

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Salix herbacea – це аркто-альпійський реліктовий вид з циркумполярним ареалом в межах голарктичної групи. Метою дослідження було уточнення даних щодо поширення *S. herbacea* в межах Мармароського масиву Українських Карпат, оскільки цей вид був зазначений для масиву без географічних деталей та опису середовища існування. Польові дослідження проводилися на Мармароському масиві на схилах гори Піп Іван (1936 м н.р.м.) та гори Рапа (1872 м н.р.м.) у 2017–2019 роках. Хорологія *S. herbacea* була проаналізована на основі даних інвентаризації гербарних колекцій УУ, КВ, КВНА, ЛВ, Карпатського біосферного заповідника, а також кафедри біології та екології Прикарпатського національного університету імені Василя Стефаника. Описано оселище виду на туристичній стежці між вершинами гір Піп Іван Мармароський та Рапа Мармароського масиву в Рахівському районі Закарпатської області. Ця популяція приурочена до скель між вищезазначеними

вершинами. Спостерігається заростання цих скельних угруповань високотравними видами *Calamagrostis villosa*, *Poa pratensis* та *Festuca picturata*. Відмічено витіснення голарктичних та альпійсько-карпатських видів (*Vaccinium uliginosum*, *Potentilla aurea*, *Pulsatilla alba*, *Thamnolia vermicularis* та *Cetraria islandica*) високотравними видами. Ймовірно, ці процеси зумовлені зменшенням інтенсивності випасу худоби протягом останніх років у цій місцевості та сприятливішими для високотравних видів кліматичними умовами. Окреслено точне розташування та ценотичні умови оселища, що знаходиться під загрозою та потребує збереження. Наголошено на необхідності розробки та впровадження природоохоронних заходів для охорони оселища *S. herbacea* на Мармароському масиві.

Ключові слова: *Salix herbacea*, Українські Карпати, Мармароський масив, гербарні колекції, поширення, охорона