

Southeastern-Alpine endemic *Leontodon hispidus* subsp. *brumatii* (Cichoriaceae) in the Sava valley (central Slovenia)

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Abstract – In the spring and summer of 2010 a number of new localities of the southeastern-Alpine endemic *Leontodon hispidus* subsp. *brumatii* were found on temporarily flooded riparian rocks in the gorge of the Sava River between the village of Sava and Zidani Most (central Slovenia). The species has so far been known only in northeastern Italy and western Slovenia (the Soča valley). In order to obtain more specific information its sites were studied phytosociologically and the communities in which it grows in the Sava and the Soča valleys compared. Two new associations were described on the basis of these comparisons: *Trisetum argentei-Leontodontetum brumatii* ass. nov. and *Leontodonti brumatii-Seslerietum calcariae* ass. nov. As this endemic taxon and its endemic communities are a characteristic of riparian flora and vegetation of some Slovenian mountain rivers and as its localities in the Sava valley are explicitly disjunct and the southeasternmost in the entire known distribution area, they deserve to be studied and protected.

Key words: *Leontodon brumatii*, phytogeography, synsystematics, Sava, Soča, Slovenia

Introduction

Leontodon hispidus L. subsp. *brumatii* (Schiede ex Reichenb) T. Wraber [*Leontodon hispidus* var. *brumatii* (Schiede ex Rchb.) Fiori = *L. brumatii* Schiede ex Rchb.] is a southeastern-Alpine endemic, known so far only in the foothills of the Julian and Carnic Alps and along some rivers in the Friuli lowland, western Slovenia and northeastern Italy (MAYER 1952, 1958, 1960; WRABER 1998, 2007; POLDINI 1991, 2002, 2009; JOGAN et al. 2001; ČUŠIN 2001, 2006; ČUŠIN and DAKSKOBLER 2001; DAKSKOBLER 2005). Its localities in Slovenia are on riparian rocks and river boulders in the Nadiža riverbed in the Breginjski kot, on riparian rocks along the Soča River between Bovec and Solkan (relatively often

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only along the middle Soča between Podselo and Plave), on similar sites along the Učja River. Reliable sites are only on the Italian side of the former border crossing Učja (WRABER 1998), very likely also downstream in the Slovenian territory, along the rivers Idrija (rarely, Golo Brdo, under Kostanjevica) and the Idrijca (very rarely, a rocky eyot on Slap ob Idrijci, under the dam at the new, small hydroelectric power plant, 9848/4, leg. et det. I. Dakskobler, 30. 5. 2010, Herbarium LJS, relevé 1 in table 2).

During our inventory of the flora in the Sava valley, between the village of Zidani most and Sava, this taxon was found at several spots on riparian rocks on both sides of the river; first on 12 May 2010 on the right bank between Trbovlje and Hrastnik, downstream from the hamlet Ribnik (Doležak) – 9856/3 (leg. I. Dakskobler et B. Vreš); on the same day on the same bank of the Sava downstream from Hrastnik, in the village of Podkraj, between the farmsteads Rus and Tohar (9856/4); two days later, on 14 May 2010, on the left bank of the Sava near Hrastnik – 9856/4 (leg. A. Seliškar). The article presents the localities and sites of this endemic taxon in the Sava valley and the communities in which it grows and compares them with its sites and communities in the Soča valley. The issue of its conservation is discussed in view of the fact that its sites along the Sava are in an area, designated for the construction of new hydroelectric power plants.

Materials and methods

Flora and vegetation along the Sava and the Soča Rivers (Figs. 1, 2) were studied according to the established central-European methods (BRAUN-BLANQUET 1964, EHRENDORFER and HAMANN 1965). Floristic records and phytosociological relevés were entered into the FloVegSi database (SELIŠKAR et al. 2003). The same application was used to make the distribution map (Fig. 2). When processing the relevés we transformed the combined cover-abundance values with numerical values (1–9) according to van der MAAREL (1979). Numerical comparisons were performed with the SYN-TAX 2000 program package (PODANI 2001). The relevés were compared by means of »(unweighted) average linkage method« – UPGMA and principal coordinates analysis (PCoA). Wishart's similarity ratio was used in all the methods. The nomenclature source for the names of vascular plants is the Mala flora Slovenije (MARTINČIČ et al. 2007), MARTINČIČ (2003) for the names of mosses and THEURILLAT (2004) for the names of the syntaxa.

Ecological description of the study area

The study area with *Leontodon hispidus* subsp. *brumatii* belongs to the pre-Alpine phytogeographical region (M. WRABER 1969). In terms of landscape regions it forms a part of the Sava valley or, more widely speaking, of the Posavsko hribovje region (PERKO and OROŽEN ADAMIČ 1998). From Litija towards Zidani Most the Sava initially still runs through a relatively wide valley which narrows at the village of Sava and remains narrow with steep banks throughout its course. On the right bank of the river, up to Hrastnik, runs a regional road, and on the left bank the double track Ljubljana–Zagreb railway. The prevailing geological bedrock consists of Triassic dolomite and limestone, in some sections (in the vicinity of Litija, Podkraj pri Hrastniku) also Permian-carbon slate claystones and sandstones (BUSER 1990). The climate is moderate continental. Mean annual air temperature in

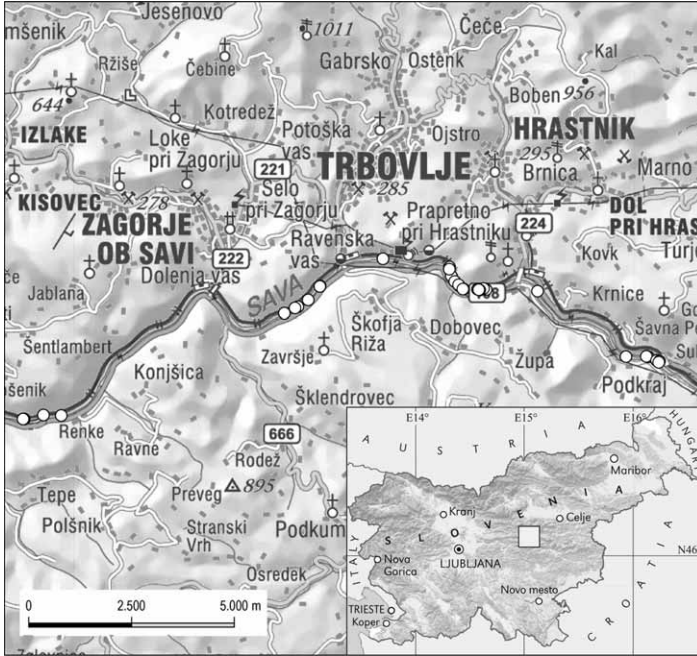


Fig. 1. Distribution of the taxon *Leontodon hispidus* subsp. *brumatii* in Slovenia with new localities in the Sava valley.

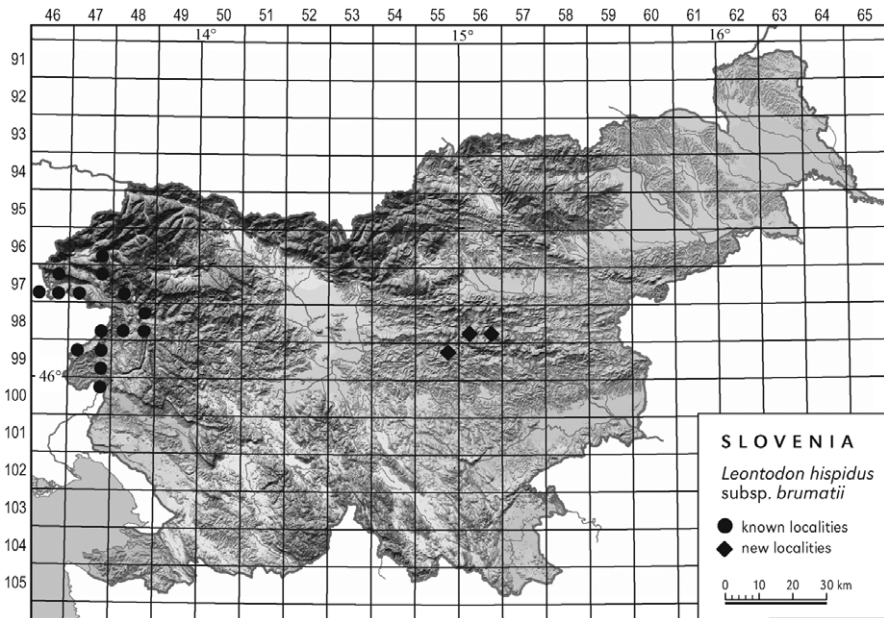


Fig. 2. Localities of the taxon *Leontodon hispidus* subsp. *brumatii* in the Sava valley (central Slovenia).

the period 1961–1990 was between 8 °C and 10 °C, mean January temperature –2 °C to 0 °C and mean July temperature 18 °C to 20 °C (CEGNAR 1998). Mean annual precipitation in the same period was between 1200 mm and 1400 mm (ZUPANČIČ 1998). The Sava River is torrential in this section and its level rapidly increases after heavy rain; rocky ledges along the river are partly or entirely flooded at least ten times a year (Fig. 3). Normally, there is a short period in May when the water level is low, and a longer period favourable for the development of the vegetation in the summer months from July to September (Hydrological data ARCHIVE 2008). Dolomite slopes above the Sava are overgrown with basophilic beech forests (*Ostryo-Fagetum*, *Arunco-Fagetum*, *Hacquetio-Fagetum*), and in areas where clay slates are the dominant bedrock also with acidophilous beech forests (*Blechno-Fagetum*). On the colluvium (hillside scree) in the gorges and at the foot of slopes there are some sites of valuable broad-leaved species (*Hacquetio-Fraxinetum*, *Veratro nigri-Fraxinetum*, *Tilio cordatae-Aceretum platanoidis ostryetosum*). The steepest, rockiest sites at the right bank of the Sava (Reber between the village of Sava and Mošenik; Reber between Zagorje and Trbovlje) are overgrown with basophilic forests of Scots pine and black pine (*Genisto januensis-Pinetum sylvestris*). On similarly steep, rocky sites on both banks of the river there are also sites of the community of pubescent oak and hop hornbeam (*Quercu pubescenti-Ostryetum carpinifoliae*). On smaller areas on rare gravel sites grows a community of grey and red willow (*Salicetum eleagno-purpureae*). The banks of the Sava between Litija and Zidani Most have been changed considerably, often reinforced with dry stone walls. Towards Zidani Most the river course becomes noticeably more placid and the banks flooded, due to the dam of the Boštanj hydroelectric power plant downstream. The best preserved natural slopes with rocky ledges are in the gorge between Hrastnik and Trbovlje and it is there that most of localities of *Leontodon hispidus* subsp. *brumatii* were found.

Results

Overview of the new localities of *Leontodon hispidus* subsp. *brumatii* in the Sava valley

9856/3 (UTM 33TWM00) Slovenia, Dolenjska, the Sava valley, the right bank of the Sava downstream from the hamlet of Ribnik (Doležak), riparian rocks and pioneer grey willow stands (*Salicetum eleagno-purpureae*), 200 m a.s.l., leg. et det. I. Dakskobler et B. Vreš, 12. May 2010, Herbarium LJS; the right bank of the Sava, upstream from the hamlet of Ribnik (Doležak) and the outfall of the Ribnik stream into the Sava, 205 m a.s.l. Det. B. Vreš, 8. June 2010.

9856/3 (UTM 33T WM00) Slovenia: Štajerska, Trbovlje, the left bank of the Sava, a rocky ledge at the Trbovlje thermal power plant; also to the east and southeast of this thermal power plant, under Ringa railway tunnel and further on to the foot of the hill Vištov vrh (opposite Ribnik or Doležak), 200 m a.s.l., Det. A. Seliškar, 19. May 2010.

9856/3 (UTM 33T WM00) Slovenia: Štajerska, the Sava valley, Trbovlje, hamlet Za Savo, on several spots on the banks of the Sava under the farmsteads Vrstovšek, Frajle, Frankovič and Kos, 200 m a.s.l. Det. B. Vreš, 27. July 2010.

9856/3 (UTM 33T WM00) Slovenia: Dolenjska, the Sava valley, Mitovšek, Ribogojnica (fish hatchery), riparian rocks on the right bank of the Sava, 205 m a.s.l. Det. B.

Vreš, 26. July 2010; Spodnji Šklendrovec, under the road Prusnik – Mitovšek, 210 m a.s.l.; Det. B. Vreš, 15. September 2010.

9856/4 (UTM 33T **WM00**) Slovenia: Dolenjska, the right bank of the Sava downstream from Hrastnik, Podkraj, at the homesteads Rus and Tohar and several spots between them (under the Ravenski hrib hill), riparian rocks, 200 m a.s.l., leg. et det. I. Dakskobler et B. Vreš, 12. May 2010, I. Dakskobler et B. Čušin, 17. June 2010, B. Vreš, 26. July 2010 and 7. October 2010, Herbarium LJS.

9856/4 (UTM 33T **WM00**) Slovenia: Štajerska, Hrastnik, the left bank of the Sava near the hamlet of Za Savo, to the east of the bridge across the river, riparian rocks, 200 m a.s.l., leg. et det. A. Seliškar, 14. May 2010 and 20. July 2010, Herbarium LJS.

9856/4 (UTM 33T **WM00**) Slovenia: Štajerska, the Sava valley, Hrastnik, the foot of the Vištov vrh hill, riparian rocks and ledges on the left bank of the Sava (under the railway track) between Trbovlje and Hrastnik, at several spots, 200 m a.s.l., leg. et det. A. Seliškar et I. Dakskobler, 18. May 2010, Herbarium LJS.

9856/4 (UTM 33T **WM00**) Slovenia: Dolenjska, the right bank of the Sava to the west of Hrastnik, under the filling station along the main road Zagorje–Hrastnik, 200 m a.s.l. Det. I. Dakskobler et A. Seliškar, 18. May 2010.

9856/4 (UTM 33T **WM10**) Slovenia: Štajerska, the left bank of the Sava, below the village of Suhadol, flood bank along the Sava, 195 m a.s.l. Det. A. Seliškar, 20. July 2010.

9955/2 (UTM 33T **V90**) Slovenia: Dolenjska, the Sava valley, Renke, the right bank of the Sava downstream from Šuštarški most, a bridge across the Sava, 220 m a.s.l., riparian rocks., leg. et det. I. Dakskobler et B. Čušin, 17. May 2010, Herbarium LJS.

9955/2 (UTM 33T **V90**) Slovenia: Štajerska, the Sava valley, Mošenik, the left bank of the Sava, to the west of the Šuštarški most (a footbridge), rocks along the Sava, at the outfall of a tufa-forming stream, 220 m a.s.l. Det. A. Seliškar and B. Vreš, 12. October 2010; Mošenik, the left bank of the Sava, to the west of the bridge Šuštarški most, riparian rocks below the abandoned Mars homestead, 220 m a.s.l. Det. A. Seliškar et B. Vreš, 12. October 2010.

Leontodon brumatii was recorded on the banks of the Sava between Litija and Zidani Most at the altitude of 195 to 220 m, at 38 microlocalities in four sections: between the villages of Sava and Zagorje (the westernmost localities are at Renke on the right and at Mošenik at the left bank of the river), between Zagorje and Trbovlje (at Mitovšek on the right and under the hamlet of Za Savo on the left bank of the river), between Trbovlje and Hrastnik (at Ribnik and the Hrastnik filling station on the right bank and at the foot of Vištov vrh on the left bank of the river, where it grows abundantly on riparian rocks) and between Hrastnik and Zidani Most or Radeče (the easternmost locality is under the village Suhadol on the left bank and at the homestead Tohar in Podkraj on the right bank) and in three quadrants – 9955/2, 9856/3 and 9856/4 (Figs. 1, 2).

Phytosociological description of the sites of *L. brumatii* in the Sava valley and in the Soča valley

Conspectus of the established syntaxa:

Asplenietea trichomanis Br.-Bl. in Meier et Br.-Bl. 1934 corr. Oberdorfer 1977

Potentilletalia caulescentis Br.-Bl. in Br.-Bl. et Jenny 1926

Cystopteridion fragilis Richard 1972

***Trisetum argentei-Leontodontetum brumatii* ass. nov. hoc loco**

var. *typica* var. nov.

var. *Chamaecytisus purpureus* var. nov.

var. *Deschampsia cespitosa* var. nov.

Festuco-Brometea Br.-Bl. et Tüxen 1943

Scorzonero-Chrysopogonetalia Horvatić et Horvat in Horvatić 1958 = *Scorzoneretalia villosae* Horvatić 1975

Saturejion subspicatae Horvatić 1975

Centaureion dichroanthae (Pignatti 1953) Poldini et Feoli Chiapella in Feoli Chiapella et Poldini 1993

***Leontodonti brumatii-Seslerietum calcariae* ass. nov. hoc loco**

***chamaecytisetum purpureae* subass. nov. hoc loco**

***saxifragetum crustatae* subass. nov. hoc loco**

Salicetea purpureae Moor 1958

Salicetalia purpureae Moor 1958

Salicion eleagno-daphnoidis (Moor 1958) Grass 1993

***Salicetum eleagno-purpureae* Sillinger 1933 *petasitetosum hybridi* (Šilc et Čušin 2000) Oriolo et Poldini 2002 var. *Populus nigra* Dakskobler 2010**

Leontodon hispidus subsp. *brumatii* is an endemic with a small distribution area. There are very few data on the communities in which it grows. It is known to grow on rocks (POLDINI 1991). The subspecies is not discussed on its own but together with *Leontodon hispidus* in the Flora alpina (AESCHIMANN et al. 2004). WRABER (1998) claims that it usually grows in a very characteristic environment, on riparian rocks that are periodically washed by river water. He stresses that the plant can also grow outside the direct influence of the water splashing, which was confirmed in our research in the Soča valley, where the studied taxon was recorded also on rocks and steep gravelly slopes that the river cannot reach even when the water level is at its highest. The specimens growing the highest above the Sava River level were found in a crevice of the retaining wall under the railway track, some 3.5 m above the low spring water level, and on a stony road slope approximately 5 m above the low spring water level. However, even these specimens are flooded when the water level is at its highest.

The rivers Soča and Idrijca are torrential and have a similar water regime to that characteristic for the Sava River (Fig. 3). Interesting is the frequent occurrence of the subspecies *L. brumatii* under the Doblar hydroelectric power plant where the fluctuation of the water level and in turn inundation of the subspecies' sites occurs on a daily basis. So far, no comprehensive phytosociological inventory of all its known localities in the Soča valley has been made, but we have made 15 relevés of this species at different locations over a longer time period. These relevés were compared to those from the Sava valley and thus the following results were obtained (Figs. 4, 5).

In all of the comparisons the relevés from the Sava valley (ZS) were grouped separately from the relevés from the Soča valley (PO). Two phytosociological tables were made for both regions (Tabs. 1, 2). 15 relevés made in the Sava valley on the both banks of Sava be-

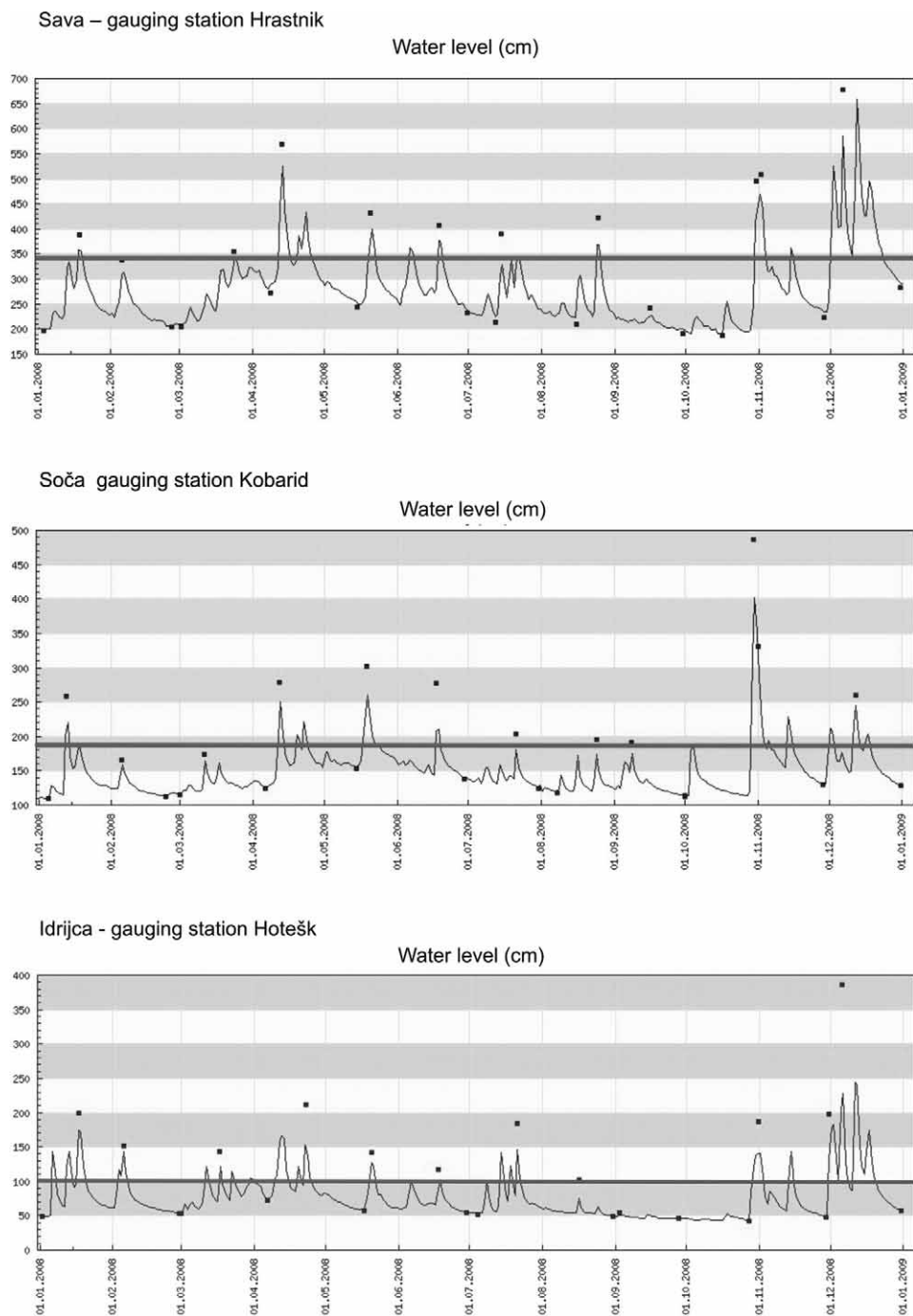


Fig. 3. Water level (in cm) of the rivers Sava, Soča and Idrija in 2008 (according to Hydrological data archive 2008). The red line marks the threshold of flooding of the sites of *Leontodon hispidus subsp. brumatii*.

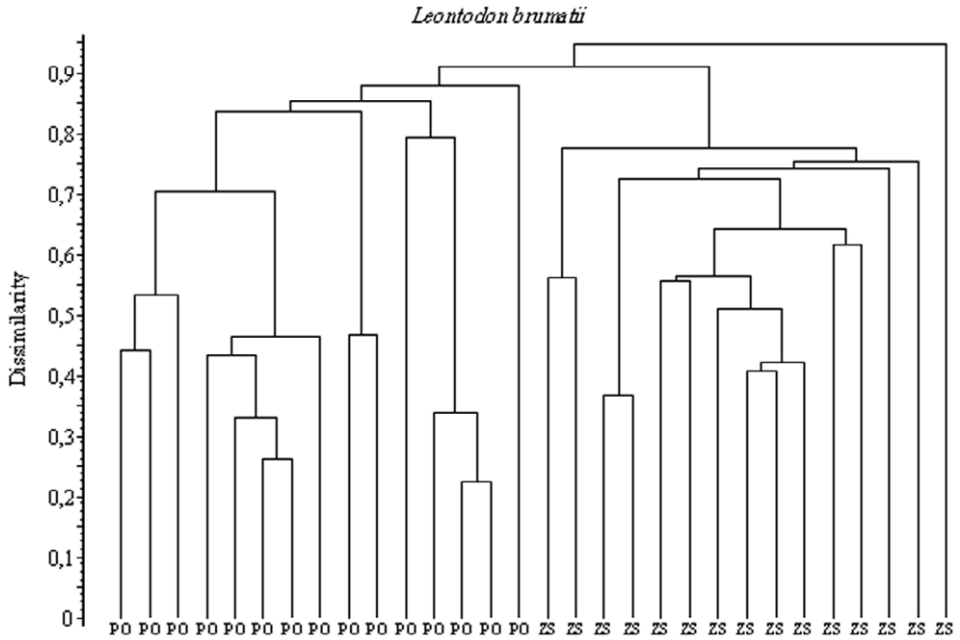


Fig. 4. Dendrogram of communities with *Leontodon hispidus* subsp. *brumatii* from the Soča valley (PO) and from the Sava valley (ZA) – UPGMA, similarity ratio.

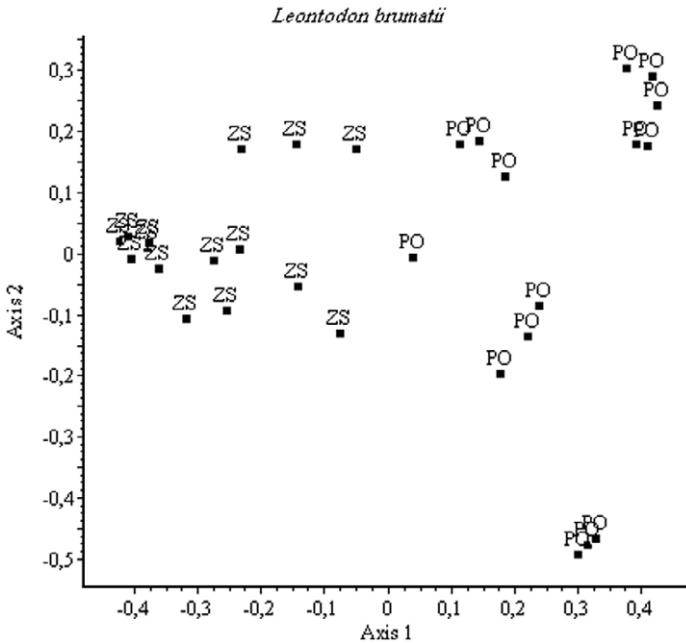


Fig. 5. Two-dimensional scatter-diagram of communities with *Leontodon hispidus* subsp. *brumatii* from the Soča valley (PO) and from the Sava valley (ZA) – PCoA, similarity ratio.

Tab. 1. Communities with *Leontodon hispidus* subsp. *brumatii* in the Sava valley (central Slovenia).
Fl – fluvisols, Li – lithosols.

Number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Pr.	Fr.
Database number of relevé	236827	237403	235795	235337	235827	235828	237387	235401	235448	235449	235830	235406	237160	235213	235829		
Altitude in m	200	220	180	200	200	200	220	200	200	200	200	200	200	200	200		
Aspect	N	S	N	S	S	S	0	0	SW	SW	0	N	0	N	0		
Slope in degrees	2	70	35	2	2	5	0	0	3	3	0	10	0	2	0		
Parent material	DA	DA	DA	DA	DA	DA	DA	DA	DA	DA	DA	DA	DA	Alu	Alu		
Soil	Fl	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Fl	Fl		
Stoniness in %	30	100	80	90	100	100	100	100	80	80	100	100	70	30	30		
Cover in %:																	
Tree layer	E3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20	
Shrub layer	E2	70	5	.	20	20	10	30	20	5	10	10	20	70	80		
Herb layer	E1	50	40	30	60	60	30	40	30	60	40	15	40	40	50	70	
Moss layer	E0	10	30	20	10	10	10	20	10	30	20	50	30	10	10		
Relevé area (m ²)	100	10	20	15	15	9	50	50	50	50	50	20	50	100	200		
Number of species	30	13	13	11	16	20	16	32	25	20	18	24	12	57	44		
Date of taking relevé	6.9.2010	12.10.2010	17.6.2010	18.5.2010	18.5.2010	18.5.2010	12.10.2010	18.5.2010	19.5.2010	19.5.2010	18.5.2010	18.5.2010	20.7.2010	12.5.2010	18.5.2010		
Locality	Ribnik	Renke	Hrastnik	Hrastnik	Hrastnik	Hrastnik	Mošenik	Hrastnik	Trbovlje	Trbovlje	Hrastnik	Hrastnik	Hrastnik	Ribnik (Doležak)	Hrastnik		
Quadrant	9856/3	9955/2	9856/4	9856/4	9856/4	9856/3	9955/2	9856/3	9856/3	9856/3	9856/3	9856/4	9856/4	9856/3	9856/3		

Character and differential species of the syntaxa

AT <i>Leontodon hispidus</i> subsp. <i>brumatii</i>	E1	+	2	2	2	2	2	2	2	3	2	2	2	1	+	15	100
M <i>Brachythecium rutabulum</i>	E0	.	3	1	1	1	+	2	+	2	1	1	3	1	+	1	93
M <i>Cinclidotus fontinaloides</i>	E0	.	.	.	.	+	1	.	1	3	2	3	1	.	+	.	53
TR <i>Trisetum argenteum</i>	E1	+	.	1	.	.	+	.	.	+	+	.	1	.	.	.	40
EP <i>Chamaecytisus purpureus</i>	E1	.	.	.	2	2	1	.	.	.	.	.	.	.	.	.	20
FB <i>Peucedanum oreoselinum</i>	E1	.	.	+	1	1	.	.	.	.	.	.	.	.	+	.	27
ES <i>Sesleria caerulea</i> subsp. <i>calcaria</i>	E1	.	+	.	.	2	+	+	.	.	.	.	.	.	+	.	33
FB <i>Inula ensifolia</i>	E1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	7

Tab. 1. – continued

Number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Pr.	Fr.
MA <i>Deschampsia</i> <i>cespitosa</i>	E1	.	.	+	.	.	1	1	1	3	2	2	2	3	1	1	11	73
PM <i>Phalaris</i> <i>arundinacea</i>	E1	.	.	.	.	.	+	+	1	+	+	+	+	+	1	+	10	67
SP <i>Populus nigra</i>	E3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	7
SP <i>Populus nigra</i>	E2b	.	.	.	1	1	1	+	2	2	+	+	+	2	3	2	12	80
SP <i>Populus nigra</i>	E2a	.	.	.	.	.	.	.	+	.	.	1	.	.	1	1	4	27
SP <i>Salix alba</i>	E2	.	.	.	.	+	.	.	.	+	+	+	.	.	r	+	6	40
SP <i>Salix eleagnos</i>	E2b	.	.	.	.	.	+	.	.	.	.	.	1	.	+	1	4	27
SP <i>Salix eleagnos</i>	E2a	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	3	20
SP <i>Salix purpurea</i>	E2b	.	.	.	.	.	+	.	1	.	+	.	.	.	3	.	4	27
SP <i>Salix purpurea</i>	E2a	.	+	.	.	.	.	.	.	+	.	+	.	.	1	.	4	27
SP <i>Salix purpurea</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	7
GU <i>Petasites hybridus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	7
FB Festuco-Brometea																		
<i>Genista tinctoria</i>	E1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	+	2	13
PA Potentillion anserineae																		
<i>Rorippa sylvestris</i>	E1	.	.	1	.	.	.	.	+	+	.	+	.	1	+	+	7	47
<i>Barbarea vulgaris</i>	E1	.	.	.	.	.	.	.	+	.	+	+	.	.	+	+	5	33
PP Potentillo- -Polygonetalia																		
<i>Agrostis stolonifera</i>	E1	.	.	.	.	.	.	1	+	+	+	.	.	+	+	.	6	40
<i>Plantago major</i>	E1	.	.	.	.	.	.	.	+	+	.	+	.	.	r	+	5	33
<i>Rumex crispus</i>	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	2	13
MA Molinio- -Arrhenatheretea																		
<i>Taraxacum officinale</i>	E1	.	+	.	.	.	+	.	.	+	.	.	+	.	+	+	6	40
<i>Trifolium pratense</i>	E1	.	.	.	.	.	+	.	+	+	+	.	.	.	+	+	6	40
<i>Plantago lanceolata</i>	E1	.	.	.	+	+	.	.	+	.	.	.	+	.	+	.	5	33
<i>Achillea millefolium</i>	E1	.	.	.	.	.	.	.	+	.	+	.	.	.	r	.	3	20
<i>Centaurea carniolica</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	3	20
<i>Dactylis glomerata</i>	E1	.	.	.	.	.	.	.	+	.	.	.	+	.	.	+	3	20
<i>Galium mollugo</i>	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	3	20
<i>Ranunculus acris</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	3	20
<i>Veronica chamaedrys</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	3	20
<i>Pastinaca sativa</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	r	.	2	13
<i>Lotus corniculatus</i>	E1	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	2	13
AV Artemisietea vulgaris																		
<i>Artemisia vulgaris</i>	E1	+	.	.	+	+	.	.	+	+	.	.	.	.	+	+	7	47
<i>Erigeron annuus</i>	E1	+	.	.	.	.	.	.	+	.	.	+	+	+	+	+	7	47
<i>Rumex obtusifolius</i>	E1	.	.	.	.	.	.	+	+	+	.	+	.	.	+	+	7	47
<i>Euphorbia esula</i>	E1	.	.	.	.	.	.	.	.	+	.	.	+	.	.	+	3	20
<i>Picris hieracioides</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	13

Tab. 1. – continued

Number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Pr.	Fr.	
PM <i>Phragmiti-</i> <i>-Magnocaricetea</i>																		
<i>Mentha aquatica</i>	E1	.	.	+	.	.	.	.	.	.	+	.	.	.	.	2	13
SP <i>Salicetea purpureae</i>																		
<i>Salix triandra</i>	E2b	.	.	.	.	.	+	.	.	.	.	.	.	.	1	2	13
AI <i>Alnion incanae</i>																		
<i>Rubus caesius</i>	E2a	.	+	+	1	1	1	1	1	+	.	.	+	.	1	11	73	
<i>Ulmus laevis</i>	E2b	.	.	.	+	+	+	.	+	.	+	.	.	.	+	1	7	47
<i>Ulmus laevis</i>	E2a	.	.	.	.	.	.	.	+	.	.	+	+	.	+	4	27
<i>Chaerophyllum hirsutum</i>	E1	+	+	2	13
AG <i>Alnus glutinosa</i>	E2	.	+	.	.	.	.	1	.	.	.	.	.	.	.	2	13
FS <i>Fagetalia sylvaticae</i>																		
<i>Fraxinus excelsior</i>	E2a	+	+	.	2	13
<i>Scrophularia nodosa</i>	E1	+	.	2	13
<i>Brachypodium sylvaticum</i>	E1	+	+	2	13
QF <i>Quercu-Fagetea</i>																		
<i>Clematis vitalba</i>	E1	+	1	2	13
RP <i>Rhamno-Prunetea</i>																		
<i>Crataegus monogyna</i>	E2b	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	7
<i>Crataegus monogyna</i>	E2a	.	.	.	.	.	.	+	+	.	.	+	.	.	.	3	20
<i>Cornus sanguinea</i>	E2a	+	+	2	13
AR <i>Agropyretea intermedi-repentis</i>																		
<i>Poa compressa</i>	E1	.	.	.	.	.	.	.	+	.	.	.	+	.	.	2	13
BT <i>Bidentetea tripartitae</i>																		
<i>Rorippa palustris</i>	E1	+	.	.	.	.	.	.	.	.	.	1	.	.	.	2	13
FC <i>Filipendulo- -Convolvuletea</i>																		
<i>Helianthus tuberosus</i>	E1	+	+	.	.	+	.	.	+	1	5	33
<i>Saponaria officinalis</i>	E1	.	.	+	+	+	+	4	27
<i>Echinocystis lobata</i>	E1	+	+	.	2	13
<i>Mentha longifolia</i>	E1	+	+	2	13
GU <i>Galio-Urticetea</i>																		
<i>Solidago gigantea</i>	E1	+	+	.	+	+	+	+	+	+	+	+	+	.	1	1	13	87
<i>Aegopodium podagraria</i>	E1	+	1	2	13
<i>Urtica dioica</i>	E1	.	+	+	2	13
O Other species																		
<i>Fallopia japonica</i>	E1	+	+	1	1	4	27
<i>Poa</i> sp.	E1	.	.	+	+	2	13
<i>Euphorbia nutans</i>	E1	+	.	.	+	2	13
<i>Malus domestica</i>	E2a	+	+	2	13
M Mosses																		
<i>Tortella</i> sp.	E0	.	.	.	1	1	1	.	1	+	+	1	+	.	.	8	53	

Appendix to Tab. 1.

Sporadic species: **Festuco-Brometea:** *Petrorhagia saxifraga* + (9), *Medicago lupulina* + (14), **Potentillo-Polygonetalia:** *Ranunculus repens* + (12), *Potentilla reptans* + (14), **Molinio-Arrhenatheretea:** *Leontodon hispidus* + (1), *Leucanthemum ircutianum* + (9), *Cerastium holosteoides* + (12), *Crepis biennis* + (14), *Leucanthemum vulgare* + (14), *Rumex acetosa* + (14), *Vicia cracca* + (14), *Vicia sepium* + (15), **Artemisietea vulgaris:** *Cichorium intybus* + (1), *Tanacetum vulgare* + (8), **Phragmiti-Magnocaricetea:** *Lycopus europaeus* + (8), **Salicetea purpureae:** *Salix fragilis* /E2b/ + (1), *Salix fragilis* /E2a/ + (2), *Humulus lupulus* + (1), **Alnion incanae:** *Ulmus laevis* /E1/ + (9), *Peucedanum verticillare* + (1), *Cardamine impatiens* + (14), *Knautia drymeia* subsp. *intermedia* + (14), **Quercetalia pubescentis:** *Campanula rapunculoides* + (3), *Fraxinus ornus* + (5), *Ostrya carpinifolia* + (14), **Quercu-Fagetea:** *Hieracium sabaudum* + (1), *Carex digitata* + (2), *Ficaria verna* subsp. *bulbifera* + (14), **Rhamno-Prunetea:** *Crataegus monogyna* /E2b/+ (10), *Rhamnus catharticus* + (5), *Rosa canina* agg. + (14), **Agropyretea intermedii-repentis:** *Equisetum arvense* (14), **Bidentetea tripartitae:** *Polygonum lapathifolium* + (1), *Polygonum mite* + (1), **Filipendulo-Convolutea:** *Calystegia sepium* + (8), *Lythrum salicaria* + (13), **Stellarietea mediae:** *Amaranthus retroflexus* + (1), *Chenopodium album* + (1), *Digitaria sanguinalis* + (1), *Echinochloa crus-galli* + (1), *Polygonum persicaria* + (1), *Setaria pumila* + (1), *Solanum nigrum* + (1), *Poa annua* + (10), *Setaria viridis* + (13), *Cerastium glomeratum* r (14), **Other species:** *Acer negundo* + (1), *Ambrosia artemisiifolia* + (1), *Brassica* sp. + (1), *Agrostis* sp. + (3), *Ribes rubrum* + (14), *Physocarpus opulifolius* + (7), **Mosses:** Musci div. + (2).

tween Mošenik and Hrastnik were grouped together (Tab. 1). In this area, *L. brumatii* mainly overgrows riparian rocks, rarely also coarse, riparian gravel, both being at least periodically flooded (Figs. 6, 7). Phanerograms and some moss species grow only rarely on these rocks. In addition to *L. brumatii* the most abundant grass among the phanerograms is *Deschampsia cespitosa*. Other species, which are mostly the character species of cultivated meadows and nitrophilic ruderal communities, have only scattered and individual occurrences. Only three of the relevés in table 1 (relevés 4 to 6) slightly resemble those in the Soča valley (Tab. 2), which is mainly due to the occurrence of *Chamaecytisus purpureus*, *Peucedanum oreoselinum* and *Inula ensifolia*. Even the subspecies *Sesleria caerulea* subsp. *calcaria*, which usually dominates in the relevés in the Soča valley (in addition to *L. brumatii*), is relatively rare on the riparian rocks in the Sava valley and is more abundantly represented in only one relevé. Most stands with *L. brumatii* in the Sava valley are described as a new association *Trisetum argentei-Leontodontetum brumatii* ass. nov. In the floristic composition as a whole there are several species which indicate a partial similarity of the studied community with the communities with dominant *Phalaris arundinacea* that overgrow periodically flooded sites immediately along the mid-course of rivers subject to considerable fluctuation of water level and that are classified into the alliance *Phalaridion arundinaceae* Kopecký 1961 and the association *Rorippo-Phalaridetum* Kopecký 1961 (BALÁTOVÁ-TULÁČKOVÁ et al. 1993). So far, this association in Slovenia has been documented with only three relevés (PETRINEC 1999). In addition to its relevés the synoptic table (Tab. 3) includes also the relevés of the same association from the border region between Slovakia and Hungary (HRIVINÁK and UJHÁZY 2003). The synoptic table and numerical comparison of the three syntaxa (Figs. 8, 9) clearly demonstrate that our stands cannot be classified into the association *Rorippo-Phalaridetum*. They comprise only a few of the species diagnostic for the class *Phragmiti-Magnocaricetea* Klika in Klika et Novák 1941 (*Mentha aquatica*, *Lycopus europaeus* and *Phalaris arundinacea*) and only *P. arundinacea*

Tab. 2. Communities with *Leontodon hispidus* subsp. *brumatii* in the Soča valley (western Slovenia).
Li – lithosols

Number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Pr.	Fr.
Database number of relevé	235465	237627	237628	218515	218517	218516	237629	237630	237631	237632	237633	237637	237638	237639	237635		
Altitude in m	176	200	200	83	84	83	120	120	120	120	120	230	220	220	160		
Aspect	0	SE	SE	SW	SW	W	NE	NNW	SW	SW	NE	NNE	NNE	N	N		
Slope in degrees	0	90	90	35	40	40	10	20	10	10	70	45	40	40	30		
Parent material	A	AR	AR	AL	AL	AL	A	A	A	A	A	AR	AR	AR	AR		
Soil	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li	Li		
Stoniness in %	100	100	100	100	100	100	90	100	90	60	100	30	30	30	90		
Cover in %:																	
Tree layer	E3	0	0	0	0	0	0	0	0	0	0	5	0	0	0		
Shrub layer	E2	10	10	5	0	0	10	30	5	10	5	10	20	30	40	5	
Herb layer	E1	20	25	30	25	30	30	30	20	40	40	40	70	70	80	30	
Moss layer	E0	0	5	5	5	10	30	5	5	5	5	10	20	10	10	15	
Relevé area (m ²)	50	50	50	10	10	10	10	10	50	10	15	100	100	100	15		
Number of species	14	29	18	20	13	18	25	22	25	22	36	37	37	33	17		
Date of taking relevé	30.5.2010	8.5.1992	8.5.1992	28.4.2008	28.4.2008	28.4.2008	4.10.2002	24.7.2002	24.7.2002	24.7.2002	24.7.2002	19.6.2001	17.5.1999	17.5.1999	19.6.2001		
Locality																	
Quadrant	9848/4	9848/3	9848/3	9947/2	9947/2	9947/2	9848/3	9848/3	9848/3	9848/3	9848/3	9848/3	9848/2	9848/2	9848/2	9848/2	
	Slap ob Idrjici	Loški poldan	Loški poldan	Anhovo	Anhovo	Anhovo	Vogršček-Spopdnji Log	Vogršček-Spopdnji Log	Vogršček-Spopdnji Log	Vogršček-Spopdnji Log	Vogršček-Spopdnji Log	Bučenica	Bučenica	Bučenica	Bučenica		

Character and differential species of the syntaxa

ES	<i>Sesleria caerulea</i> subsp. <i>calcaria</i>	E1	1	1	+	2	2	2	2	2	2	2	3	3	3	+	15	100	
AT	<i>Leontodon hispidus</i> subsp. <i>brumatii</i>	E1	1	+	+	2	2	1	1	1	+	r	+	+	+	r	+	15	100
EP	<i>Calamagrostis varia</i>	E1	.	.	.	.	.	+	+	+	+	+	1	+	+	+	1	10	67
AT	<i>Hieracium porrifolium</i>	E1	.	.	.	+	.	.	1	+	+	+	+	+	+	.	.	9	60
ES	<i>Aster bellidiastrum</i>	E1	.	.	.	.	.	.	+	+	+	.	1	+	+	+	1	8	53
AT	<i>Athamanta turbith</i>	E1	.	1	2	.	.	+	+	.	+	.	.	+	+	.	.	8	53
AT	<i>Campanula carnica</i>	E1	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	2	13
AT	<i>Campanula pyramidalis</i>	E1	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	2	13
AT	<i>Sedum album</i>	E1	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	2	13

Tab. 2. – continued

	Number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Pr.	Fr.	
EP	<i>Chamaecytisus purpureus</i>	E1	.	.	.	+	1	+	1	2	2	2	2	.	.	.	.	8	53
FB	<i>Carex humilis</i>	E1	.	.	.	+	+	+	.	+	1	2	1	.	.	.	.	7	47
FB	<i>Centaurea scabiosa</i> subsp. <i>fritschii</i>	E1	.	.	.	+	.	1	1	+	+	+	+	.	.	.	.	7	47
EP	<i>Allium ericetorum</i>	E1	.	.	.	+	.	.	1	1	2	2	1	.	.	.	.	6	40
FB	<i>Inula ensifolia</i>	E1	.	.	.	.	.	.	+	1	1	1	.	.	.	.	.	4	27
EP	<i>Erica carnea</i>	E1	.	.	.	.	.	.	+	.	.	.	.	2	2	1	+	5	33
AT	<i>Saxifraga crustata</i>	E1	.	.	.	.	.	.	.	.	.	.	.	2	2	2	r	4	27
Mo	<i>Laserpitium prutenicum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	1	1	1	+	4	27
TR	<i>Petasites paradoxus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	1	1	1	1	4	27
TR	<i>Campanula cespitosa</i>	E1	.	.	.	.	.	.	.	.	.	.	.	1	1	1	.	3	20
ES	<i>Rhinanthus aristatus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	3	20
FB	<i>Stachys recta</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	3	20
AT	<i>Asplenietea trichomanis</i>																		
	<i>Asplenium ruta-muraria</i>	E1	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	3	20
	<i>Phyteuma scheuchzeri</i> subsp. <i>columnae</i>	E1	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	3	20
ES	<i>Elyno-Seslerietea</i>																		
	<i>Globularia cordifolia</i>	E1	.	.	.	+	.	.	.	.	+	.	.	.	+	.	.	3	20
FB	<i>Festuco-Brometea</i>																		
	<i>Genista tinctoria</i>	E1	.	.	+	+	+	+	+	.	.	.	.	1	+	+	.	8	53
	<i>Euphorbia cyparissias</i>	E1	+	.	.	.	1	.	+	.	+	.	+	.	.	.	.	5	33
	<i>Satureja montana</i> subsp. <i>variegata</i>	E1	.	1	1	.	.	.	.	.	+	+	.	.	.	+	.	5	33
	<i>Peucedanum oreoselinum</i>	E1	.	.	.	.	.	.	1	+	+	+	.	.	.	.	+	5	33
	<i>Buphthalmum salicifolium</i>	E1	.	.	+	.	.	.	.	.	.	.	.	1	+	1	.	4	27
	<i>Bromopsis erecta</i>	E1	.	+	.	+	.	.	.	.	.	.	+	.	.	.	.	3	20
	<i>Koeleria pyramidata</i>	E1	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	2	13
	<i>Inula hirta</i>	E1	.	.	.	.	.	.	+	.	.	.	r	.	.	.	.	2	13
	<i>Ononis spinosa</i>	E1	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	2	13
	<i>Medicago falcata</i>	E1	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	2	13
	<i>Gymnadenia conopsea</i>	E1	.	.	.	.	.	.	.	.	.	.	r	.	+	.	.	2	13
Mo	<i>Molinion caeruleae</i>																		
SCF	<i>Parnassia palustris</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	2	13
MA	<i>Molinio-Arrhenatheretea</i>																		
	<i>Taraxacum officinale</i>	E1	.	.	.	r	.	+	.	r	.	.	.	.	.	.	.	3	20
	<i>Lotus corniculatus</i>	E1	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	2	13

Tab. 2. – continued

Number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Pr.	Fr.	
TG	<i>Trifolio-Geranietea</i>																		
	<i>Peucedanum cervaria</i>	E1	.	+	.	.	.	+	1	1	.	1	+	.	.	.	6	40	
TR	<i>Thlaspietea rotundifolii</i>																		
	<i>Achnatherum calamagrostis</i>	E1	.	1	1	.	.	.	.	.	.	.	.	+	.	.	3	20
	<i>Peucedanum verticillare</i>	E1	.	.	.	.	.	.	.	.	.	.	r	+	.	.	2	13
	<i>Biscutella laevigata</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	1	.	2	13
EP	<i>Erico-Pinetea</i>																		
	<i>Aster amellus</i>	E1	.	+	1	.	.	.	+	.	+	+	1	.	+	+	8	53	
	<i>Leontodon incanus</i>	E1	.	+	+	.	.	.	+	1	1	+	1	.	.	.	7	47	
	<i>Carex ornithopoda</i>	E1	.	.	.	.	.	+	.	.	.	.	.	+	+	+	4	27
	<i>Epipactis atrorubens</i>	E1	.	.	.	.	.	.	.	.	.	.	.	1	+	.	3	20
	<i>Pinus nigra</i>	E2b	.	.	.	.	.	.	.	.	.	.	.	1	r	r	3	20
	<i>Pinus nigra</i>	E2a	.	.	.	.	.	.	.	.	.	.	.	r	+	.	2	13
	<i>Polygala chamaebuxus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	1	1	1	3	20
	<i>Chamaecytisus hirsutus</i>	E2a	.	.	.	+	.	+	.	.	.	.	.	.	.	.	2	13
MuA	<i>Mulgedio-Aconitetea</i>																		
	<i>Salix appendiculata</i>	E2a	.	.	.	.	.	.	+	.	.	.	+	+	+	+	6	40
QP	<i>Quercetalia pubescentis</i>																		
	<i>Fraxinus ornus</i>	E2b	+	+	1	.	3	20
	<i>Fraxinus ornus</i>	E2a	.	+	+	.	.	+	.	+	1	+	1	1	1	1	10	67	
	<i>Fraxinus ornus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	1	1	1	4	27
	<i>Ostrya carpinifolia</i>	E2b	.	.	.	.	.	.	.	.	.	.	.	1	1	2	3	20
	<i>Ostrya carpinifolia</i>	E2a	.	+	.	.	.	.	.	+	.	.	+	1	1	.	5	33
	<i>Lembotropis nigricans</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	+	+	3	20
	<i>Carex flacca</i>	E1	.	.	.	.	.	.	.	.	.	.	.	1	1	1	3	20
	<i>Campanula rapunculoides</i>	E1	.	.	.	.	r	.	.	.	.	.	.	+	.	.	2	13
	<i>Clematis recta</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	+	.	2	13
FS	<i>Fagetalia sylvaticae</i>																		
	<i>Mycelis muralis</i>	E1	.	+	+	.	.	.	.	.	.	.	.	.	.	.	2	13
	<i>Anemone trifolia</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7
	<i>Lathyrus vernus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	7
	<i>Ranunculus lanuginosus</i>	E1	.	.	.	.	.	.	.	.	.	.	.	r	.	.	1	7
	<i>Tilia cordata</i>	E2a	+	.	.	.	.	.	.	.	.	.	.	r	.	.	2	13
QF	<i>Quercu-Fagetea</i>																		
	<i>Clematis vitalba</i>	E2a	.	+	+	+	+	.	.	+	+	.	.	.	.	.	7	47
	<i>Carex digitata</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	1	2	13

Tab. 2. – continued

Number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Pr.	Fr.	
SP <i>Salicetea purpureae</i>																		
<i>Populus nigra</i>	E2a	+	.	.	.	+	+	.	.	.	.	.	.	.	.	3	20
<i>Salix eleagnos</i>	E2	1	.	.	.	.	.	.	.	.	.	.	.	+	+	3	20
<i>Salix purpurea</i>	E2a	+	+	+	3	20
AV <i>Artemisietea vulgaris</i>																		
<i>Erigeron annuus</i>	E1	+	.	.	r	.	.	.	.	.	.	.	.	.	.	2	13
O Other species																		
<i>Festuca</i> sp.	E1	.	.	+	.	.	.	.	.	+	.	.	.	.	.	2	13
M Mosses																		
<i>Schistidium apocarpum</i>	E0	.	1	.	.	.	.	1	+	+	1	+	.	.	.	6	40
<i>Tortella</i> sp.	E0	.	+	.	+	1	1	1	1	.	6	40
<i>Tortella tortuosa</i>	E0	1	1	1	1	+	.	.	.	1	6	40
<i>Cinclidotus fontinaloides</i>	E0	.	.	.	+	1	2	.	.	.	.	.	.	.	.	3	20
<i>Ctenidium molluscum</i>	E0	1	1	+	.	3	20
<i>Fissidens dubius</i>	E0	+	+	+	.	3	20
<i>Collema</i> sp.	E0	.	+	+	.	.	.	.	.	.	.	.	.	.	.	2	13
<i>Dicranum</i> sp.	E0	.	.	.	.	.	.	.	.	.	.	.	+	+	.	2	13
Musci div.	E0	+	.	.	2	2	13

Appendix to Tab. 2.

Sporadic species: **Asplenieta trichomanis**: *Hieracium austriacum* + (1), *Calamintha einseleana* + (2), *Sedum maximum* + (2), *Asplenium trichomanes* + (2), *Ceterach javorkeanum* + (2), *Paederota lutea* + (15), **Elyno-Seslerietea**: *Erigeron glabratus* + (8), **Festuco-Brometea**: *Allium carinatum* subsp. *pulchellum* + (2), *Thymus praecox* + (4), *Salvia pratensis* + (7), *Trifolium montanum* + (11), **Trifolio-Geranietea**: *Digitalis grandiflora* + (2), *Verbascum lychnitis* r (2), *Vincetoxicum hirundinaria* + (7), *Lilium bulbiferum* r (11), **Thlaspietea rotundifolii**: *Hieracium bifidum* + (1), *Hieracium piloselloides* + (1), *Trisetum argenteum* + (4), *Silene vulgaris* subsp. *glareosa* + (13), **Erico-Pinetea**: *Molinia caerulea* subsp. *arundinacea* + (14), *Pinus sylvestris* r (14), **Vaccinio-Piceetea**: *Solidago virgaurea* + (11), *Picea abies* + (14), **Quercetalia pubescentis**: *Ostrya carpinifolia* /E1/ 1 (12), *Arabis turrita* + (2), *Coronilla emerus* subsp. *emeroides* r (6), *Sorbus aria* + (11), *Coronilla emerus* subsp. *emerus* + (14), **Fagetalia sylvaticae**: *Anemone trifolia* + (11), *Lathyrus vernus* + (11), *Ranunculus lanuginosus* r (11), *Tilia cordata* /E2a/ r (11), *Tilia cordata* /E1/ + (12), *Fagus sylvatica* /E2/ r (12), *Fagus sylvatica* /E1/ + (12), **Quercu-Fagetea**: *Ulmus minor* + (4), *Pyrus pyraster* + (9), *Listera ovata* + (11), *Corylus avellana* r (12), *Quercus robur* r (12), **Salicetea purpureae**: *Salix eleagnos* /E1/ + (12), *Salix purpurea* /E1/ + (4), **Artemisietea vulgaris**: *Artemisia vulgaris* + (1), *Melilotus albus* r (8), **Other species**: *Mentha* sp. + (15), *Robinia pseudacacia* r (5), **Mosses**: *Homalothecium sericeum* + (2), *Encalypta streptocarpa* + (11)

occurs at a higher frequency, but in modest abundance (mainly +). The decisive factor for the synsystematic classification of the studied stands is therefore the dominant *L. brumatii*, which is characteristic of wet rocks. Based on the available material the most sensible classification of the new association is therefore into the alliance *Cystopteridion fragilis*, order *Potentilletalia caulescentis* and class *Asplenieta trichomanis*, even though no other diagnostic species of the alliance, order and class have been recorded in these stands.



Fig. 6. *Leontodon hispidus* subsp. *brumatii* on temporarily flooded riparian rocks in the Sava valley (central Slovenia) (Photo I. Dakskobler).

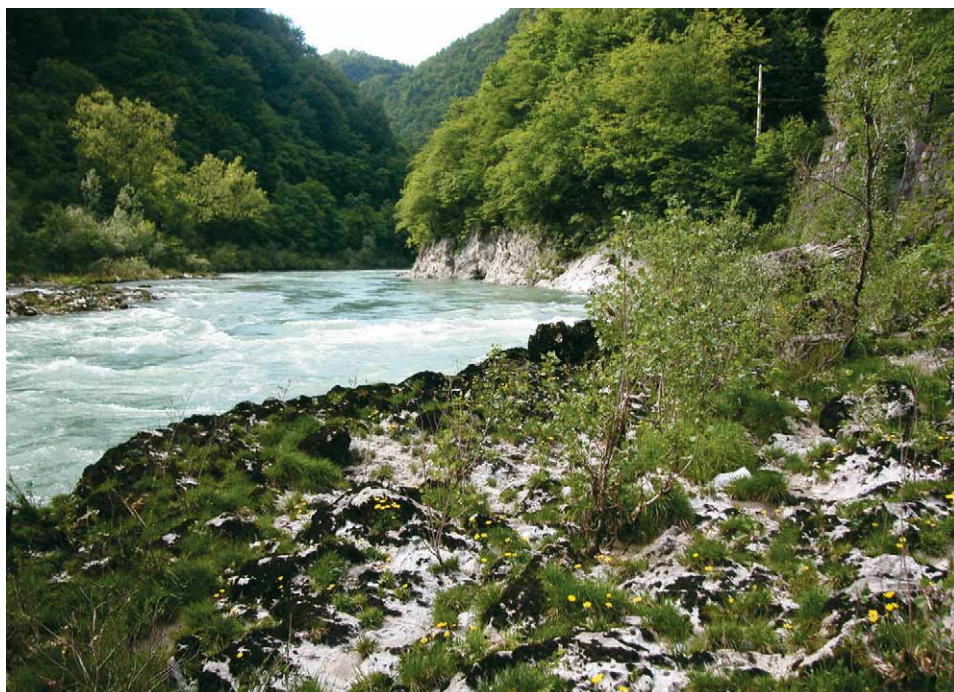


Fig. 7. Typical site (habitat) of the *Trisetum argentei*-*Leontodontetum brumatii* community in the Sava valley (Photo A. Seliškar).

Tab. 3. Synoptic table of the three riparian communities.

Successive number		1	2	3	Successive number		1	2	3
Number of relevé		12	3	10	Number of relevé		12	3	10
Author		DSV	VP	HU	Author		DSV	VP	HU
Sign		TL	RP	RP1	Sign		TL	RP	RP1
<i>Asplenietea trichomanis</i>					<i>Bidens frondosa</i>	E1	.	.	20
<i>Leontodon hispidus</i> subsp. <i>brumatii</i>	E1	100	.	.	<i>Atriplex prostrata</i>	E1	.	.	10
<i>Thlaspietea rotundifolii</i>					<i>Galio-Urticetea</i>				
<i>Trisetum argenteum</i>	E1	42	.	.	<i>Solidago gigantea</i>	E1	83	.	.
<i>Phragmiti-Magnocaricetea</i>					<i>Urtica dioica</i>	E1	8	33	90
<i>Phalaris arundinacea</i>	E1	67	100	100	<i>Glechoma hederacea</i>	E1	.	.	10
<i>Mentha aquatica</i>	E1	17	.	.	<i>Lamium maculatum</i>	E1	.	.	10
<i>Lycopus europaeus</i>	E1	8	100	10	<i>Artemisietea vulgaris</i>				
<i>Veronica anagallis-aquatica</i>	E1	.	66	.	<i>Rumex obtusifolius</i>	E1	42	.	10
<i>Glyceria notata</i>	E1	.	66	.	<i>Artemisia vulgaris</i>	E1	33	.	.
<i>Leersia oryzoides</i>	E1	.	66	.	<i>Erigeron annuus</i>	E1	33	.	.
<i>Rumex hydrolapathum</i>	E1	.	66	.	<i>Euphorbia esula</i>	E1	20	.	.
<i>Veronica becabunga</i>	E1	.	33	.	<i>Tanacetum vulgare</i>	E1	8	.	.
<i>Scrophularia umbrosa</i>	E1	.	33	.	<i>Stellarietea mediae</i>				
<i>Berula erecta</i>	E1	.	33	.	<i>Poa annua</i>	E1	8	.	.
<i>Carex pseudocyperus</i>	E1	.	33	.	<i>Setaria viridis</i>	E1	8	.	.
<i>Iris pseudacorus</i>	E1	.	.	50	<i>Polygonum persicaria</i>	E1	.	33	.
<i>Galium palustre</i>	E1	.	.	30	<i>Galeopsis bifida</i>	E1	.	33	.
<i>Carex acuta</i>	E1	.	.	20	<i>Galium aparine</i>	E1	.	33	30
<i>Glyceria maxima</i>	E1	.	.	20	<i>Cirsium arvense</i>	E1	.	.	40
<i>Poa palustris</i>	E1	.	.	10	<i>Lemnetea minoris</i>				
<i>Filipendulo-Convolvuletea</i>					<i>Lemna minor</i>	E1	.	33	.
<i>Helianthus tuberosus</i>	E1	17	.	.	<i>Potametea pectinati</i>				
<i>Saponaria officinalis</i>	E1	17	.	.	<i>Elodea canadensis</i>	E1	.	33	.
<i>Calystegia sepium</i>	E1	8	.	50	<i>Agropyretea intermedii-repentis</i>				
<i>Lythrum salicaria</i>	E1	8	33	40	<i>Poa compressa</i>	E1	17	.	.
<i>Epilobium hirsutum</i>	E1	.	66	.	<i>Elytrigia repens</i>	E1	.	.	10
<i>Mentha longifolia</i>	E1	.	33	.	<i>Potentillion anserineae</i>				
<i>Myosoton aquaticum</i>	E1	.	33	10	<i>Rorippa sylvestris</i>	E1	42	.	10
<i>Galega officinalis</i>	E1	.	33	.	<i>Barbarea vulgaris</i>	E1	25	66	.
<i>Stachys palustris</i>	E1	.	.	20	<i>Alopecurus geniculatus</i>	E1	.	66	.
<i>Echinocystis lobata</i>	E1	.	.	10	<i>Potentillo-Polygonetalia</i>				
<i>Bidentetea tripartitae</i>					<i>Agrostis stolonifera</i>	E1	42	66	.
<i>Rorippa palustris</i>	E1	8	.	.	<i>Plantago major</i>	E1	25	.	.
<i>Polygonum hydropiper</i>	E1	.	100	30	<i>Rumex crispus</i>	E1	8	.	10
<i>Polygonum lapathifolium</i>	E1	.	33	20	<i>Ranunculus repens</i>	E1	8	.	.
<i>Ranunculus sceleratus</i>	E1	.	33	.					

Tab. 3. – continued

Successive number	1	2	3	Successive number	1	2	3	
Number of relevé	12	3	10	Number of relevé	12	3	10	
Author	DSV	VP	HU	Author	DSV	VP	HU	
Sign	TL	RP	RP1	Sign	TL	RP	RP1	
<i>Molinietalia caeruleae</i>				<i>Alnion incanae</i>				
<i>Myosotis scorpioides</i>	E1	.	100	<i>Rubus caesius</i>	E2	75	.	10
<i>Equisetum palustre</i>	E1	.	.	10	<i>Ulmus laevis</i>	E2	67	.
<i>Scirpus sylvaticus</i>	E1	.	.	10	<i>Alnus glutinosa</i>	E2	17	.
<i>Molinio-Arrhenatheretea</i>				<i>Solanum dulcamara</i>	E1	.	.	20
<i>Deschampsia cespitosa</i>	E1	75	.	<i>Equisetum arvense</i>	E1	.	.	10
<i>Taraxacum officinale</i>	E1	33	.	<i>Humulus lupulus</i>	E1	.	.	10
<i>Trifolium pratense</i>	E1	33	.	<i>Fagetalia sylvaticae</i>				
<i>Plantago lanceolata</i>	E1	33	.	<i>Carpinus betulus</i>	E2	17	.	.
<i>Achillea millefolium</i>	E1	17	.	<i>Fraxinus excelsior</i>	E2	8	.	.
<i>Dactylis glomerata</i> s.str.	E1	17	.	<i>Scrophularia nodosa</i>	E1	8	.	.
<i>Lotus corniculatus</i>	E1	17	.	<i>Quercetalia pubescentis</i>				
<i>Galium mollugo</i>	E1	8	.	<i>Campanula rapunculoides</i>	E1	8	.	.
<i>Ranunculus acris</i>	E1	8	.	<i>Fraxinus ornus</i>	E1	8	.	.
<i>Veronica chamaedrys</i>	E1	8	.	<i>Quercu-Fagetea</i>				
<i>Leucanthemum ircutianum</i>	E1	8	.	<i>Clematis vitalba</i>	E1	8	.	.
<i>Cerastium holosteoides</i>	E1	8	.	<i>Carex digitata</i>	E1	8	.	.
<i>Poa trivialis</i>	E1	.	66	50	<i>Rhamno-Prunetea</i>			
<i>Alopecurus pratensis</i>	E1	.	.	20	<i>Crataegus monogyna</i>	E2	33	.
<i>Symphytum officinale</i>	E1	.	.	20	<i>Rhamnus catharticus</i>	E2	8	.
<i>Lysimachia nummularia</i>	E1	.	.	20	<i>Erico-Pinetea</i>			
<i>Carex hirta</i>	E1	.	.	20	<i>Sesleria caerulea</i> subsp.	E1	33	.
<i>Potentilla anserina</i>	E1	.	.	10	<i>calcaria</i>			
<i>Vicia cracca</i>	E1	.	.	10	<i>Chamaecytisus purpureus</i>	E1	25	.
<i>Festuco-Brometea s. lat.</i>				<i>Calamagrostis varia</i>	E1	8	.	.
<i>Peucedanum oreoselinum</i>	E1	25	.	Other species				
<i>Genista tinctoria</i>	E1	8	.	<i>Fallopia japonica</i>	E1	8	.	.
<i>Petrorhagia saxifraga</i>	E1	8	.	<i>Poa sp.</i>	E1	8	.	.
<i>Inula ensifolia</i>	E1	8	.	<i>Agrostis sp.</i>	E1	8	.	.
<i>Salicetea purpureae</i>				<i>Physocarpus opulifolius</i>	E2	8	.	.
<i>Populus nigra</i>	E2	83	.	<i>Galium rivale</i>	E1	.	.	10
<i>Salix alba</i>	E2	33	.	Mosses				
<i>Salix eleagnos</i>	E2	25	.	<i>Brachythecium rutabulum</i>	E0	100	.	.
<i>Salix purpurea</i>	E2	58	.	<i>Cinclidotus fontinaloides</i>	E0	58	.	.
<i>Salix triandra</i>	E2	8	.	<i>Tortella sp.</i>	E0	67	.	.
<i>Salix fragilis</i>	E2	8	.					

1: *Trisetu-Leontodontetum* – this paper; 2: *Rorippo-Phalaridetum* – Petrinac 1999; 3: *Rorippo-Phalaridetum* – Hrivnák and Ujházy 2003

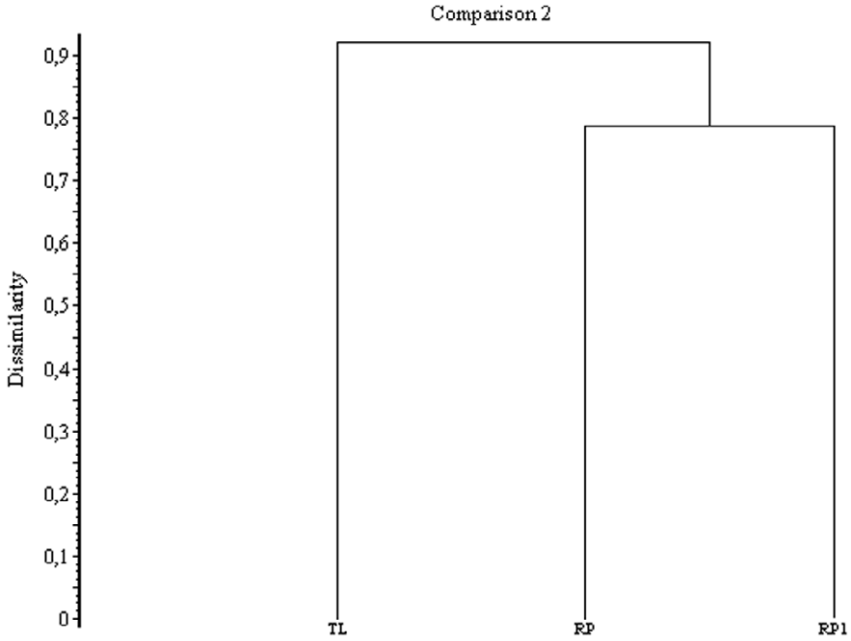


Fig. 8. Dendrogram of the two riparian communities (TL – *Trisetum-Leontodontetum*, RP and RP1 – *Rorippo-Phalaridetum*) – UPGMA, similarity ratio.

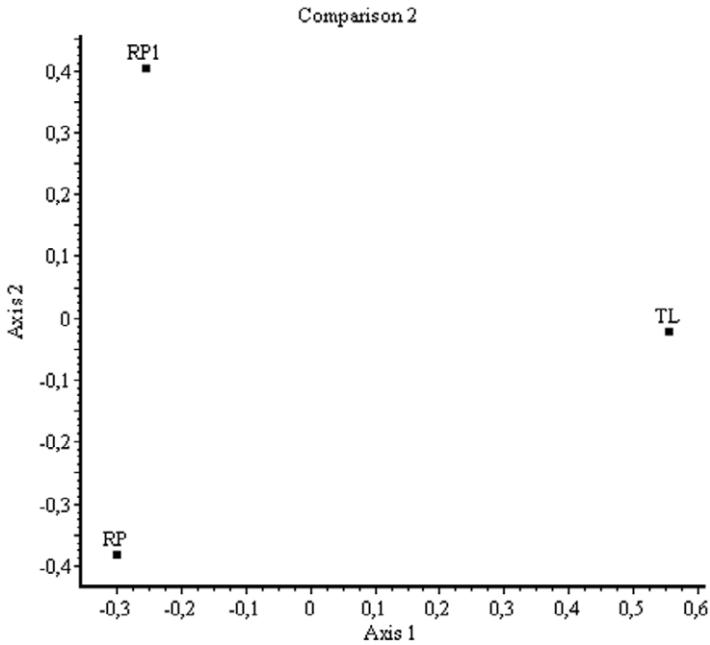


Fig. 9. Two-dimensional scatter-diagram of two riparian communities (TL – *Trisetum-Leontodontetum*, RP and RP1 – *Rorippo-Phalaridetum*) – PCoA, similarity ratio.

Diagnostic species of the new association are *Leontodon brumatii* (dominant species), *Trisetum argenteum* and some riparian mosses of which we established two – *Brachythecium rutabulum* and *Cinclidotus fontinaloides*. *Trisetum argenteum* is a character species of scree communities, especially in the subalpine and alpine belts (AESCHIMANN et al. 2004). It is relatively frequently deposited and preserved on riparian rocks along the central or lower course of Alpine rivers, e.g. in Slovenia along the Soča and the Sava, so it is also a good indicator of the site or community of *L. brumatii* on riparian rocks. The nomenclature type of the new association, *holotypus*, is relevé No. 12 in table 1. The new association is subdivided into three variants: the typical (relevés 2 and 3 in table 1); the variant with *Chamaecytisus purpureus* (the differential species are also *Peucedanum oreoselinum*, *Sesleria caerulea* subsp. *calcaria* and *Inula ensifolia*) – relevés 4 to 6 in table 1 – these stands indicate a possible transition into the community *Leontodonti brumatii-Seslerietum calcariae* described hereinafter, i.e. into the initial riparian grassland; and the variant with *Deschampsia cespitosa* (the differential species is also *Phalaris arundinacea*) – relevés 7 to 13 in table 1. Everywhere sand accumulates in the runnels carved into the rocks or in coarse gravel, conditions are created that facilitate successional development towards riparian willow stands with black poplar, which respond particularly well to sufficient amount of fine particles (BOŽIČ et al. 2008). The stands of this variant therefore indicate potential successional development into the community *Salicetum eleagno-purpureae* var. *Populus nigra*, into which relevés No. 14 and 15 were classified (see DAKSKOBLER 2010). Individual shoots of tree species *Populus nigra*, *Ulmus laevis* and *Salix alba* occur also in other relevés.

Most of the relevés in table 2 (the Soča valley) are classified into the new association *Leontodonti brumatii-Seslerietum calcariae* ass. nov. Its stands characterize the initial stony riparian grassland on undeveloped soil (lithosol). The species composition belongs to very different phytosociological groups (Tab. 4); the largest, some 21 %, is the

Tab. 4. Structure of the association *Leontodonti brumatii-Seslerietum calcariae* according phytosociological groups (in %).

<i>Asplenetia trichomanis</i>	13
<i>Elyno-Seslerietea</i>	10
<i>Festuco-Brometea</i>	21
<i>Molinion caeruleae</i>	1,4
<i>Molinio-Arrhenatheretea</i>	1,4
<i>Scheuchzerio-Caricetea fuscae</i>	0,7
<i>Trifolio-Geranietea</i>	2,5
<i>Thlaspietea rotundifolii</i>	5,1
<i>Erico-Pinetea</i>	21
<i>Vaccinio-Piceetea</i>	0,7
<i>Mulgedio-Aconitetea</i>	2,2
<i>Quercetalia pubescentis</i>	9,5
<i>Fagetalia sylvaticae</i>	2,2
<i>Quercu-Fagetea</i>	4,4
<i>Salicetea purpureae</i>	2,9
<i>Artemisietea vulgaris</i>	0,7
Other species	1,1
Total	100

proportion of species of dry grasslands from the class *Festuco-Brometea* and species of basophilic pine forests from the class *Erico-Pinetea*, followed by chasmophytic species (*Asplenietea trichomanis*), species of subalpine grasslands (*Elyno-Seslerietea*) and thermophilic oak forests (*Quercetalia pubescentis*), which have a proportion of 10 %. Varied species composition also indicates a certain similarity with the communities of thermophilic forest edges from the class *Trifolio-Geranietea*, although it features a small proportion of diagnostic species of this class (2.5 %). In support of the synsystematic classification a synoptic table was made (Tab. 5), into which two riparian meadow communities – *Centaureo dichroanthae-Globularietum cordifoliae* Pignatti 1953 (FEOLI

Tab. 5. Synoptic table of pioneer grassland and fringe vegetation.

Succesive number		1	2	3	4	5
Number of relevé		12	14	9	21	10
Author		DSV	CFP	DZ	GKL	AC
Sign		LS	CG	GB	CP	GP
<i>Asplenietea trichomanis</i>						
<i>Leontodon hispidus</i> subsp. <i>brumatii</i>	E1	100	.	.	.	.
<i>Hieracium porrifolium</i>	E1	75	36	.	.	.
<i>Athamanta turbith</i>	E1	50	.	.	.	.
<i>Saxifraga crustata</i>	E1	33	.	.	.	.
<i>Phyteuma scheuchzeri</i> subsp. <i>columnae</i>	E1	25	.	.	.	.
<i>Asplenium ruta-muraria</i>	E1	8	.	.	.	.
<i>Paederota lutea</i>	E1	8	.	.	.	.
<i>Seseli gouanii</i>	E1	.	43	.	.	.
<i>Dianthus sylvestris</i>	E1	.	7	.	.	10
<i>Silene hayekiana</i>	E1	.	.	33	.	.
<i>Elyno-Seslerietea</i>						
<i>Sesleria caerulea</i> subsp. <i>calcaria</i>	E1	100	86	.	.	.
<i>Aster bellidiastrum</i>	E1	67	7	.	.	.
<i>Globularia cordifolia</i>	E1	25	100	33	.	.
<i>Rhinanthus aristatus</i>	E1	25	14	11	.	.
<i>Erigeron glabratus</i>	E1	8	.	.	.	.
<i>Phyteuma orbiculare</i>	E1	8	.	.	.	.
<i>Carex mucronata</i>	E1	.	93	.	.	.
<i>Helianthemum alpestre</i>	E1	.	36	.	.	.
<i>Dryas octopetala</i>	E1	.	14	.	.	.
<i>Gentiana clusii</i>	E1	.	7	.	.	.
<i>Carlina acaulis</i> s. lat.	E1	.	7	89	.	20
<i>Helianthemum nummularium</i> subsp. <i>grandiflorum</i>	E1	.	.	89	.	.
<i>Ranunculus carinthiacus</i>	E1	.	.	56	.	.
<i>Betonica alopecuroides</i>	E1	.	.	44	.	.
<i>Galium anisophyllum</i>	E1	.	.	33	.	.
<i>Alchemilla glaucescens</i>	E1	.	.	22	.	.
<i>Gentiana verna</i>	E1	.	.	11	.	.

Tab. 5. – continued

Succesive number	1	2	3	4	5	
Number of relevé	12	14	9	21	10	
Author	DSV	CFP	DZ	GKL	AC	
Sign	LS	CG	GB	CP	GP	
<i>Hieracium valdepilosum</i>	E1	.	11	.	.	
<i>Hieracium villosum</i>	E1	.	11	.	.	
<i>Festuca calva</i>	E1	.	11	.	.	
<i>Phyteuma orbiculare</i>	E1	.	11	.	.	
<i>Festuco-Brometea</i>						
<i>Carex humilis</i>	E1	58	86	11	70	10
<i>Centaurea scabiosa</i> (inc. subsp. <i>fritschii</i>)	E1	58	.	44	10	70
<i>Genista tinctoria</i>	E1	58	.	11	10	10
<i>Peucedanum oreoselinum</i>	E1	42	93	56	70	60
<i>Inula ensifolia</i>	E1	33	86	.	.	10
<i>Euphorbia cyparissias</i>	E1	33	21	44	50	90
<i>Satureja montana</i> subsp. <i>variegata</i>	E1	25	14	.	10	.
<i>Stachys recta</i>	E1	25	.	.	30	50
<i>Bupthalmum salicifolium</i>	E1	25	7	.	50	80
<i>Bromopsis erecta</i>	E1	17	.	100	50	30
<i>Inula hirta</i>	E1	17	.	.	50	10
<i>Ononis spinosa</i>	E1	17	.	22	.	.
<i>Medicago falcata</i>	E1	17	.	.	40	10
<i>Gymnadenia conopsea</i>	E1	17	29	78	10	.
<i>Koeleria pyramidata</i>	E1	8	.	100	30	40
<i>Thymus praecox</i> s. lat.	E1	8	7	78	10	50
<i>Salvia pratensis</i>	E1	8	.	78	30	70
<i>Trifolium montanum</i>	E1	8	.	56	50	20
<i>Allium carinatum</i> s. lat.	E1	7	.	44	.	30
<i>Centaurea dichroantha</i>	E1	.	100	.	.	.
<i>Teucrium montanum</i>	E1	.	93	11	10	10
<i>Fumana procumbens</i>	E1	.	93	.	.	.
<i>Stipa eriocaulis</i>	E1	.	93	.	10	.
<i>Galium lucidum</i>	E1	.	93	.	30	.
<i>Plantago holostium</i>	E1	.	86	67	.	.
<i>Thesium divaricatum</i>	E1	.	71	.	.	.
<i>Bromopsis condensata</i>	E1	.	71	.	.	.
<i>Genista sericea</i>	E1	.	64	.	.	.
<i>Thymus longicaulis</i>	E1	.	64	.	.	.
<i>Chrysopogon gryllus</i>	E1	.	64	.	10	10
<i>Helianthemum nummularium</i> subsp. <i>obscurum</i>	E1	.	64	.	10	40
<i>Scorzonera austriaca</i>	E1	.	57	.	50	.
<i>Linum tenuifolium</i>	E1	.	50	.	.	.
<i>Cytisus pseudoprocumbens</i>	E1	.	50	.	.	.
<i>Potentilla australis</i>	E1	.	43	.	.	.
<i>Leontodon crispus</i>	E1	.	43	.	10	.

Tab. 5. – continued

Succesive number	1	2	3	4	5	
Number of relevé	12	14	9	21	10	
Author	DSV	CFP	DZ	GKL	AC	
Sign	LS	CG	GB	CP	GP	
<i>Asperula cynanchica</i>	E1	.	43	22	10	70
<i>Orchis morio</i>	E1	.	43	.	.	.
<i>Scabiosa graminifolia</i>	E1	.	36	.	.	.
<i>Dianthus monspessulanus</i>	E1	.	36	.	10	10
<i>Hippocrepis comosa</i>	E1	.	36	78	10	.
<i>Teucrium chamaedrys</i>	E1	.	29	.	30	90
<i>Plantago argeneta</i>	E1	.	21	33	30	.
<i>Sanguisorba muricata</i> (inc. <i>S. minor</i>)	E1	.	21	100	10	40
<i>Galium verum</i>	E1	.	21	89	.	80
<i>Carex liparocarpos</i>	E1	.	14	.	.	.
<i>Asperula purpurea</i>	E1	.	14	.	.	.
<i>Scabiosa triandra</i>	E1	.	14	67	.	40
<i>Festuca rupiciola</i> (inc. <i>F. pseudovina</i> , <i>F. ovina</i> agg.)	E1	.	14	100	30	50
<i>Anacamptys pyramidalis</i>	E1	.	14	.	.	.
<i>Carex caryophyllea</i>	E1	.	14	78	.	.
<i>Hypochoeris maculata</i>	E1	.	14	.	.	10
<i>Globularia elongata</i>	E1	.	14	.	.	.
<i>Allium senescens</i>	E1	.	14	11	.	.
<i>Botriochloa ishaemum</i>	E1	.	7	.	.	.
<i>Ophrys apifera</i>	E1	.	7	.	.	.
<i>Centaurea bracteata</i> (<i>C. gaudinii</i>)	E1	.	7	.	.	.
<i>Betonica serotina</i>	E1	.	7	.	.	.
<i>Gentianella pilosa</i>	E1	.	7	56	.	.
<i>Hieracium pilosella</i>	E1	.	7	11	10	.
<i>Brachypodium rupestre</i>	E1	.	.	100	70	80
<i>Pimpinella saxifraga</i>	E1	.	.	100	30	60
<i>Plantago media</i>	E1	.	.	100	10	30
<i>Prunella grandiflora</i>	E1	.	.	89	10	20
<i>Briza media</i>	E1	.	.	89	30	30
<i>Medicago lupulina</i>	E1	.	.	89	10	20
<i>Polygala comosa</i>	E1	.	.	89	.	.
<i>Silene vulgaris</i> subsp. <i>vulgaris</i>	E1	.	.	89	.	20
<i>Orchis ustulata</i>	E1	.	.	89	.	.
<i>Campanula rotundifolia</i>	E1	.	.	79	.	.
<i>Campanula glomerata</i>	E1	.	.	78	.	.
<i>Orchis militaris</i>	E1	.	.	67	.	.
<i>Linum catharticum</i>	E1	.	.	56	.	20
<i>Ranunculus bulbosus</i>	E1	.	.	44	.	.
<i>Euphrasia stricta</i>	E1	.	.	22	.	.
<i>Potentilla pusilla</i>	E1	.	.	11	.	.
<i>Arabis hirsuta</i>	E1	.	.	11	.	.

Tab. 5. – continued

Successive number	1	2	3	4	5	
Number of relevé	12	14	9	21	10	
Author	DSV	CFP	DZ	GKL	AC	
Sign	LS	CG	GB	CP	GP	
<i>Astragalus onobrychis</i>	E1	.	.	11	.	.
<i>Cuscuta epithimum</i>	E1	.	.	11	.	10
<i>Carlina vulgaris</i>	E1	.	.	11	.	.
<i>Filipendula vulgaris</i>	E1	.	.	11	70	60
<i>Orobanche gracilis</i>	E1	.	.	11	.	.
<i>Gentianella ciliata</i>	E1	.	.	11	.	.
<i>Rhinanthus freynii</i>	E1	.	.	11	.	.
<i>Hypochoeris maculata</i>	E1	.	.	11	30	10
<i>Cirsium pannonicum</i>	E1	.	.	.	70	30
<i>Euphorbia verrucosa</i>	E1	.	.	.	70	30
<i>Knautia illyrica</i>	E1	.	.	.	50	.
<i>Dorycnium germanicum</i>	E1	.	.	.	50	60
<i>Vicia tenuifolia</i>	E1	.	.	.	30	.
<i>Genista sylvestris</i>	E1	.	.	.	30	.
<i>Centaurea rupestris</i>	E1	.	.	.	30	.
<i>Scorzonera villosa</i>	E1	.	.	.	30	.
<i>Veronica barrelieri</i>	E1	.	.	.	10	.
<i>Euphorbia nicaeensis</i>	E1	.	.	.	10	.
<i>Thesium linophyllum</i>	E1	.	.	.	10	.
<i>Pulsatilla montana</i>	E1	.	.	.	10	.
<i>Lychnis viscaria</i>	E1	.	.	.	.	60
<i>Scabiosa hladnikiana</i>	E1	.	.	.	.	30
<i>Prunella laciniata</i>	E1	.	.	.	.	20
<i>Cuscuta epithimum</i>	E1	.	.	.	.	20
<i>Ornithogalum sphaerocarpum</i>	E1	.	.	.	.	20
<i>Anthyllis vulneraria</i>	E1	.	.	.	.	10
<i>Thero-Brachypodietea</i>						
<i>Koeleria lobata</i>	E1	.	100	.	.	.
<i>Artemisia alba</i>	E1	.	29	.	.	.
<i>Eryngium amethystinum</i>	E1	.	21	.	.	10
<i>Campanula sibirica</i>	E1	.	21	.	.	.
<i>Medicago prostrata</i>	E1	.	7	.	.	.
<i>Melica ciliata</i>	E1	.	7	.	.	.
<i>Koelerio-Corynephoretea</i>						
<i>Cardaminopsis arenosa</i>	E1	.	.	33	.	.
<i>Sedum sexangulare</i>	E1	.	.	22	.	.
<i>Cerastium brachypetalum</i>	E1	.	.	22	.	.
<i>Petrorhagia saxifraga</i>	E1	.	.	11	.	.
<i>Molinion caeruleae</i>						
<i>Laserpitium prutenicum</i>	E1	33	.	.	.	.
<i>Molinia caerulea</i> subsp. <i>caerulea</i>	E1	.	.	11	.	.

Tab. 5. – continued

Successive number	1	2	3	4	5	
Number of relevé	12	14	9	21	10	
Author	DSV	CFP	DZ	GKL	AC	
Sign	LS	CG	GB	CP	GP	
<i>Carex distans</i>	E1	.	11	.	.	
<i>Carex tomentosa</i>	E1	.	11	.	.	
<i>Sanguisorba officinalis</i>	E1	.	11	.	.	
<i>Herminium monorchis</i>	E1	.	11	.	.	
<i>Inula salicina</i>	E1	.	.	10	20	
<i>Selinum carvifolia</i>	E1	.	.	.	10	
<i>Molinio-Arrhenatheretea</i>						
<i>Taraxacum officinale</i>	E1	25	.	.	.	
<i>Lotus corniculatus</i> agg.	E1	8	29	89	50	30
<i>Dactylis glomerata</i>	E1	.	29	89	10	80
<i>Senecio jacobea</i>	E1	.	14	.	10	.
<i>Leontodon hispidus</i> subsp. <i>hispidus</i>	E1	.	.	100	.	10
<i>Trifolium pratense</i>	E1	.	.	89	.	.
<i>Centaurea jacea</i>	E1	.	.	78	10	70
<i>Achillea millefolium</i>	E1	.	.	78	.	50
<i>Galium mollugo</i> (inc. <i>G. album</i>)	E1	.	.	78	.	30
<i>Helictotrichon pubescens</i>	E1	.	.	78	.	.
<i>Prunella vulgaris</i>	E1	.	.	78	.	.
<i>Rhinanthus minor</i>	E1	.	.	67	.	10
<i>Trifolium repens</i>	E1	.	.	67	.	.
<i>Vicia cracca</i>	E1	.	.	67	.	.
<i>Leucanthemum ircutianum</i> (inc. <i>L. vulgare</i>)	E1	.	.	67	10	30
<i>Plantago lanceolata</i>	E1	.	.	56	.	.
<i>Orchis coriophora</i> subsp. <i>coriophora</i>	E1	.	.	56	.	.
<i>Ranunculus acris</i>	E1	.	.	44	.	.
<i>Euphrasia rostkoviana</i>	E1	.	.	44	.	.
<i>Lathyrus pratensis</i>	E1	.	.	44	10	40
<i>Leontodon autumnalis</i>	E1	.	.	44	.	.
<i>Tragopogon pratensis</i>	E1	.	.	44	.	10
<i>Ranunculus nemorosus</i>	E1	.	.	33	.	.
<i>Rumex acetosa</i>	E1	.	.	33	.	.
<i>Luzula campestris</i>	E1	.	.	33	.	.
<i>Festuca pratensis</i>	E1	.	.	22	.	.
<i>Achillea roseoalba</i>	E1	.	.	22	.	.
<i>Carex hirta</i>	E1	.	.	11	.	.
<i>Trifolium campestre</i>	E1	.	.	11	.	.
<i>Knautia arvensis</i>	E1	.	.	11	.	30
<i>Festuca arundinacea</i>	E1	.	.	11	.	.
<i>Heracleum sphondylium</i>	E1	.	.	11	.	.
<i>Pimpinella major</i>	E1	.	.	11	.	.
<i>Allium scorodoprasum</i>	E1	.	.	11	.	.

Tab. 5. – continued

Succesive number	1	2	3	4	5
Number of relevé	12	14	9	21	10
Author	DSV	CFP	DZ	GKL	AC
Sign	LS	CG	GB	CP	GP
<i>Stellaria graminea</i>	E1	.	11	.	.
<i>Bromus hordeaceus</i>	E1	.	11	.	.
<i>Veronica chamaedrys</i>	E1	.	.	10	20
<i>Arrhenatherum elatius</i>	E1	.	.	10	.
<i>Knautia arvensis</i>	E1	.	.	.	30
<i>Festuca rubra</i>	E1	.	.	.	30
<i>Poa angustifolia</i>	E1	.	.	.	20
<i>Rumex acetosa</i>	E1	.	.	.	10
<i>Trisetum flavescens</i>	E1	.	.	.	10
Calluno-Ulicetea					
<i>Potentilla erecta</i>	E1	.	78	.	10
<i>Chamaecytisus supinus</i>	E1	.	.	30	.
<i>Chamaespartium sagittale</i>	E1	.	.	10	.
<i>Genista germanica</i>	E1	.	.	.	10
<i>Polygala vulgaris</i>	E1	.	.	.	10
Scheuchzerio-Caricetea fuscae					
<i>Parnassia palustris</i>	E1	17	33	.	.
<i>Schoenus nigricans</i>	E1	.	79	.	.
<i>Carex panicea</i>	E1	.	11	.	.
Trifolio-Geranietea					
<i>Peucedanum cervaria</i>	E1	42	.	100	100
<i>Vincetoxicum hirundinaria</i>	E1	8	7	22	30
<i>Lilium bulbiferum</i>	E1	8	.	.	.
<i>Anthericum ramosum</i>	E1	.	43	50	80
<i>Silene nutans</i>	E1	.	89	30	30
<i>Thalictrum minus</i>	E1	.	33	70	40
<i>Valeriana collina</i>	E1	.	11	.	10
<i>Ferulago galbanifera</i>	E1	.	.	90	.
<i>Dictamnus albus</i>	E1	.	.	70	.
<i>Iris illyrica</i>	E1	.	.	50	.
<i>Geranium sanguineum</i>	E1	.	.	50	70
<i>Polygonatum odoratum</i>	E1	.	.	50	10
<i>Paeonia officinalis</i>	E1	.	.	30	.
<i>Trifolium alpestre</i>	E1	.	.	30	.
<i>Viola hirta</i>	E1	.	.	30	70
<i>Trifolium rubens</i>	E1	.	.	30	50
<i>Coronilla coronata</i>	E1	.	.	20	.
<i>Trifolium medium</i>	E1	.	.	10	20
<i>Ruta divaricata</i>	E1	.	.	10	.
<i>Verbascum austriacum</i>	E1	.	.	10	.
<i>Lathyrus latifolius</i>	E1	.	.	10	.

Tab. 5. – continued

Successive number		1	2	3	4	5
Number of relevé		12	14	9	21	10
Author		DSV	CFP	DZ	GKL	AC
Sign		LS	CG	GB	CP	GP
<i>Lilium bulbiferum</i>	E1	.	.	.	10	.
<i>Hypericum perforatum</i>	E1	.	.	.	10	.
<i>Potentilla recta</i>	E1	.	.	.	10	.
<i>Origanum vulgare</i>	E1	.	.	.	.	70
<i>Clinopodium vulgare</i>	E1	.	.	.	.	50
<i>Coronilla varia</i>	E1	.	.	.	.	20
<i>Rosa gallica</i>	E1	.	.	.	.	20
<i>Veronica jacquinii</i>	E1	.	.	.	.	10
<i>Melampyrum nemorosum</i>	E1	.	.	.	.	10
<i>Dianthus barbatus</i>	E1	.	.	.	.	10
<i>Inula conyza</i>	E1	.	.	.	.	10
<i>Veronica teucrium</i>	E1	.	.	.	.	10
<i>Lathyrus sylvestris</i>	E1	.	.	.	.	10
<i>Vicia tenuifolia</i>	E1	.	.	.	.	10
<i>Thlaspietea rotundifolii</i>						
<i>Petasites paradoxus</i>	E1	33	7	22	.	.
<i>Campanula cespitosa</i>	E1	25	14	.	.	.
<i>Peucedanum verticillare</i>	E1	17	.	.	.	.
<i>Biscutella laevigata</i>	E1	17	50	78	.	.
<i>Achnatherum calamagrostis</i>	E1	8	14	.	.	.
<i>Trisetum argenteum</i>	E1	8	.	.	.	.
<i>Silene vulgaris</i> subsp. <i>glareosa</i>	E1	8	7	.	.	.
<i>Euphorbia triflora</i> subsp. <i>kernerii</i>	E1	.	93	.	.	.
<i>Gypsophila repens</i>	E1	.	79	.	.	.
<i>Trinia glauca</i>	E1	.	71	.	.	.
<i>Matthiola carnica</i>	E1	.	57	.	.	.
<i>Hieracium piloselloides</i>	E1	.	50	22	.	.
<i>Brassica glabrescens</i>	E1	.	36	.	.	.
<i>Crambe tataria</i>	E1	.	36	.	.	.
<i>Reseda lutea</i>	E1	.	21	.	.	.
<i>Diplotaxis tenuifolia</i>	E1	.	21	.	.	.
<i>Euphrasia cuspidata</i>	E1	.	14	.	.	.
<i>Rumex scutatus</i>	E1	.	7	.	.	.
<i>Rumex scutatus</i>	E1	.	.	33	.	.
<i>Hieracium glaucum</i>	E1	.	.	11	.	.
<i>Dianthus sternbergii</i>	E1	.	.	11	.	.
<i>Erico-Pinetea</i>						
<i>Calamagrostis varia</i>	E1	83	.	11	10	10
<i>Chamaecytisus purpureus</i>	E1	67	57	11	.	.
<i>Allium ericetorum</i>	E1	50	7	.	.	.
<i>Erica carnea</i>	E1	42	93	.	.	20

Tab. 5. – continued

Successive number		1	2	3	4	5
Number of relevé		12	14	9	21	10
Author		DSV	CFP	DZ	GKL	AC
Sign		LS	CG	GB	CP	GP
<i>Aster amellus</i>	E1	50	.	11	.	10
<i>Leontodon incanus</i>	E1	42	7	.	.	.
<i>Carex ornithopoda</i>	E1	33	.	.	.	.
<i>Epipactis atrorubens</i>	E1	25	.	11	.	.
<i>Pinus nigra</i>	E2	25	.	.	.	.
<i>Polygala chamaebuxus</i>	E1	25	7	.	.	.
<i>Chamaecytisus hirsutus</i>	E2	17	.	.	.	20
<i>Molinia caerulea</i> subsp. <i>arundinacea</i>	E1	8	7	11	30	.
<i>Pinus sylvestris</i>	E2	8	.	.	.	.
<i>Polygala nicaeensis</i> subsp. <i>forojulensis</i>	E1	.	43	11	10	.
<i>Daphne cneorum</i>	E1	.	14	.	.	.
<i>Genista januensis</i>	E1	.	.	.	.	10
Vaccinio-Piceetea						
<i>Solidago virgaurea</i>	E1	8	.	.	10	60
<i>Picea abies</i>	E2a	8	.	11	.	.
Mulgedio-Aconitetea						
<i>Salix appendiculata</i>	E2a	50	.	.	.	.
Rhamno-Prunetea						
<i>Cornus sanguinea</i>	E1	.	.	.	30	.
<i>Prunus mahaleb</i>	E1	.	.	.	20	.
<i>Crataegus monogyna</i>	E1	.	.	.	10	.
<i>Rhamnus rupestris</i>	E1	.	.	.	10	.
<i>Prunus spinosa</i>	E1	.	.	.	10	.
<i>Rosa canina</i>	E1	.	.	.	10	.
<i>Rubus fruticosus</i> agg.	E1	.	.	.	.	10
Quercetalia pubescentis						
<i>Fraxinus ornus</i>	E2a	75	7	.	30	.
<i>Ostrya carpinifolia</i>	E2a	33	7	.	10	30
<i>Lembotropis nigricans</i>	E1	25	.	.	10	20
<i>Carex flacca</i>	E1	25	.	22	.	70
<i>Campanula rapunculoides</i>	E1	17	.	.	10	20
<i>Clematis recta</i>	E1	17	7	.	.	10
<i>Coronilla emerus</i> subsp. <i>emeroides</i>	E1	8	.	.	.	.
<i>Sorbus aria</i>	E2a	8	.	.	10	.
<i>Coronilla emerus</i> subsp. <i>emerus</i>	E2a	8	.	.	.	.
<i>Primula veris</i> subsp. <i>columnae</i>	E1	.	.	89	.	.
<i>Helleborus multifidus</i> subsp. <i>istriacus</i>	E1	.	.	.	50	.
<i>Sesleria autumnalis</i>	E1	.	.	.	30	.
<i>Mercurialis ovata</i>	E1	.	.	.	30	.
<i>Melittis melissophyllum</i>	E1	.	.	.	30	40
<i>Lathyrus niger</i>	E1	.	.	.	20	10

Tab. 5. – continued

Successive number	1	2	3	4	5
Number of relevé	12	14	9	21	10
Author	DSV	CFP	DZ	GKL	AC
Sign	LS	CG	GB	CP	GP
<i>Cnidium silaifolium</i>	E1	.	.	10	.
<i>Quercus pubescens</i>	E1	.	.	10	.
<i>Hypericum montanum</i>	E1	.	.	10	20
<i>Tanacetum corymbosum</i>	E1	.	.	.	20
<i>Buglossoides purpureoerulea</i>	E1	.	.	.	20
<i>Campanula persicifolia</i>	E1	.	.	.	10
<i>Quercus cerris</i>	E1	.	.	.	10
<i>Calamintha menthifolia</i>	E1	.	.	.	10
Fagetalia sylvaticae					
<i>Tilia cordata</i>	E2	17	.	.	.
<i>Anemone trifolia</i>	E1	8	.	.	.
<i>Lathyrus vernus</i>	E1	8	.	.	.
<i>Ranunculus lanuginosus</i>	E1	8	.	.	.
<i>Fagus sylvatica</i>	E2	8	.	.	.
<i>Knautia drymeia</i>	E1	.	11	.	30
<i>Cyclamen purpurascens</i>	E1	.	.	10	.
<i>Salvia glutinosa</i>	E1	.	.	.	20
Quercus-Fagetea					
<i>Clematis vitalba</i>	E2	42	.	10	10
<i>Carex digitata</i>	E1	17	.	.	.
<i>Ulmus minor</i>	E1	8	.	.	.
<i>Pyrus pyraeaster</i>	E2	8	.	.	.
<i>Listera ovata</i>	E1	8	11	.	.
<i>Corylus avellana</i>	E1	8	.	20	.
<i>Quercus robur</i>	E1	8	.	.	.
<i>Cruciata glabra</i>	E1	.	67	.	20
<i>Potentilla alba</i>	E1	.	.	70	.
<i>Betonica officinalis</i>	E1	.	.	70	70
<i>Serratula tinctoria</i>	E1	.	.	30	30
<i>Hepatica nobilis</i>	E1	.	.	10	.
<i>Carex montana</i>	E1	.	.	10	.
<i>Helleborus odorus</i>	E1	.	.	.	30
<i>Festuca heterophylla</i>	E1	.	.	.	20
<i>Hieracium racemosum</i>	E1	.	.	.	10
<i>Pteridium aquilinum</i>	E1	.	.	.	10
<i>Hedera helix</i>	E1	.	.	.	10
Salicetea purpureae					
<i>Salix eleagnos</i>	E2	25	7	.	.
<i>Salix purpurea</i>	E2	25	.	.	.
<i>Populus nigra</i>	E2	17	.	.	.

Tab. 5. – continued

Successive number	1	2	3	4	5
Number of relevé	12	14	9	21	10
Author	DSV	CFP	DZ	GKL	AC
Sign	LS	CG	GB	CP	GP
Artemisietea vulgaris					
<i>Erigeron annuus</i>	E1	8	.	.	.
<i>Melilotus albus</i>	E1	8	.	.	.
Other species					
<i>Festuca</i> sp.	E1	8	.	.	.
<i>Mentha</i> sp.	E1	8	.	.	.
<i>Robinia pseudacacia</i>	E1	8	.	.	.
<i>Phalaris arundinacea</i>	E1	.	.	11	.
<i>Salix cinerea</i>	E1	.	.	11	.
<i>Fragaria vesca</i>	E1	.	.	.	80
<i>Verbascum nigrum</i>	E1	.	.	.	30
<i>Geranium phaeum</i>	E1	.	.	.	20
<i>Juniperus communis</i>	E1	.	.	.	30

1: *Leontodonti-Seslerietum calcariae*, this paper

2: *Centaureo dichroanthae-Globularietum cordifoliae*, Feoli Chiapella and Poldini 1993

3: *Gentianello pilosae-Brometum erecti*, Daksobler and Završnik 2009

4: *Cirsio-Peucedanetum cervariae*, van Gils, Keyzers and Launsbach 1975

5: *Geranio-Peucedanetum cervariae*, Čarni 1998

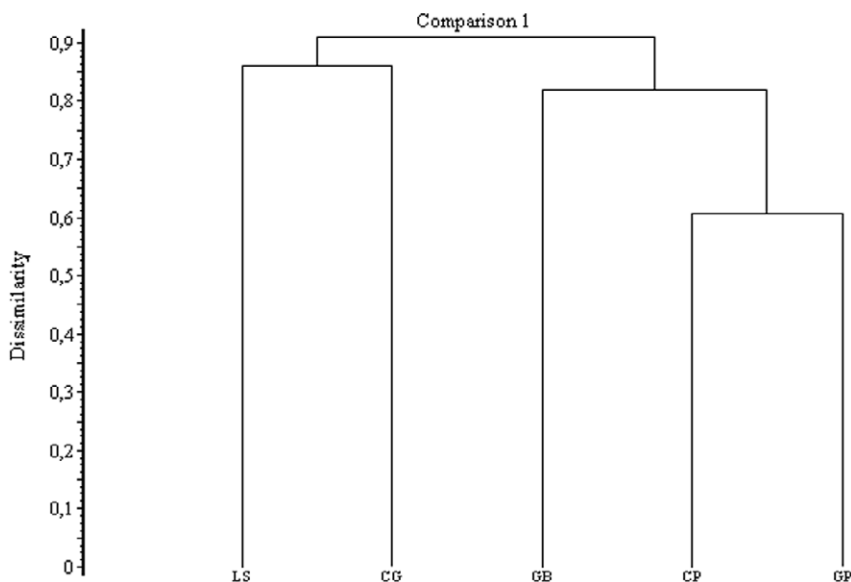


Fig. 10. Dendrogram of pioneer grassland and fringe vegetation (LS – *Leontodonti-Seslerietum calcariae*, CG – *Centaureo dichroanthae-Globularietum cordifoliae*, GB – *Gentianello pilosae-Brometum erecti*, CP – *Cirsio pannonicae-Peucedanetum cervariae*, GP – *Geranio-Peucedanetum cervariae*) – UPGMA, similarity ratio.

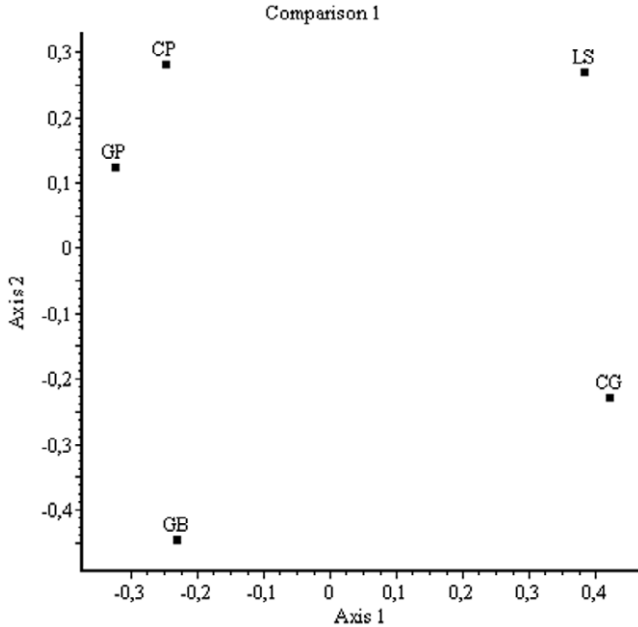


Fig. 11. Two-dimensional scatter-diagram of pioneer grassland and fringe vegetation (LS – *Leontodonti-Seslerietum calcariae*, CG – *Centaureo dichroanthae-Globularietum cordifoliae*, GB – *Gentianello pilosae-Brometum erecti*, CP – *Cirsio pannonicae-Peucedanetum cervariae*, GP – *Geranio-Peucedanetum cervariae*) – PCoA, similarity ratio.

CHIAPELLA and POLDINI 1993), *Gentianello pilosae-Brometum erecti* Dakskobler et Završnik 2009 (DAKSKOBLER and ZAVRŠNIK 2009), and two thermophilic forest edge communities – *Cirsio pannonicae-Peucedanetum cervariae* van Gils et al. 1975 (van GILS et al. 1975) and *Geranio-Peucedanetum cervariae* (KUHN 1937) T. Müller 1961 var. geogr. *Knautia drymeia* Čarni 1998 (ČARNI 1998) were ranged and compared using numerical methods. The results (Figs. 10, 11) clearly demonstrate that our stands are the most similar to the initial grassland on gravel sites of mountain rivers and streams in the foothills of the Southeastern Alps (association *Centaureo dichroanthae-Globularietum cordifoliae*) and are considerably different from thermophilic forest edge communities. Their floristic composition is also clearly different from riparian stands of the association *Gentianello pilosae-Brometum erecti*. This community is much more species-rich and grows on more developed soils, rendzinas. The stands of the association *Leontodonti brumatii-Seslerietum calcariae* are a successional stage in the afforestation of riparian rocks towards scrub and forest communities (*Seslerio albicantis-Ostryetum*, *Ostryo-Fagetum*). In addition to some meadow species they are mainly characterized by diagnostic species or rock crevices, screes and basophilic pine forests. Diagnostic species of the new association are *Leontodon hispidus* subsp. *brumatii*, *Sesleria caerulea* subsp. *calcaria*, *Calamagrostis varia*, *Hieracium porrifolium*, *Aster bellidiastrum* and *Athamanta turbith*. The holotypus of the new association is relevé No. 7 in table 2. The new association is classified as an explicitly fringe association (non-typical; with its species composition it is close also to the classes *Elyno-Seslerietea*, *Thlapietea rotundifolii* and *Asplenieta trichomanis*), into the Illyrian-pre-Alpine

suballiance *Centaureion dichroanthae*, into the alliance *Saturejion subspicatae*, order *Scorzonero-Chrysopogonetalia* and class *Festuco-Brometea*. It is subdivided into two subassociations. The differential species of the subassociation *Leontodonti-Seslerietum chamaecytisetum purpureae* subass. nov. are *Chamaecytisus purpureus*, *Carex humilis*, *Allium ericetorum*, *Centaurea scabiosa* subsp. *fritschii* and *Inula ensifolia*. Its nomenclatural type is the *holotypus* of the association (relevé No. 7 in table 2); its sites are limestone riparian rocks. It is still flooded when the water level is high, but soil has already started accumulating in the runnels, which allows for a progressive development of the vegetation. The differential species of the subassociation *Leontodonti-Seslerietum saxifragetum crustatae* subass. nov. are *Saxifraga crustata*, *Erica carnea*, *Laserpitium prutenicum*, *Campanula cespitosa*, *Petasites paradoxus* and *Stachys recta*. The nomenclatural type, *holotypus*, is relevé No.13 in table 2. The sites of this subassociation are steep, gravelly, erosion slopes on platy limestone with addition of chert on the northeastern slopes of Bučenica, some ten metres above the Soča between Tolmin and Most na Soči. The species composition indicates the development from a scree community through stony grassland into a thermophilic forest (*Ostryo-Fagetum*). The first three relevés in table 2 could not be classified into the new association. The floristic composition of relevé No. 1 in table 2 (rocky eyot in the Idrijca at Slap ob Idrijci) shows some similarities with the stands of the association *Trisetum-Leontodontetum*, while relevés 2 and 3 in the same table represent a chasmophytic community, for the time being synsystematically still undefined, at the road cut between Podsela and Dobljar, dominated by *Athamanta turbith*, *Campanula carnica* and *C. pyramidalis*.

Discussion

The new localities of the southeastern-Alpine endemic *Leontodon hispidus* subsp. *brumatii* in the Sava valley (central Slovenia, the Black Sea river basin), in the gorge of the Sava between the village of Sava and Zidani Most, are rather surprising, because so far this taxon was known in Slovenia only in the Soča basin (on riparian rocks along the Soča, Nadiža, Učja, Idrija and Idrijca), which belongs the Adriatic Sea river basin, but not along other Alpine rivers. Nevertheless, the new localities are situated in the region where quite a few species with predominantly Alpine distribution grow (e.g. *Rhododendron hirsutum*, *Paederota lutea*, *Pinguicula alpina*, *Rosa pendulina*, *Cerastium subtriflorum*, *Tephroseris pseudocrispa*, *Aster bellidiastrum*, *Campanula carnica*, *C. cespitosa*, *Trisetum argenteum*, *Arabis alpina* subsp. *alpina*, *Astrantia carniolica*, *Acinos alpinus*, *Aconitum degenii* subsp. *paniculatum*, *Tofieldia calyculata*, *Myrrhis odorata* – the latter is mentioned by PETKOVŠEK 1939). The flora of the Sava valley also comprises some species that most frequently occur in the Soča valley, but are usually much rarer in other landscape regions of Slovenia. Such species are for example *Saxifraga petraea*, *Veratrum nigrum*, *Hemerocallis lilioasphodelus*, *Spiraea chamaedryfolia*. There are also some similarities between the forest communities of valuable broad-leaved species (e.g. the probable occurrence of the stands of two associations described in the Soča valley, *Veratro nigri-Fraxinetum* and *Saxifraga petraeae-Tilietum*, also in the Sava valley). It is also likely that the taxon *L. brumatii* occurs on suitable sites elsewhere in the Sava basin (and other Slovenian Alpine rivers), but has been overlooked. Riparian sites are usually difficult to access and are therefore not the subject of a more detailed floristic inventory. The established differences in the communities

of *L. brumatii* between the Soča and the Sava valleys do not rule out the possibility that the stands of the association *Triseti-Leontodontetum* that was described in the Sava valley occur also in the Soča valley (which is very likely, because the sites in the Soča valley comprise a higher number of this endemic than those in the Sava valley). Similarly, the occurrence of the stands of the association *Leontodonti-Seslerietum* described in the Soča valley, is likely also in the Sava valley (already demonstrated in one of the relevés). Both newly described associations include phytocoenoses that are usually distributed in smaller areas and are more or less long-term successional stages. These are by nature subject to the river dynamics and can disappear from one spot only to reappear in another. They are extremely exposed to human interventions of any kind. The endemic *Leontodon brumatii* and its communities are a characteristic of riparian flora and vegetation of some of Slovenian mountain rivers. According to current knowledge, the localities in the Sava valley are explicitly disjunct and the southeasternmost in the entire known distribution area, so they deserve our attention and protection. The envisaged interventions along the central Sava, i.e. construction of new hydroelectric power plants, would most probably lead to destruction of suitable habitats for *Leontodon brumatii*. With a higher water level between Zagorje and Hrastnik, this endemic is likely to disappear from the river's riparian zone, as has probably already happened downstream, before Zidani Most or Radeče and further south.

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