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The dolina system vegetation of the northern glacio-karst sector of the Asiago Plateau (Venetian Prealps – NE Italy)

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Abstract
The paper describes the glacio-karst basin and dolina vegetation of the subcontinental enclave in the northern sector of the Asiago Plateau (south-eastern Prealps). Eleven associations were recognized in the lowest parts of dolina systems where the snow melting is delayed and exclusively chamaephytic/hemicryptophytic coenoses develop. They belong to *Arabidion caeruleae, Caricion ferrugineae, Loiseleurio-Vaccinion, Nardion strictae, Oxytropido-Elynion, Seslerion variae* and *Sodanello alpinae-Salicion retusae* alliances. Two new coenoses are described: *Salicetum reticulato-breviserratae* and *Salici reticulatae-Caricetum rupestris*. Some new geographical variants are proposed too. The high phytogeographic value of this calcareous prealpine plateau characterized by relict tundra vegetation surviving the more thermophilous phases that followed the Last Glacial Maximum is proved.

Key words: Asiago Plateau, *Carici rupestris-Kobresietea bellardii*, *Elyno-Seslerietea*, glacio-karst system, *Juncetea trifidi*, *Loiseleurio-Vaccinietea*, south-eastern Prealps, *Thlaspietea rotundifolii*

Introduction

The Asiago Plateau is one of the largest and most articulated limestone mountain in the context of the Venetian Prealps (north-eastern Italy). It is an area of great environmental interest, included in its northernmost sector within the SIC/ZPS "Altopiano dei Sette Comuni " (IT3220036). In the area several floristic researches were conducted since the beginning of the eighteenth century (Tita, 1713), but only quite marginally mountain range has been involved in vegetation studies. In this regard, it is possible to mention meadow relevés by Gerola & Gerola (1955), an investigation on Marcesina bogs (Busnardo, 1988) and some relevés aimed at the characterization of dry meadows and *Arrhenatherum elatius* grasslands of Venetian Prealps (Lasen, 1989; Buffa *et al*., 1995). Since data on alpine belt vegetation lack completely, a survey of the plant communities of northern plateau was undertaken. The aim of this study is to present the results of data gathered in the peculiar glaciokarst landform system that models the wide summit plateau of the limestone upland. More specifically, the investigated vegetation types are those primarily characterized by cryophilous hemicryptophytes and chamaephyites that during the postglacial period occupied bottoms, low slopes and microrises inside glaciokarst basins and dolines, i.e. hostile habitats to conifers. Here the dominant species mix is determined by minimal variations in humidity, wind intensity, calcium and humus content, but mainly by the snow absence period. The found plant communities are expressions of alpic vegetation within the twisted shrub belt.

Study area

The Asiago Plateau lies between the Veneto Region and the Province of Trento and covers a total area of over 600 km^2 ranging from 600 to over 2300 m a.s.l. (Fig. 1). It is bordered to the west and east by two deep valleys, Astico Valley and Brenta Canal respectively, to the north it is enclosed by the Valsugana complex rift and to the south a tectonic slope connects it to the Venetian high plain through a range of subalpine hills. It is divided, from south to north, into three subunits defined by homogeneous features: a southern plateau where differently oriented ridges interpose themselves to broad valleys without water courses, a central basin open to the west, with an irregularly wavy bottom and extending east-northeast with a system of ridges and hanging valleys above the Brenta Canal, finally a northern plateau closed to the north by highest peaks, slightly inclined towards the south and east and with the central sector characterized by glaciokarst basins, dolinas and bumps. Of the three subunits the northern plateau with its extension of about 200 km^2 constitutes the object of this study (Fig. 2).

The northern plateau is largely constituted by the Monte Zugna Formation (Jurassic), i.e. the lower unit of the group of Calcari Grigi group (Barbieri & Grandesso, 2007). It consists of cyclic sequences of micritic and oolitic-bioclastic, whitish or grey-brown limestones which are arranged in medium-size strata or massive banks. They are very bioturbated and permeated with various color mudstones, but mostly greenish (clay or clayey-dolomitic greenish intercalations). The thickness of the formation is fairly con-

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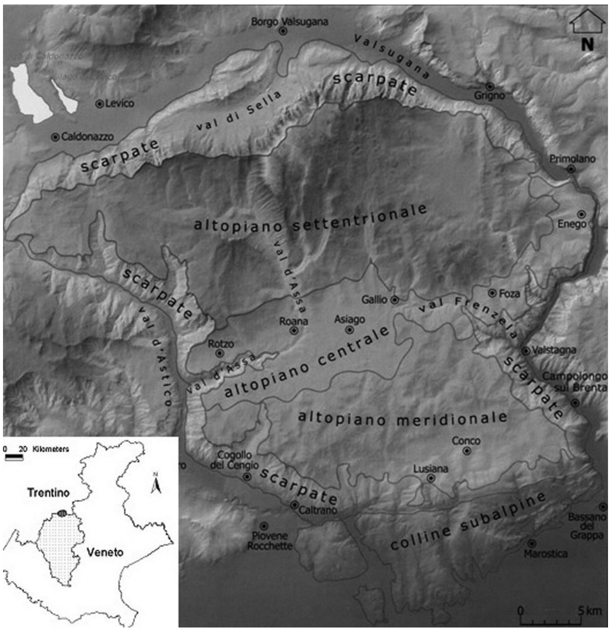


Fig. 1 – Localization of the study area at the boundaries between Veneto and Trentino (grey circle) and its orographic subunities (modified from Sauro, 2009).

stant around 300-350 m. In the central area, between M. Chiesa and Val Galmarara, and in the west in Val Trentin, Monte Zugna Formation presents dolomitized facies or recrystallized one due to late phenomena. The Rotzo Formation (Jurassic), upper unit of the Calcari Grigi group, extends in a central-eastern sector from M. Fiara in the south, M. Magari in the north, Spitz Keserle in the west to M. Cucco of Mandrielle in the east. It occurs again further south on M. Zebio and further east on the southern slopes of Col of Meneghini, M. Brustolac-Col Chempele and on the eastern slope M. Tondarecar. This lithological unit consists of marly limestones with metric or plurimetric thickness. The other unit of northern plateau is the Dolomia Principale that uninterrupted emerges in the lower part of the western slope of M. Meatta-M. Portule ridge, along the Val d'Assa and on the northern slope of the peaks overlooking the Valsugana. It also constitutes the lower parts of the valleys of Portule and Galmarara. The total thickness ranges from 500 to 600 m. In northern plateau can be found also indirect evidences of volcanic activity that are closely related to extensional tectonics that occurred during the Paleogene in western Veneto and southern Trentino. Basalt veins intersect a bit everywhere the pre-Paleogenic sedimentary sequence. Where they are masked by hemicryptophytic perennial grasslands or dwarf shrub vegetation their presence sometimes makes manifest in the material brought to light by excavations produced by marmots, like in Campi Lussi and Cinta del Pettine valleys.

Trevisan (1939) outlines a clear reconstruction of the last glacial maximum in the Asiago Plateau. The northern plateau was almost entirely covered by a single large ice cap that let emerge only the peaks surrounding it to the north and a few other peaks, especially in the east and west of it. Based on moraine development and on the preservation degree of the corresponding morphology, Barbieri & Grandesso (2007) update the Trevisan's reconstruction of the last glacial maximum in the Asiago Plateau. Contrary to the claims of the latter author, Val d'Assa would remain unglaciated except for the short section covered by Valgalmarara glacier that would come up to the present village of Roana (Fig. 3).

For a definition of climatic and bioclimatic characteristics of the study area we have to refer to thermopluvial data of Asiago station (1046 m a.s.l.) which is however located on the central basin, within an altitudinal range of about 700-1200 m lower. The mean annual temperature is 6.8 °C and the mean annual rainfall is 1411 mm (Servizio Idrografico Italiano, 1957; 1966). According to the methodology proposed by Rivas-Martínez & Rivas-Saenz (2009) the Asiago Plateau belongs to the temperate-oceanic bioclimate, upper supra-temperate thermotype and lower hyperhumid ombrotype. Nevertheless, in the study area mean annual rainfall decreases at 1100-1200 mm (Servizio Idrografico Italiano, 1957) due to the physical barrier formed by the peak chain standing between the central basin and the northern plateau itself.

Fig. 2 – The northern Asiago Plateau with the large glacio-karst enclave and the terminal summit system.

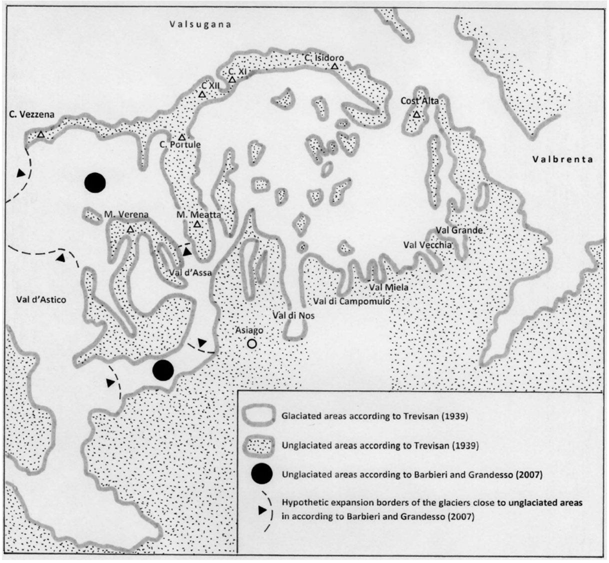


Fig. 3 – The Last Glacial Maximum in the Asiago Plateau in according to Trevisan's reconstruction (1939) and to the revision suggested by Barbieri & Grandesso (2007).

Karst landforms are widespread, with dolinas often aligned on the bottom of depressions corresponding to the flow directions of the Quaternary glaciers, where phenomena of thermic inversion originate and snow melting is delayed (Fig. 4). During 2009, measurements recorded in the bottom of the Campiluzzi dolina, within the study area, showed that the minimum mean temperature was 1.1 °C in August and 17 days the minimum temperature was below 0 °C in the bimester July-August (Renon, 2011). Thus it can be assumed that the study area is affected by a microclimate with progressive and marked continental influences. Snow cover distribution depends on microgeomorphological traits of the ground surface and on wind action which removes snow from small, exposed ridges to accumulate it in shallow depressions. In this case the vegetation mosaic resulted in communities of a few tens of square decimetres, i.e. in a microgeosigmetum (Fig. 5).

Further details on the study area can be obtained from a previous contribution (Giovagnoli & Tasinazzo, 2008)

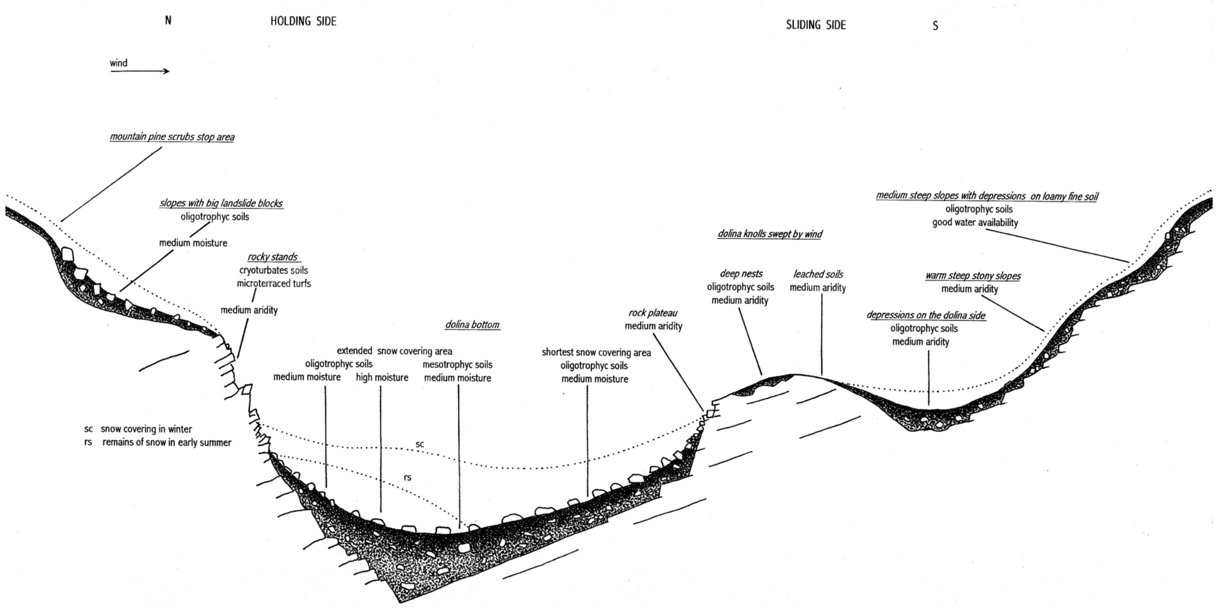
Materials and methods

In total, 104 relevés were carried out by means of the Braun-Blanquet's methodology (1964). Cover-abundance data were transformed according to van der Maarel (1979) and then subjected to multivariate analysis. The obtained matrix consists of 104 columns (relevés) x 245 rows (species). Hierarchical classifications were performed with Syn-Tax (Podani, 2001) whereas ordinations using CANOCO (ter Braak & Šmilauer, 2002). The choice of the ordination method - unimodal vs. linear - was based on the indications provided by Lepš & Šmilauer (2003).

As regards vascular species, chorotypes are derived from Aeschimann *et al.* (2004), life forms and bioindicator values from Pignatti (2005). Bryophyte and lichen ecological data are taken from Düll (1992) and

Fig. 4 – Typical glacio-karst basin with dolinas and small interconnected knolls in the bottom.

Fig. 5 – Morphology and ecological features of the dolina system in the northern sector of the Asiago Plateau.



Wirth (1992), respectively, chorological and life forms moss traits from Dierßen (2001). Soil reaction analyses were performed with a Hanna pH-instrument as reported in AA.VV. (1985). The original stands were compared with others in the literature from neighboring alpine areas. Due to the exclusion of mosses and lichens by authors in most phytosociological tables and since only in some vegetation types was considered necessary their sampling, they were used only in some statistical analysis and their inclusion/exclusion is time to time specified in the text. The taxonomic nomenclature follows Conti *et al.* (2005) for tracheophytes, Dierßen (2001) for bryophytes and Nimis & Martellos (2008) for lichens.

Results and discussion

Cluster analysis highlights the presence of 10 main relevés groups and a single stand (Fig. 6). They are interpreted like as many coenoses below explained on floristic-ecological basis. Confirming the segregation into two major clusters already made by the classification (A-G and H-L), principal component analysis separates relevés in the same way arranging them along the first axis according to a snow cover decreasing gradient (Fig. 7). Relevés with marked chamaephytism from the bottom of the glaciokarst system, where snow melting is delayed, are placed on the left of the diagram; perennial grassland stands from the slopes of the dolinas and valleys, where snow cover is more short-lasting, occupy the right part of the diagram.

SALICI RETICULATAE-CARICETUM RUPESTRIS ass. nova hoc loco (Tab. 1, holotypus rel. n° 9)

Differential species: *Carex rupestris, Salix reticulata, Vaccinium uliginosum/microphyllum*

Floristic composition: *Carex rupestris* tends to constitute dense covers on 5-10 m2 areas, recognizable even at a distance because of its brown dried end leaves. The high frequency, and sometimes cover, of *Salix reticulata* (V frequency class) and *S. breviserrata* (IV) highlights the catenal contacts of the coenose with *Salicetum reticulato-breviserratae* which is located on the dolina bottom. Well represented is the *Elyno Seslerietea* class with *Silene acaulis, Sesleria caerulea, Festuca quadriflora* and *Potentilla crantzii* in V and IV frequency class. Constant companions are *Carex capillaris*, to emphasize the water availability, *Bistorta vivipara* and *Cetraria islandica*. The average species number in the stands is 25.0.

Life forms and chorotypes: The coenoses is mainly composed of hemicryptophytes (55.9% presence/absence data, 58.3% cover data) followed by chamaephytes (33.3% vs. 32%; Fig. 16). As regards the chorological spectrum (Fig. 17), the Arctic-Alpine species predominate (36.8% vs. 46.8%) with values that are the highest among the found communities, followed by southern European orophytes (25.5% vs. 22.2%) and euro-siberian/North American ones (17% vs. 14.7%).

Syntaxonomy: The only described coenose characterized by *Carex rupestris* in the Alps is *Caricetum rupestris* that Pignatti & Pignatti (1985) formalized for the windy carbonate ledges of cryorotemperate belt of Dolomites and referred to the class *Carici-Kobresietea*, whereas Oriolo (2001) more properly put it in *Caricion firmae* (see Fig. 9). The comparison between *C. rupestris* relevés from Asiago Plateau and from Do-

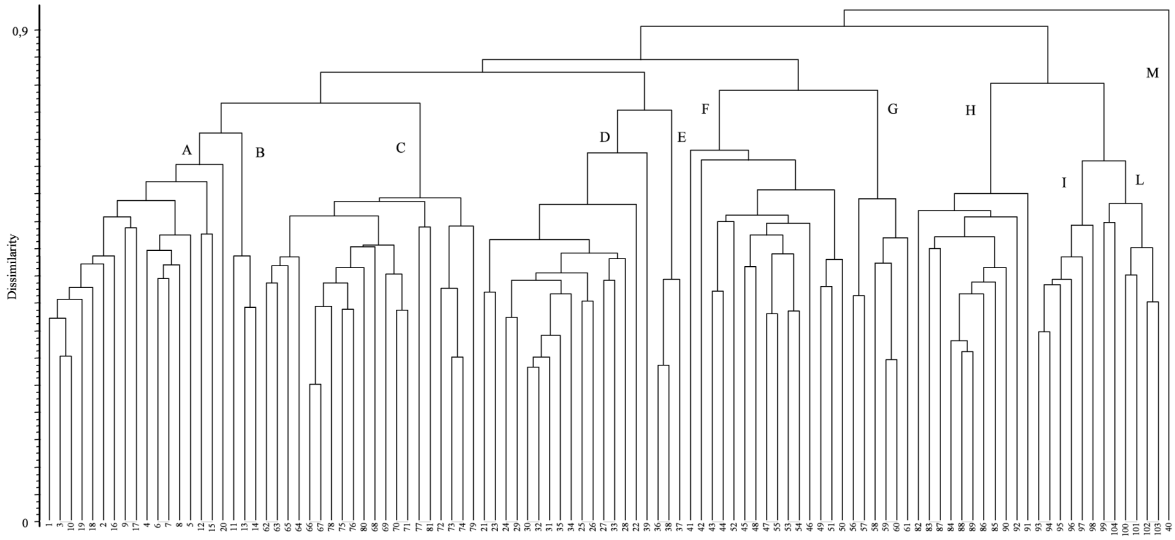


Fig. 6 – Dendrogram of 104 relevés from the glaciokarst system in the northern sector of the Asiago Plateau (Vicenza Province, south-eastern Prealps) (UPGMA, similarity ratio, cover data).
A: *Salici reticulatae-Caricetum rupestris;* B: *Elynetum myosuroides* fragm.; C: *Salicetum reticulato-breviserratae*; D: *Homogyno discoloris-Loiseleurietum procumbentis*; E: *Empetro-Vaccinietum gaultherioides*; F: *Salicetum retuso-reticulatae*; G: *Potentillo dubiae-Homogynetum discoloris*; H: *Sieversio montanae-Nardetum strictae*; I: *Campanulo scheuchzeri-Festucetum noricae*; L: *Ranunculo hybridi-Caricetum sempervirentis*; M: *Arabidetum caeruleae* fragm.

lomites highlights their marked difference (Fig. 8) due to the presence of species of *Scheuchzerio-Caricetea fuscae, Loiseleurio-Vaccinietea* and *Vaccinio-Picetea* which lack completely in *Caricetum rupestris*, within which are instead widespread species of *Asplenietea trichomanis* (Tab. 2). These floristic differences reflect the great diversity of ecological conditions in which the two plant communities develop. The autonomy of our plant community is also supported on a statistical basis being it more close to *Elynetum* than to *Caricetum rupestris* (Fig. 9). For the new association it is proposed the name *Salici reticulatae-Caricetum rupestris* with differential species the dominant *C. rupestris, Salix reticulata*, attesting the dolina original context, and *Vaccinium uliginosum/microphyllum* to underline the acidification processes involving the substrate. The connection with *Oxytropido-Elynion* and *Carici-Kobresietea* is assured by the occurance of *Kobresia myosuroides, Carex atrata/atrata, Antennaria carpathica* and *Lloydia serotina*. Their presence, although not reaching high values of frequency and coverage, is of high significance considering their local rarity (Giovagnoli & Tasinazzo, 2008) which is a direct consequence of the marginal position of Asiago Plateau with respect to the Alpine chain. This marginality amplifies the relict trait as well as the fragmentary condition which already characterize the class *Carici-Kobresietea* in southern European mountains and at the same time it represents reason of great phytogeographical interest. On the basis of numerical analysis

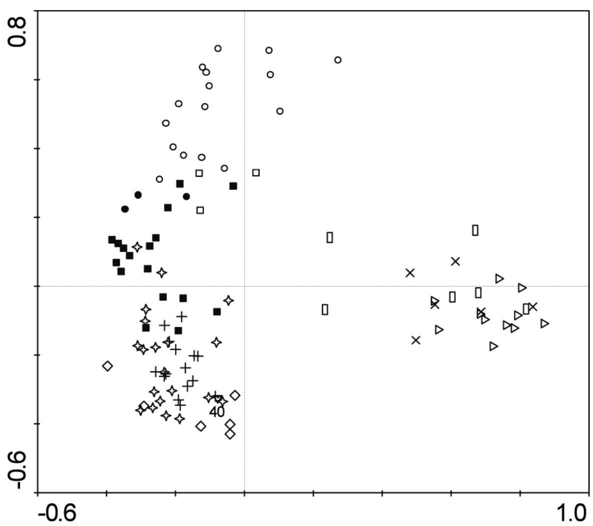


Fig. 7 – PCA ordination diagram of the glaciokarst system relevés from northern sector of the Asiago Plateau (Vicenza Province, south-eastern Prealps) (1° axis accounts for 13.6% of the variance; 2° axis for 8.4%).
■: *Salici reticulatae-Caricetum rupestris*; □: *Elynetum myosuroides* fragm.; ○: *Homogyno discoloris-Loiseleurietum procumbentis*; ●: *Empetro-Vaccinietum gaultherioides*; ▽: *Arabidetum caeruleae* fragm. (also indicated by 40); +: *Salicetum retuso-reticulatae*; ◇: *Potentillo dubiae-Homogynetum discoloris*; ✧: *Salicetum reticulato-breviserratae*; ▷: *Sieversio montanae-Nardetum strictae*; ×: *Campanulo scheuchzeri-Festucetum noricae*; ▯ : *Ranunculo hybridi-Caricetum sempervirentis*.

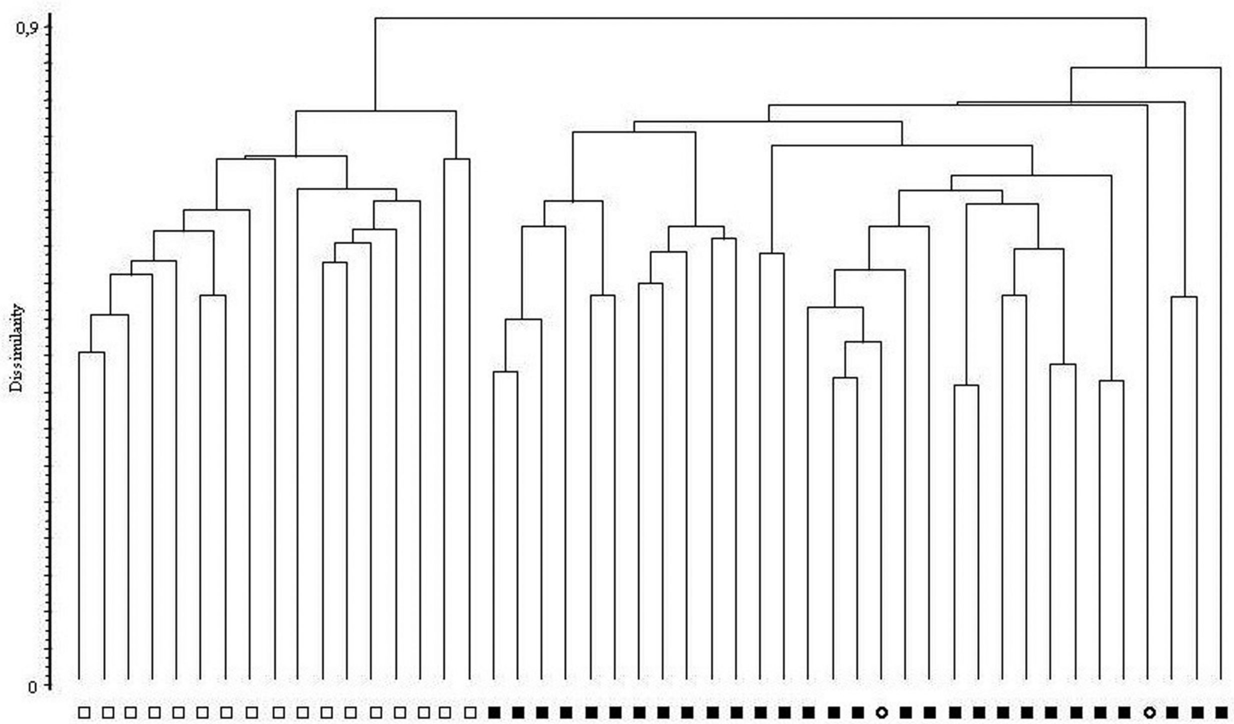


Fig. 8 – Dendrogram (UPGMA, Jaccard index, binary data) of *Salici reticulatae-Caricetum rupestris* (□: this study) and *Caricetum rupestris* relevés [■: Pignatti & Pignatti, 1985; O: rel. 113 and 152 in Tab. 11 in Boiti *et al*., 1989; Lasen's relevés (1983) not included because lacking of moss and lichen data]. Mosses and lichens included.

performed on floristic compositions and chorological spectra of alpine and subalpine calcareous grasslands, Oriolo (2001) comes to refute the existence of the class *Carici-Kobresietea* on Alps and Apennines and to embrace the classical Authors' scheme that included *Oxytropido-Elynion* in *Elyno-Seslerietea*. Peyre & Font (2011) attain the same conclusion by means of a syntaxonomic revision paper based on a large database from Pyrenees and Cantabrian Mountains. On the other hand Petrik *et al*. (2005) consider Oriolo's thesis marred by questionable interpretation of species chorology, reject it and stress the relict presence of the class *Carici-Kobresietea* in the Carpathians. Its presence was recently confirmed also in Apennines (Lancioni *et al*., 2011). Despite the inadequacy of some species with wide ecological and sociological behaviour to characterize, also in the study area, the class (e.g. *Dryas octopetala, Potentilla crantzii, Silene acaulis*) we choose classic Ohba's scheme which is largely adopted by leading syntaxonomical systems (Oberdorfer, 1978; Grabherr, 1993a; Theurillat *et al*., 1995; Rivas-Martínez *et al*. 2001).

Synecology: This chionophilous association colonizes the slopes of dolinas lying in the bottom of glaciokarst valleys where the intense cryoturbation causes the formation of soils characterized by discontinuous and microterraced turfs. The distinctive habitat of this association is highlighted by the high frequency of species belonging to *Soldanello-Salicion* and *Arabidetalia,* such as *Salix reticulata, S. retusa* and *Galium baldense* showing the catenal contacts with snow bed communities. The rendzinamorphic soil has an A/C profile and a slightly acid reaction with pH around 6.10. The stands are localized in close proximity to frosty draught holes emanating from coarse blocky debris slipped on

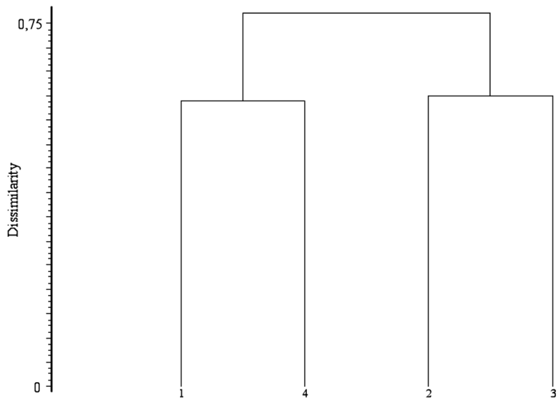


Fig. 9 – Dendrogram (UPGMA, similarity ratio, cover data) of synthetic tables of *Salici reticulatae-Caricetum rupestris* (1; this study), *Caricetum rupestris* (2; Pignatti & Pignatti, 1985), *Gentiano terglouensis-Caricetum firmae* (3; Carnic Alps, Poldini & Feoli, 1976), *Elynetum myosuroides* (4; Friuli Venezia Giulia, rel. 1-15 and 18 in Tab. 2 in Oriolo, 2001).

Tab. 1 – *Salici reticulatae-Caricetum rupestris* ass. nova; holotypus rel. n° 9

N° of relevé	1	3	10	19	18	2	16	9	17	4	6	7	8	5	12	15	20	presences
Altitude (m a.s.l.)	1820	1915	1790	1820	1855	2210	1740	1740	1785	1910	1905	1850	1785	1775	2130	2280	1860	
Exposure	N	N	NE	N	SW	N	S	NE	N	SSE	SE	E	W	W	NW	E	N	
Slope (°)	20	30	20	40	30	10	30	30	20	30	5	30	10	30	20	5	15	
Area (m^2)	9	10	15	15	15	6	8	10	4	15	6	15	12	8	10	6	5	
Coverage (%)	95	90	90	90	90	100	70	80	100	80	90	80	90	90	70	95	90	
N° of species	28	23	26	23	25	22	29	23	24	33	28	23	31	23	20	21	23	
																		fr%
Diff. species of association																		
Carex rupestris (C)	4	3	3	5	4	4	3	3	2	3	4	5	3	3	3	4	1	100
Salix reticulata	1	+	1	1	+	+	.	1	1	1	+	1	+	+	+	.	1	88
Vaccinium uliginosum/microphyllum	+	+	1	+	+	.	.	1	2	1	.	.	+	.	+	1	+	71
Char. species of *Oxytropido-Elynion* and *Carici-Kobresietea* (C)																		
Kobresia myosuroides	.	.	+	.	+	1	1	.	.	.	.	+	1	+	.	.	2	47
Salix serpillifolia	.	.	.	.	.	+	.	+	.	.	+	.	+	1	.	.	.	29
Carex atrata/atrata	.	.	+	.	.	.	.	+	.	.	.	1	+	.	.	.	.	24
Antennaria carpathica	1	.	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	18
Gentiana nivalis	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	12
Lloydia serotina	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	6
Charact. species of *Elyno-Seslerietea*																		
Silene acaulis/longiscapa	+	+	+	+	+	+	1	1	+	+	1	1	+	+	.	.	+	88
Sesleria caerulea/caerulea	+	+	+	.	+	+	+	+	.	1	+	+	+	+	+	+	.	82
Festuca quadriflora	.	+	+	+	1	+	1	+	1	1	+	1	+	.	.	.	1	76
Potentilla crantzii/crantzii	+	.	+	.	+	+	.	+	.	1	+	+	1	+	.	+	+	71
Dryas octopetala/octopetala	2	2	2	1	+	1	1	.	1	.	.	.	.	.	1	+	+	65
Anthyllis vulneraria/alpestris	.	.	+	.	.	.	.	+	.	+	+	.	+	1	+	+	.	47
Erigeron glabratus	.	.	.	.	.	+	+	.	.	.	+	+	.	1	+	+	.	41
Agrostis alpina	.	.	.	.	+	.	.	.	.	.	+	+	.	.	1	1	+	35
Pedicularis verticillata	.	.	+	.	.	.	.	+	.	+	.	+	+	+	.	.	.	35
Ranunculus carinthiacus	.	+	.	.	.	+	.	.	.	+	+	.	+	+	.	.	.	35
Minuartia verna/verna	.	.	.	.	.	.	+	.	.	+	+	1	+	.	.	.	.	29
Carex firma	.	+	+	.	.	+	.	.	.	.	.	.	.	.	+	1	.	29
Helianthemum oleandicum/alpestre	.	.	.	.	+	.	.	.	.	+	+	.	+	.	.	.	.	24
Bellidiastrum michelii	.	.	.	.	.	+	.	.	.	.	+	+	+	.	.	.	.	24
Bartsia alpina	+	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	18
Carex ornithopoda	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	18
Euphrasia salisburgensis	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	1	.	18
Saxifraga caesia	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	12
Chamorchis alpina	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	12
Draba aizoides	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	12
Galium anisophyllon	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	12
Aster alpinus	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	6
Erigeron alpinus	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	6
Leontopodium alpinum	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	6
Oxytropis jacquinii	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	6
Polygala alpestris	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	6
Charact. species of *Scheuchzerio-Caricetea fuscae*																		
Carex capillaris/capillaris	+	1	1	+	+	+	+	.	1	.	+	.	.	.	+	.	+	65
Parnassia palustris/palustris	.	+	+	.	+	+	+	.	.	.	+	.	.	.	.	+	.	41
Pinguicula alpina	.	+	+	.	.	.	+	+	.	1	.	.	.	.	+	.	+	41
Charact. species of *Loiseleurio-Vaccinietea*																		
Kalmia procumbens	r	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	24
Juniperus communis/nana	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	12
Arctostaphylos alpina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	6
Charact. species of *Vaccinio-Picetea*																		
Vaccinium vitis-idaea	+	+	.	1	+	.	+	+	1	+	.	.	.	.	.	.	1	53
Homogyne alpina	.	.	.	+	.	+	.	.	+	.	.	.	.	.	.	.		18
Pyrola rotundifolia	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.		6
Rhododendron ferrugineum	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.		6
other species																		
Bistorta vivipara	+	+	1	+	1	+	+	1	+	1	+	1	+	1	1	+	.	94
Salix breviserrata	+	+	+	+	1	.	+	.	1	2	1	1	+	2	.	.	+	76
Galium baldense	+	+	+	+	.	.	.	.	.	+	+	+	+	.	.	.	+	53
Selaginella selaginoides	+	+	+	+	1	.	+	.	+	.	.	.	.	.	+	.	+	53
Poa alpina/alpina	+	.	.	.	.	.	+	1	+	1	.	1	+	.	.	.	.	41
Pinus mugo/mugo	+	+	.	.	+	.	.	.	+	+	.	.	.	.	.	.	r	35
Carex ericetorum	+	+	.	+	.	.	+	.	.	.	.	.	.	.	.	.	+	29
Daphne striata	.	.	.	r	.	.	+	.	.	+	.	.	+	1	.	.	.	29
Viola biflora	+	+	.	.	.	.	+	.	.	+	.	1	.	.	.	.	.	29
Salix retusa	.	.	+	.	.	+	.	.	.	1	.	.	+	.	.	.	+	29
Carex sempervirens	.	.	.	.	+	.	.	.	.	.	.	+	.	.	+	.	.	18
Antennaria dioica	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	.	.	18
Thymus praecox/polytrichus	.	.	.	.	+	.	.	.	.	.	r	.	.	+	.	.	.	18
Agrostis rupestris	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	12
Ligusticum mutellinoides	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	12
Saxifraga aizoides	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	12
Asplenium viride	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	12
Cystopteris fragilis	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	12
mosses and lichens																		
Cetraria islandica	+	+	+	+	1	+	+	.	.	1	+	+	+	+	.	+	+	82
Cladonia convoluta	+	+	+	.	.	.	+	.	+	.	+	.	.	.	+	.	.	41
Cladonia rangiferina	+	.	.	+	.	+	+	+	+	.	.	.	1	.	.	.	.	41
Sanionia uncinata	+	.	.	+	.	.	.	+	1	.	.	.	.	.	.	.	+	29
Cladonia arbuscula	.	.	.	.	.	.	.	.	+	.	.	1	.	1	.	.	.	18
Cladonia furcata	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	18
Onchophorus virens	.	.	.	+	.	.	.	+	1	.	.	.	.	.	.	.	.	18
Cladonia pyxidata	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	12
Polytrichum juniperinum	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	12

Tab. 2 – *Salici reticulatae-Caricetum rupestris* vs. *Caricetum rupestris* (data from Pignatti & Pignatti, 1985 and Boiti *et al.*, 1989) synoptic table. Companions, mosses and lichens present in a single table and only once are excluded.

	Salici-Caricetum	*Caricetum rupestris*
charact. species of *Oxytropido-Elynion*		
Kobresia myosuroides	47	32
Salix serpillifolia	29	55
Carex atrata/atrata	24	.
Antennaria carpathica	18	.
Gentiana nivalis	12	.
Lloydia serotina	6	.
Erigeron uniflorus	.	10
charact. species of *Carici-Kobresietea*		
Carex rupestris	100	100
Arenaria ciliata	.	16
Minuartia biflora	.	13
Draba siliquosa	.	3
charact. species of *Elyno-Seslerietea*		
Silene acaulis/longiscapa	88	52
Sesleria caerulea/caerulea	82	.
Festuca quadriflora	76	13
Potentilla crantzii/crantzii	71	.
Dryas octopetala/octopetala	65	13
Anthyllis vulneraria/alpestris	47	.
Erigeron glabratus	41	.
Agrostis alpina	35	.
Pedicularis verticillata	35	.
Ranunculus carinthiacus	35	.
Minuartia verna/verna	29	52
Carex firma	29	32
Helianthemum oleandicum/alpestre	24	16
Bellidiastrum michelii	24	.
Bartsia alpina	18	3
Carex ornithopoda	18	.
Euphrasia salisburgensis	18	.
Saxifraga caesia	12	29
Chamorchis alpina	12	.
Draba aizoides	12	.
Galium anisophyllon	12	.
Aster alpinus	6	.
Erigeron alpinus	6	.
Leontopodium alpinum	6	.
Oxytropis jacquinii	6	.
Polygala alpestris	6	.
Sesleria sphaerocephala	.	81
Gentiana terglouensis	.	35
Saxifraga exarata/moschata	.	13
charact. species of *Asplenietea trichomanis*		
Draba dubia	.	45
Potentilla nitida	.	42
Minuartia cherlerioides/cherlerioides	6	39
Festuca alpina/alpina	6	26
Saxifraga squarrosa	.	26
Erithrichium nanum	.	16
Phyteuma sieberi	.	16
Androsace hausmannii	.	13
Saxifraga paniculata	6	6
Androsace helvetica	.	6
Draba tomentosa	.	6
Petrocallis pyrenaica	.	3
Asplenium viride	12	.
Cystopteris fragilis	12	.
Campanula cohleariifolia	6	.
Silene pusilla	6	.
charact. species of *Thlaspietea rotundifolii*		
Salix reticulata	88	.
Galium baldense	53	.
Salix retusa	29	.
Minuartia sedoides	6	81
Hornungia alpina/alpina	6	.
Sedum alpestre	6	.
Veronica alpina	6	.
Draba hoppeana	.	13
Saxifraga facchinii	.	13
Saxifraga sedoides	.	10
Cerastium uniflorum	.	3
Moehringia ciliata	.	3
Sedum atratum	.	3
charact. species of *Scheuchzerio-Caricetea fuscae*		
Carex capillaris/capillaris	65	.
Selaginella selaginoides	53	.
Parnassia palustris/palustris	41	.
Pinguicula alpina	41	.
charact. species of *Loiseleurio-Vaccinietea*		
Vaccinium uliginosum/microphyllum	71	.
Kalmia procumbens	24	.
Juniperus communis/nana	12	.
Arctostaphylos alpina	6	.
charact. species of *Vaccinio-Picetea*		
Vaccinium vitis-idaea	53	.
Homogyne alpina	18	.
Pyrola rotundifolia	6	.
Rhododendron ferrugineum	6	.
other species		
Bistorta vivipara	94	52
Salix breviserrata	76	.
Poa alpina/alpina	41	3
Pinus mugo/mugo	35	.
Carex ericetorum	29	.
Daphne striata	29	.
Viola biflora	29	.
Antennaria dioica	18	.
Carex sempervirens	18	.
Thymus praecox/polytrichus	18	.
Agrostis rupestris	12	.
Ligusticum mutellinoides	12	.
Saxifraga aizoides	12	.
Saxifraga oppositifolia	.	16
mosses and lichens		
Cetraria islandica	82	13
Cladonia convoluta	41	13
Cladonia rangiferina	41	.
Sanionia uncinata	29	.
Cladonia arbuscula	18	.
Cladonia furcata	18	.
Onchophorus virens	18	.
Cladonia pyxidata	12	16
Polytrichum juniperinum	12	.
Thamnolia vermicularis	6	26
Tortella tortuosa	.	35
Flavocetraria nivalis	.	32
Schistidium apocarpum	.	16
Flavocetraria cucullata	.	13
Squamarina gypsacea	.	13
Toninia sedifolia	.	13

the bottom of the hollow where *Salicetum reticulato-breviserratae* often occurs. The freezing air gives rise around the exit holes to thermic conditions normally found in location placed in extreme high altitude.
Synchorology: The coenose is currently reported only from the Asiago Plateau.
Natura 2000: 6170.

ELYNETUM MYOSUROIDES Rübel 1911 fragm. (Tab. 3)

Differential species: *Kobresia myosuroides*.
Floristic composition: In comparison to *Salici-Caricetum*, with which the higher the affinities, *Kobresia myosuroides* predominates slightly on *Carex rupestris* and remarkable is the exclusive occurance of *Juncetea trifidi* species such as *Potentilla aurea*, replacing *P. crantzii*, and *Avenula versicolor*. Species belonging to the class *Elyno-Seslerietea* constantly present are numerous (*Sesleria caerulea/caerulea, Bartsia alpina, Carex firma, Agrostis alpina, Erigeron glabratus*). The average species number per relevé is 28.7.
Life forms and chorotypes: The biological spectrum shows the predominance of hemicryptophytes (73.4% presence/absence data; 78.0% coverage data) followed by chamaephytes (20.3% vs. 17.2%; Fig. 16). Southern European orophytes (40.0% vs. 37.1%) are at a higher rate than the Arctic-Alpine species (26.3% vs. 32.5%), which is just the opposite of what happens in *Salici-Caricetum*; the contribution of southeastern

European orophytes proves also important (6.3% vs. 6.1%; Fig. 17).

Syntaxonomy: The esalpic connotation of the plateau is thought to be responsable of the above mentioned smaller percentage of arctic-alpine chorotype which is reduced of a group of closely endalpic distribution species, some of which are considered by many authors characteristics of *Elynetum*: *Cerastium alpinum, Gentiana prostrata, Erigeron uniflorus* etc. These include also *Saussurea alpina* and *Lloydia serotina* which, although taking into account the extreme rarity in the Asiago Plateau (Giovagnoli & Tasinazzo, 2008), do not take part in composition of *Elynetum* fragments, the same way as *Antennaria carpatica* indeed locally diagnostic of *Homogyno-Loiseleurietum*. It follows that the cenose is differentiated only by the dominance of *K. myosuroides* in a scheme matching the few available relevés from other south-eastern prealpic zones where *Elynetum* appears with a relict feature and as such it shows fragmentary and lacks the characteristic floristic composition (Feltre Alps: Lasen, 1983; Carnic Prealps: Oriolo, 2001). This results in a weak connection with syntaxonomical higher ranks that is nevertheless assured by the dominance of *K. myosuroides* and *Carex rupestris*, as well as by the occurance of *Carex atrata* and of the weakly characteristic S*alix serpyllifolia*. The stands from Asiago Plateau exhibit a good resemblance with the subass. seslerietosum variae, as the occurrence of the differential species *Sesleria caerulea/caerulea, Carex firma, Pedicularis rostrato-capitata, Helianthemum oelandicum/alpestre* and *Thymus praecox/polytrichus* reveals (Oberdorfer, 1978).

Synecology: Sporadic relict fragments of nacked rush sward are found on the rises interspersed inside the dolina system, especially in corrispondence of the little passes lying at the higher northern fringes of the glacio-karst enclave. The cryoxerophytic community occupies few-square meters areas in windswept sites where *C. rupestris* grows in pioneering conditions on bare rocks and *K. myosuroides* where the humus accumulation buffers the basic influence of the lithological substrate, inducing a pH ranging between moderately (5.80) and slightly acid (6.10) values. Based on previous data dating back to 1990, the increase in *Avenula versicolor* coverage highlights the progressive acidification of the sites. The occurrence of several other acidophilous species, such as *Vaccinium uliginosum/microphyllum, V. vitis-idea, Potentilla aurea* and *Antennaria dioica*, or *Soldanello-Salicion* and *Arabidetalia entities*, such as *Salix reticulata, S. retusa* and *Galium baldense*, highlights the greater snow cover characterizing these chionophilous fragments of *Elyna*-sward with respect to wind-exposed ridge classic coenoses. The particular sharing of calcicolous and acidophilous species was described as subass. *helictotrichetosum versicoloris* (Albrecht, 1969). Although *Kobresia* can be find in the study area just from 1700 m, the *Elynetum* fragments only occur above 2100 m.

Tab. 3 – *Elynetum myosuroides* Rübel 1911 fragm.

N° of relevé	11	13	14	
Altitude (m a.s.l.)	2138	2155	2158	
Exposure	SSE	NNW	N	
Slope (°)	10	5	5	
Area (m^2)	9	8	8	
Coverage (%)	100	90	90	
N° of species	24	33	29	presences
				fr%
charact. species of *Oxytropido-Elynion* and *Carici-Kobresietea*				
Kobresia myosuroides	2	2	3	100
Carex rupestris (C)	+	2	2	100
Salix serpillifolia	1	+	+	100
Carex atrata/atrata	.	+	+	67
charact. species of *Elyno-Seslerietea*				
Sesleria caerulea/caerulea	2	+	+	100
Bartsia alpina	1	1	1	100
Agrostis alpina	+	1	1	100
Carex firma	+	1	1	100
Dryas octopetala/octopetala	1	+	1	100
Erigeron glabratus	+	+	+	100
Silene acaulis/longiscapa	.	+	+	67
Festuca quadriflora	+	.	+	67
Anthyllis vulneraria/alpestris	+	.	+	67
Euphrasia salisburgensis	+	+	.	67
Gentiana verna/verna	.	+	+	67
Pedicularis rostratocapitata	.	+	+	67
Ranunculus carinthiacus	.	.	+	33
Helianthemum oleandicum/alpestre	.	+	.	33
Carex ornithopoda	+	.	.	33
Saxifraga caesia	.	.	+	33
Chamorchis alpina	.	.	+	33
Galium anisophyllon	+	.	.	33
Leontopodium alpinum	.	+	.	33
Polygala alpestris	.	+	.	33
other species				
Avenula versicolor	2	+	1	100
Potentilla aurea	1	1	1	100
Carex capillaris/capillaris	+	+	+	100
Parnassia palustris/palustris	1	1	1	100
Bistorta vivipara	.	+	+	67
Campanula scheuchzeri/scheuchzeri	+	+	.	67
Selaginella selaginoides	.	+	+	67
Antennaria dioica	+	.	.	33
Thymus praecox/polytrichus	+	.	.	33
Petrocallis pyrenaica	.	+	.	33
Galium baldense	.	+	.	33
Primula spectabilis	+	.	.	33
Phyteuma sieberi	.	+	.	33
Minuartia sedoides	.	+	.	33
Carex ornithopodioides	.	.	+	33
Carex sempervirens	.	.	+	33
Salix reticulata	.	+	.	33
Homogyne alpina	.	.	+	33
Vaccinium uliginosum/microphyllum	.	.	1	33
Alchemilla flabellata	+	.	.	33
mosses and lichens				
Cetraria islandica	+	+	.	67
Cladonia convoluta	.	.	+	33
Thamnolia vermicularis	.	r	.	33
Vulpicida tubulosus	.	r	.	33
Flavocetraria cucullata	.	+	.	33

Synchorology: The association is found mainly on siliceous substrates rich in carbonates and with subacid-neutral reaction (Albrecht, 1969), within an area including the Central-Western and Central-Eastern Alps and with the maximum eastern penetration in Carinthia (Huttegger *et al*., 2004). Rather than the substrate reaction is anyway the soil microtopography that determines the prevalence of *Elynetum* which grows in exposed sites which suffer the effects of extreme temperature due to the snowpack removal. Few data are available in the literature for the Southern Alps where the association occurs infrequently and in the form of fragments always characterized by a pronounced continental footprint. Published papers are those inherent the Erera-Brendol-Campotorondo Plateaus (Lasen,

1983), Val Venegia (Boiti *et al*., 1989) and the Carnic and Julian Alps (Oriolo, 2001).
Natura 2000: 6170.

SALICETUM RETICULATO-BREVISERRATAE ass. nova hoc loco (Tab. 4, holotypus rel. n° 72)

Differential species: *Salix breviserrata* (dom.), *S. reticulata* (subdom.)
Floristic composition: The physiognomy of the coenose arises from the dominance of *Salix breviserrata* which develops a slightly higher vegetation layer and reaches a higher coverage than the other differential species, i.e. *Salix reticulata*. The former takes roots in depth between the large clasts slipped on the bottom of the dolina, covering them, the latter grows only in correspondence of thin-matrix pockets of humus formed by leaching especially at the foot of the block landslide. Besides the two willows, also *Potentilla crantzii/crantzii, Bistorta vivipara, Poa alpina* and, among bryophytes and lichens, *Cetraria islandica* and *Sanionia uncinata* are at V frequency class. The average species number per relevé is 27.8.
Life forms and chorotypes: The coenose is almost entirely made up of hemicryptophytes (63.3% presence/absence data, 54.3% coverage data) and chamaephytes (27.7% vs. 38%). With regard to biogeographic distribution, Arctic-Alpine species (32.9% vs. 36%) prevail on southern European orophytes (24.9% vs. 21%) and eurosiberian/North American ones (18.8% vs. 16.5%). The same *Salix breviserrata* is responsible of the western mark of the plant community (southwestern European orophytes: 4.4% vs. 12.9%), a distinctive trait compared to the other chionophilous Salix-coenoses of dolina.
Syntaxonomy: *Salix breviserrata* is considered characteristic of *Salicion pentandrae* (Aeschimann *et al*., 2004), but it is also frequently found in plant communities of fens belonging to *Scheuchzerio-Caricetea* (Oberdorfer, 1983). *Salix breviserrata*-dominated chionophilous phytocoenoses have not been yet described. Therefore the community from Asiago Plateau can be attributed to a new association, Salicetum reticulato-breviserratae, distinctly characterized also from an ecological point of view and with the eponymous *Salix breviserrata* and *S. reticulata* as differential species. The connection with *Soldanello-Salicion* is assured by the three most important environmental factors outlined by English (1999) – high scree stability, good soil accumulation, gentle slope – and by the occurrence of many of the species included in the characteristics species combination provided by the same author. The frequent and high-coverage *Salix reticulata* and *S. retusa*, several *Elyno-Seslerietea* entities – even though in class I and II except for *Silene acaulis* (IV) – are among these. The link with the order *Arabidetalia* is based on a small species group which, with a high frequency, includes only *Galium baldense* and *Carex parviflora*. The contribution of glareicolous species characteristics of the class *Thlaspietea rotundifolii* appears even more marginal, if not negligible, according to a pattern already highlighted in the neighboring Vette Feltrine by Tomaselli *et al*. (2005). For these reasons, these authors prefer to put the found snow bed vegetation types in *Arabidion caeruleae, Arabidetalia* and *Salicetea herbaceae* following the traditional approach set up by Braun-Blanquet & Jenny (1926) – adopted also by other later researchers – disregarding the recently syntaxonomical scheme introduced by English *et al*. (1993) and English (1999). The structural sinking of the Calcari Grigi group gives rise to large blocks landslides, on which the coenosis develops, among whose interstices are lacking the build-up of fine soil and the light contribution, both necessary to the young seedling growth. This may be the reason for the absence of *Thlaspietea* species. They prove to be much more frequent in the upper part of the northern plateau, where Calcari Grigi and, primarily, Dolomia Principale outcrops cause the formation of thinner clasts along more developed screes.
Synecology: The coenose ecology was assessed by comparing it with the other two plant communities of dolina bottom in the study area, whose physiognomy similarly arises from the predominace of chamaephytic *Salix* species (Tab. 14). As available data set is very homogeneous, the ordination of the relevés with the environmental variables (Fig. 18) was performed by means of a redundancy analysis (RDA) (Lepš & Šmilauer, 2003). The first two axes explain 21.9% and 10.3% of the total variance in the species data. They are also highly correlated to the environmental variables (r = 0.950 e r = 0.947). The inter-set correlations between environmental variables, estimated through Ellenberg's bioindicator values, and the ordination axes derived from species data associate the first canonical axis with altitude and secondarily with moisture, the second canonical axis with soil reaction (Tab. 15). The coenose is located at lower altitudes (mean: 1804 m) and in relatively less damp sites than *Salicetum retuso-reticulatae*. Despite this, the two willow communities can also be found in catenal contact in the same depression in relation to the clast sizes and the duration of snow cover. Wherever the dolina is formed in the presence of inclined instead of subhorizontal strata, it assumes an asymmetrical shape characterized by a lower slope in the side where the orientation of the rock strata is in the slope direction. Here the bottom and the foot of the scree slope are richer in coarse clasts with an average diameter exceeding 25 cm and constitute the optimal niche of the Salicetum reticulato-breviserratae. Therefore, it takes shape as a limestone scree community developing on the depression bottom

at the build up of rocky debris resulting from Calcari Grigi disintegration and where snow cover is some way shorter. Hence the traits of a more continental microclimate which reminds *Salix breviserrata* features and marks the coenoses. The soil has the classic profile A/C with stronghly to moderately acid pH values ranging between 5.20 and 5.60, from which the occurring of numerous acidophilous components belonging to *Juncetea trifidi, Rododendro-Vaccinietalia, Vaccinio-Piceetea* derives.
Synchorology: The coenoses is currently reported only from the Asiago Plateau where is widely distributed.
Natura 2000: 4080.

HOMOGYNO DISCOLORIS-LOISELEURIETUM PROCUMBENTIS Aichinger 1933 var. geogr. *Galium baldense* (Tab. 5)

Differential species: *Kalmia procumbens* (dom.), *Agrostis rupestris, Vaccinium vitis-idaea, Carex ericetorum* (loc.), *Antennaria carpathica* (loc.). *Carex ericetorum* is considered characteristic of *Pyrolo-Pinetea*, but its constant occurrence in alpine vegetation types such as *Elynetum* s.l. (Horvat, 1974; Oberdorfer, 1983) and *Kalmia* – rich swards themselves (Ziliotto *et al*., 2004) has already been highlighted.
Floristic composition: The physiognomy of the association looks as a dwarf shrub with *Kalmia procumbens* predominating upon the subordinate *Vaccinium uliginosum*/*microphyllum* and *Dryas octopetala*. *Sesleria caerulea, Bistorta vivipara, Selaginella selaginoides* and the lichens *Cladonia rangiferina* and *Cetraria islandica* grow with high frequency amongst the creeping plaiting of the chamaephytes. The mean number of species/relevé amounts to 31.9.
Life forms and chorotypes: The hemicryptophytes prevail on chamaephytes in terms of presence/absence data (53.5% vs. 31.9%), whereas the two biological forms are almost equivalent by comparing coverage data (47.6% vs. 39.5%). Geophytes amounted to 5% in each case. As regards the chorological spectrum, southern European orophytes (41.2% presence/absence data; 37.1% coverage data) surpass Arctic-Alpine species (23.5% vs. 26%) and eurosiberian/North American ones (20% vs. 26.8%).
Syntaxonomy: Many papers dealing with *Kalmia*-dominating dwarf shrubs on siliceous bedrocks and refering to *Cetrario-Loiseleurietum* were published, conversely, few data are available for similar formations of carbonate lithotypes. At the time the only formalization of a *Kalmia*-rich calcareous coenoses is due to Aichinger (1933) who described the *Homogyno discoloris-Loiseleurietum* from the Carnic Alps of Villach (Dobratsch). This remains also the only tabular data for the Southern Alps – if we exclude a couple of stands from Val Venegia (Boiti *et al*., 1989) – whereas various contributions from Northern alpine chain are at researcher's disposal, such as Pignatti-Wikus (1959) and Wikus (1961) studies. The attribution of relevés from Dachstein area to *Cetrario-Loiseleurietum* made by Pignatti-Wikus (1959) is refuted by Wendelberger (1962) who emphasizes the basiphilous feature of this vegetation type by referring it to a *Loiseleurietum calcicolum*, then extended to the Rax Plateau (Wendelberger, 1971), against the more basiphilous *Homogyno-Loiseleurietum* of which it is now considered synonimous (Grabherr, 1993b). The classification of the relevés on lime rich soils as well as a sample of those on siliceous ones (Giacomini & Pignatti, 1955), shows that the latter aggregate with some transitional aspects from Rätikon (Hartmann, 1971) and Val Venegia (Boiti *et al*., 1989) attributed to *Elynetum loiseleurietosum* (Fig. 10). The other stands form a single undifferentiated group. Those from Lienz Dolomites (Wikus, 1961) separate, although not equally, by binding with a greater degree of similarity now to relevès from the Asiago Plateau now to the corresponding ones from Carnic Alps containing the lectotype of the plant community. Therefore, also relevés from the Asiago Plateau can be ascribed to the association *Homogyno-Loiseleurietum*, assigning them to a new geographic variant because of the particular phytogeographic features of Venetian Prealps, with geographical differential species the endemic *Galium baldense*. The latter and other chionophilous entities belonging to *Soldanello-Salicion*, such as *Salix reticulata* and *S. retusa*, stress the different snow cover conditions between these prealpin *Kalmia*-sites and the wind-swept ridge heaths previously described by the above mentioned authors. With respect to the original description, the eponymous species *Homogyne discolor* lacks due to biogeographical reasons, i.e. the species is absent from the area, but there are *Antennaria carpathica, Agrostis alpina* and *Festuca quadriflora*, all species shared with *Elynetum loiseleurietosum*. The association is framed in *Caricenion firmae* despite the low presence of *Carex firma* due to the progressive covering of acid raw humus that separates its roots from bedrock. At a higher rank, the connection with *Elyno-Seslerietea* is in particular ensured by *Sesleria caerulea* (V frequency class), *Festuca quadriflora, Potentilla crantzii, Agrostis alpina, Bellidiastrum michelii* and *Bartsia alpina* (IV). The contribution of *Loiseleurio-Vaccinietea* characteristic species appears to be marginal for sharing the Roithinger's proposal (1996) of including the coenoses in this phytosociological class, the attribution to *Elyno-Seslerietea* remaining preferable (Grabherr *et al*., 1993).
Synecology: The plant community develops inside the glacio-karst system on windswept little knolls or few-square meters shelves lying often just above the dolina hollows and undergoing a lower and shorter snow cover. Therefore, it establishes catenal relationships

Tab. 4 - *Salicetum reticulato-breviserratae* ass. nova; holotypus rel. n° 72

N° of relevé	62	63	65	64	66	67	78	75	76	80	68	69	70	71	77	81	72	73	74	79	presences
Altitude (m a.s.l.)	1800	1920	1800	1910	1800	1800	1807	1710	1715	1715	1780	1780	1800	1850	1810	1783	1850	1855	1860	1740	
Exposure	S	SSO	NW	N	SW	NO	NO	SO	E	N	E	NO	N	S	NO	NE	NE	NO	NO	N	
Slope (°)	0	0-10	5-15	10	0-10	0-10	0-5	0-10	0-15	5	0-20	5	10	0-15	5	10	5	0-15	0-10	5	
Area (m^2)	8	6	10	9	10	10	16	30	20	6	10	15	10	16	9	4	20	10	10	15	
Coverage (%)	90	70	95	95	90	70	90	90	90	90	70	75	70	90	70	90	95	85	90	95	
N° of species	39	29	30	28	17	15	23	28	25	24	24	30	22	24	29	35	26	31	26	51	
																					fr%
diff. species of association																					
Salix breviserrata	4	2	5	4	4	4	4	4	4	4	4	3	3	2	2	4	3	3	3	2	100
Salix reticulata (All)	2	2	1	2	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	+	100
charact. species of *Soldanello-Salicion retusae* and *Arabidetalia*																					
Salix retusa	1	+	.	1	.	.	+	.	1	.	+	.	1	1	.	.	1	1	+	+	60
Galium baldense	+	+	+	+	.	.	+	.	.	+	.	.	.	.	+	+	1	+	+	+	60
Carex parviflora	.	.	.	.	+	+	.	+	.	.	.	+	+	+	+	.	+	.	.	+	45
Anemone baldensis	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	1	20
Gnaphalium hoppeanum/hoppeanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	15
Soldanella minima	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	5
charact. species of *Thlaspietea rotundifolii*																					
Onchophorus virens	.	.	.	.	1	.	.	+	.	+	.	.	.	.	1	.	.	1	+	.	30
Pohlia cruda	.	.	.	.	.	.	.	+	.	+	.	.	.	+	.	1	.	.	.	+	25
Hornungia alpina/alpina	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Veronica alpina	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	5
charact. species of *Elyno-Seslerietea*																					
Potentilla crantzii/crantzii	+	+	+	+	+	+	+	+	+	+	+	1	+	1	+	+	+	+	+	1	100
Ranunculus carinthiacus	+	+	+	+	1	+	+	+	.	.	.	+	+	1	.	.	+	+	.	+	70
Silene acaulis/longiscapa	1	+	+	+	.	.	.	.	.	+	.	+	1	1	+	+	+	+	+	+	70
Pedicularis verticillata	+	+	+	+	+	.	.	+	+	.	r	.	+	+	.	.	.	.	.	+	55
Sesleria caerulea/caerulea	1	+	+	+	.	.	.	+	.	+	.	.	.	+	+	.	.	.	.	+	45
Dryas octopetala/octopetala	+	1	1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	1	+	35
Bartsia alpina	+	1	1	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	+	30
Festuca quadriflora	.	+	.	+	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	r	30
Galium anisophyllon	.	.	.	.	.	.	.	+	.	.	+	+	.	+	.	+	.	.	.	.	25
Biscutella levigata/laevigata	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	15
Oxytropis jacquinii	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	.	.	.	.	+	15
Polygala alpestris	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15
Thesium alpinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	15
Agrostis alpina	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	10
Carex firma	1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	10
Carex ornithopoda	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	10
Hieracium villosum	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10
Myosotis alpestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	10
Anthyllis vulneraria/alpestris	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	5
Bellidiastrum michelii	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Draba aizoides	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	5
Erigeron glabratus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	5
Gentiana verna/verna	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Juncus trifidus/monanthos	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	5
Lotus corniculatus s.l.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	5
Minuartia verna/verna	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Senecio abrotanifolius/tiroliensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	5
charact. species of *Jucetea trifidi*																					
Luzula spicata/mutabilis	.	.	+	.	.	+	.	.	+	.	+	.	.	.	.	.	.	+	+	+	35
Geum montanum	.	.	.	.	.	.	+	.	.	.	+	+	+	.	.	.	.	.	.	+	25
Ligusticum mutellinoides	.	.	.	.	.	.	.	.	.	.	.	1	+	+	.	+	.	.	.	.	20
Agrostis rupestris	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	15
Potentilla aurea	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	10
Ajuga pyramidalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	5
Anthoxanthum odoratum/nipponicum	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	5
Euphrasia minima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	5
Pulsatilla vernalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	5
charact. species of *Carici-Kobresietea*																					
Carex atrata/atrata	.	.	.	+	1	1	+	+	+	+	.	1	+	1	.	.	1	.	.	+	60
Carex rupestris	.	.	.	+	+	+	+	+	+	.	.	+	+	1	.	+	+	.	1	.	60
Salix serpillifolia	.	.	1	.	.	.	.	.	.	.	1	+	1	+	.	.	.	.	.	.	25
Gentiana nivalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	5
Kobresia myosuroides	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	5
Saussurea alpina/alpina	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	5
charact. species of *Salicetea herbaceae*																					
Alchemilla fissa	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	10
Salix herbacea	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	10
Sagina saginoides	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	5
other species																					
Bistorta vivipara	+	+	1	.	1	1	+	+	1	+	1	1	1	1	+	+	1	1	1	+	95
Poa alpina/alpina	+	1	1	+	1	1	1	+	+	+	+	+	1	1	.	.	1	+	+	+	90
Vaccinium uliginosum/microphyllum	1	.	1	1	.	.	.	1	+	.	.	+	1	.	1	+	3	2	2	2	65
Viola biflora	1	.	.	.	.	+	+	+	+	+	+	+	.	.	+	+	.	.	.	.	50
Pinguicula alpina	1	+	.	.	.	.	+	+	+	.	.	.	1	.	.	+	.	+	.	.	40
Carex capillaris/capillaris	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	+	.	+	+	+	35
Homogyne alpina	+	+	+	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	35
Parnassia palustris/palustris	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	+	+	+	+	35
Selaginella selaginoides	.	.	.	+	.	.	.	+	.	+	.	.	.	.	.	+	.	1	1	+	35
Vaccinium vitis-idaea	+	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	+	+	+	35
Carex sempervirens	1	r	1	.	.	.	+	.	.	.	.	.	.	.	+	+	.	.	.	.	30
Carex montana	1	.	1	.	.	+	.	.	.	.	.	+	.	.	.	.	.	+	+	.	30
Pinus mugo/mugo	+	r	.	+	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+	+	30
Alchemilla glaucescens	+	.	1	+	1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	30
Antennaria dioica	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	+	.	1	.	.	20
Asplenium viride	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	20
Daphne striata	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	20
Luzula campestris	.	.	.	+	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	20
Campanula scheuchzeri/scheuchzeri	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	+	20
Kalmia procumbens	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	1	.	15
Trifolium badium	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	15
Carex brunnescens	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	10
Coeloglossum viride	.	.	r	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	10
Juniperus communis/nana	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	10
Larix decidua	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	10

Luzula sylvatica/sieberi	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	10
Potentilla erecta	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	10
Rhododendron ferrugineum	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	10
Trifolium pratense/nivale	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10
Trollius europaeus/europaeus	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	10
mosses and lichens																					
Cetraria islandica	+	1	1	1	+	+	1	+	+	+	+	+	1	.	+	+	+	1	1	+	95
Sanionia uncinata	+	1	1	1	+	1	+	1	1	1	1	1	1	1	1	1	1	.	.	+	90
Cladonia rangiferina	+	.	.	.	+	.	+	.	.	.	.	2	.	1	+	1	+	1	.	1	50
Cladonia convoluta	+	+	+	.	+	1	.	.	.	.	+	.	.	.	+	+	.	.	.	.	40
Distichium inclinatum	.	.	.	.	+	.	.	+	.	+	.	.	.	+	.	.	.	+	.	+	30
Polytrichum juniperinum	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	.	+	20
Bryum capillare	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	+	.	.	.	.	15
Pleurozium schreberi	.	.	.	+	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	15
Solorina saccata	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	15
Bryum pseudotriquetrum	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	10
Cladonia furcata	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	10

with *Salici-Caricetum* and *Salicetum reticulato-breviserratae*, presenting itself as a very heterogeneous plant community. The soil is 30-40 cm deep, with high humus content and a very strongly acid pH (about 4.5) in the first 3-4 cm and a reaction ranging between 5.1 and 5.9 in the underlying horizons. According to a classical vision, acidification would be caused by phenomena of humus accumulation and leaching responsible of the removal of carbonate ions from the upper levels, resulting in a gradual change from a basiphilous to an acidophilous vegetation (Braun-Blanquet & Jenni, 1926). However, in the north-eastern Alpine limestone plateaus has been highlighted as, in areas partially glaciated, tertiary soils have been enriched with aeolian sediments coming from neighboring siliceous sectors. This fact has contributed to the genesis of deep clay substrates with a more or less acidic reaction on which *Homogyno-Loiseleurietum* settles (Dullinger *et al*., 2000). Also the Asiago Plateau was affected by the contribution of loess consisting of minerals other than carbonate ones deposited by the wind from adjacent siliceous parts of the Valsugana and subsequently processed by water run-off during the process of deglaciation (Sauro, 2009). In particular, it is possible to assume that *Homogyno-Loiseleurietum* follows initial colonization stages of small flat shoulders by *Dryas octopetala*, as a result of the later entry of humus-producer species, such as *Agrostis alpina* and *Festuca quadriflora*, all entities well represented in our relevés. Whatever was the origin of these acidified islands, they favour the development of a dwarf shrub heath constituted primarily of *Ericaceae* (*K. procum-*

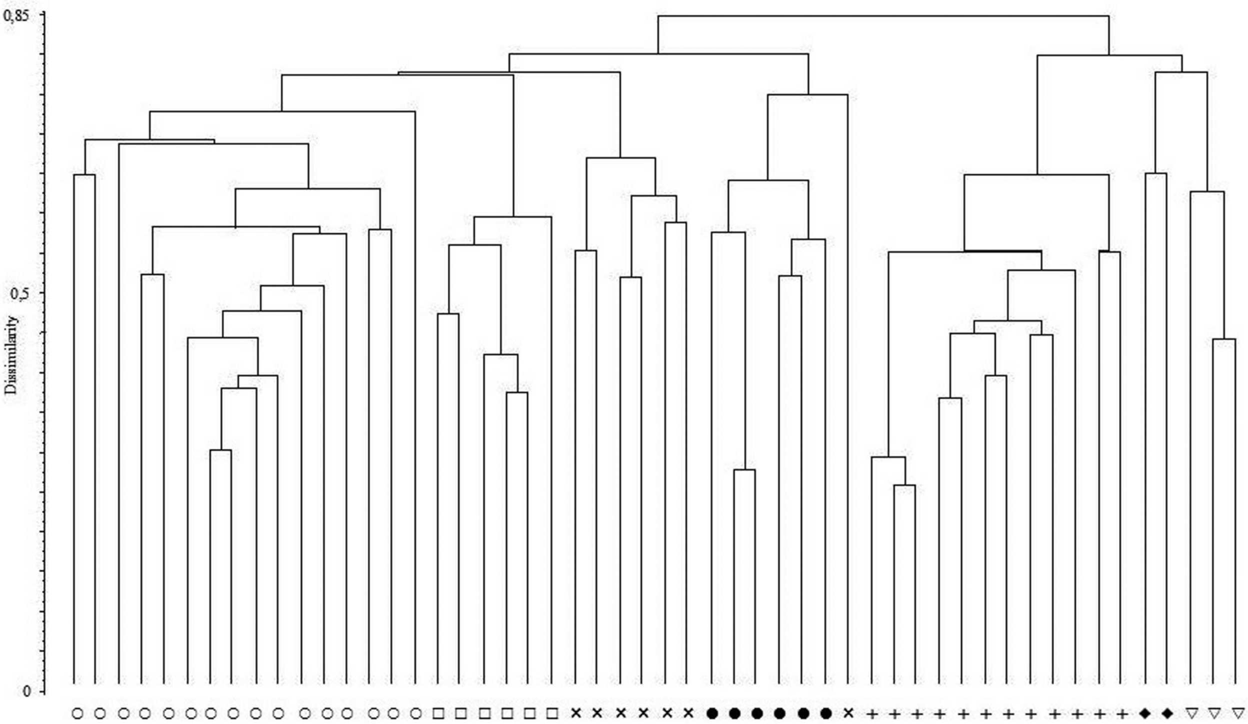


Fig. 10 – Classification of the *Kalmia*-dominated relevés from Alps (UPGMA, Jaccard index, binary data). Mosses and lichens included.

○: *Homogyno-Loiseleurietum* (Asiago Plateau; this study); □: *Homogyno-Loiseleurietum* (Dachstein; Pignatti-Wikus, 1959); ✕: *Homogyno-Loiseleurietum* (Lienz Dolomites; Wikus, 1961); ●: *Homogyno-Loiseleurietum* (Karawanks; Aichinger, 1933); +: *Cetrario-Loiseleurietum* (Valle del Braulio; Giacomini & Pignatti, 1955); ◆: *Elynetum loiseleurietosum* (Val Venegia; rel. 112 and 115 in tab. 11 in Boiti *et al*., 1989); ▽: *Elynetum loiseleurietosum* (Rätikon; rel. 5-7 in tab. 7 in Hartmann, 1971).

Tab. 5 – *Homogyno discoloris-Loiseleurietum procumbentis* Aichinger 1933 var. geogr. *Galium baldense*

N° of relevé	21	23	24	29	30	32	31	35	34	25	26	27	33	28	22	39	presences
Altitude (m a.s.l.)	2160	1850	2070	1951	2065	2025	2070	2070	2049	2100	2032	1958	1960	1963	2180	1640	
Exposure	N	NE	NE	N	N	N	N	E	NE	NNW	E	N	N	NW	N	N	
Slope (°)	25	10	15	5	15	5	5	3	10	15	5	5	5	5	10	5	
Area (m^2)	4	8	5	5	6	4	5	3	6	16	5	2	5	6	4	3	
Coverage (%)	100	95	90	100	100	90	90	100	100	90	100	90	100	100	100	100	
N° of species	18	25	31	33	36	35	37	30	24	31	35	39	35	45	33	23	fr%
diff. species of association																	
Kalmia procumbens (Loiseleurio-Vaccinietea)	4	3	4	4	3	4	4	4	4	3	4	4	4	4	4	2	100
Agrostis rupestris (Juncetea)	.	1	+	+	+	+	+	+	.	+	+	.	+	1	.	+	75
Carex ericetorum (loc.: Pyrolo-Pinetea)	.	.	.	+	+	+	+	1	+	+	.	1	+	1	.	+	69
Antennaria carpathica (loc.: Carici-Kobresietea)	.	.	1	+	+	1	+	.	.	+	+	+	+	.	+	.	63
Vaccinium vitis-idaea (Vaccinio-Piceetea)	.	.	.	+	+	1	+	1	.	.	+	+	.	.	.	+	50
charact. species of *Caricenion firmae*																	
Carex firma	+	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	19
charact. species of *Seslerion variae*																	
Festuca quadriflora	.	+	+	+	+	+	+	+	1	.	+	.	.	.	.	+	63
Potentilla crantzii/crantzii	.	.	.	+	+	+	+	+	+	.	+	+	+	.	.	+	63
Silene acaulis/longiscapa	+	+	+	+	.	+	.	.	+	+	+	.	.	.	+	.	56
Biscutella levigata/laevigata	+	.	.	.	+	.	.	.	.	.	.	+	.	+	+	.	31
Erigeron glabratus	.	.	+	.	.	.	.	.	.	1	.	.	.	+	.	.	19
Helianthemum oleandicum/alpestre	.	+	.	.	.	.	.	.	.	.	+	.	+	.	.	.	19
Senecio abrotanifolius/tiroliensis	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	19
Thesium alpinum	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	13
Juncus trifidus/monanthos	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	6
Pedicularis rostratocapitata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	6
Pulsatilla alpina s.l.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
Chamorchis alpina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	6
charact. species of *Elyno-Seslieretea*																	
Dryas octopetala/octopetala	1	1	+	+	+	+	+	+	+	+	1	+	+	+	.	+	94
Sesleria caerulea/caerulea	1	+	.	+	+	+	+	+	+	+	+	+	.	.	+	+	81
Agrostis alpina	.	.	1	.	+	+	+	+	+	1	+	1	+	.	+	+	75
Bellidiastrum michelii	+	.	.	+	+	+	+	+	+	.	1	+	+	+	+	.	75
Bartsia alpina	+	.	+	+	+	.	+	+	.	+	+	+	.	1	+	.	69
Anthyllis vulneraria/alpestris	.	.	+	.	+	.	+	+	.	+	.	+	.	+	.	.	44
Ranunculus carinthiacus	+	.	.	+	.	+	.	.	.	.	.	+	.	+	+	.	38
Lotus corniculatus s.l.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	13
Carex ornithopoda	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	13
Euphrasia salisburgensis	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	6
charact. species of *Loiseleurio-Vaccinietea*																	
Vaccinium uliginosum/microphyllum	1	2	1	1	2	2	1	+	1	2	1	+	1	1	+	1	100
Juniperus communis/nana	.	+	.	.	+	+	+	.	.	+	+	.	.	+	.	.	44
Arctostaphylos alpina	.	.	.	.	.	+	.	.	.	.	.	+	.	+	+	.	25
Calluna vulgaris	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	13
Empetrum nigrum/hermaphroditum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	6
charact. species of *Juncetea trifidi*																	
Potentilla aurea	+	+	1	+	+	+	+	+	.	1	.	+	+	.	.	.	69
Soldanella alpina/alpina	.	.	.	.	+	+	+	+	.	.	+	+	+	+	.	.	50
Euphrasia minima	.	.	.	.	.	+	.	+	+	1	.	.	+	+	+	.	44
Ligusticum mutellinoides	.	.	.	.	1	+	+	+	+	.	.	.	.	.	.	.	31
Avenula versicolor	.	.	.	.	.	.	.	1	.	.	+	1	.	1	+	.	31
Leontodon helveticus	.	.	.	.	.	1	+	.	.	.	.	.	+	+	.	.	25
Pulsatilla vernalis	.	+	.	.	.	.	.	.	.	.	.	+	1	+	.	.	25
Phyteuma hemisphaericum	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	19
Geum montanum	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	6
Juncus trifidus/trifidus	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	6
charact. species of *Vaccinio-Piceetea*																	
Homogyne alpina	1	+	.	+	1	+	+	+	.	+	+	+	+	+	1	.	81
Rhododendron ferrugineum	+	.	.	.	+	+	.	+	.	+	1	.	.	+	.	.	44
Vaccinium myrtillus	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	13
Luzula sylvatica/sieberi	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	13
Lycopodium annotinum	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	13
Lonicera caerulea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	6
charact. species of *Nardetea strictae*																	
Antennaria dioica	.	.	1	+	.	.	.	.	.	.	+	+	+	+	.	.	38
Nardus stricta	.	.	.	.	.	.	1	.	.	.	.	+	+	+	.	.	25
Arnica montana/montana	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	13
Hieracium lactucella	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	6
charact. species of *Carici-Kobresietea*																	
Carex rupestris	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	+	25
Kobresia myosuroides	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	.	19
Salix serpillifolia	.	.	+	.	.	.	.	.	.	.	.	.	.	+	1	.	19
Carex atrata/atrata	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	13
Saussurea alpina/alpina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
charact. species of *Thlaspietea rotundifolii*																	
Salix retusa	+	.	1	1	+	+	+	+	1	1	+	+	+	+	.	.	81
Salix reticulata	1	1	+	+	+	.	.	+	+	1	+	.	+	.	+	.	69
Galium baldense	.	+	+	+	+	+	+	+	+	.	+	+	+	.	.	.	69
Minuartia sedoides	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	19
Anemone baldensis	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	19
Carex parviflora	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	13
Gnaphalium hoppeanum/hoppeanum	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
other species																	
Selaginella selaginoides	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	94
Bistorta vivipara	+	1	1	+	+	+	+	.	+	1	+	+	.	+	+	+	88
Pinus mugo/mugo	.	.	+	+	+	+	+	r	+	+	1	+	r	+	.	.	75
Campanula scheuchzeri/scheuchzeri	.	.	1	+	+	+	+	+	.	.	+	+	+	+	1	+	75
Parnassia palustris/palustris	+	+	1	+	+	.	.	.	+	.	+	+	.	.	.	+	56
Carex sempervirens	.	.	+	.	+	.	+	.	+	+	+	+	.	+	+	.	56

Salix breviserrata	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	1	19
Leontodon hispidus	.	.	.	.	+	.	.	.	+	.	.	.	.	+	.	.	19
Carex montana	.	+	.	.	.	.	.	.	.	.	.	.	1	1	.	.	19
Daphne striata	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	.	19
Carex capillaris/capillaris	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	19
Thymus praecox/polytrichus	.	.	.	.	.	.	.	+	.	.	.	+	+	.	.	.	19
Salix hastata	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	13
Saxifraga aizoides	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	13
Festuca rubra/rubra	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	13
mosses and lichens																	
Cladonia rangiferina	1	1	+	+	+	+	+	.	.	1	+	+	1	+	1	+	88
Cetraria islandica	.	+	+	+	+	+	+	+	+	+	.	+	1	+	+	+	88
Cladonia pyxidata	.	.	.	+	+	+	+	+	.	.	+	.	.	+	.	.	44
Cladonia arbuscula	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	2	19
Cladonia deformis	.	.	+	.	.	+	.	.	.	+	.	.	.	.	.	.	19
Polytrichum juniperinum	.	.	.	+	.	+	.	.	.	.	+	.	.	.	.	.	19
Cladonia digitata	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	13
Cladonia furcata	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	13

bens, Vaccinium sp.pl.) and lichens (*Cladonia* sp. pl., *Cetraria islandica*) and characterized by marked cryoxerophytism. For the same reason characteristic silicicolous species of *Juncetea trifidi, Vaccinio-Piceetea, Loiseleurio-Vaccinetea* and *Nardetea strictae* are well represented. The coexistence, without a clear segregation, of elements of *Carici-Kobresietea* and *Loiseleurio-Vaccinietea* reflects the vegetational mosaic of arctic tundra as already noted in relation to *Elynetum loiseleurietosum* by Grabherr *et al*. (1993). This coenoses, which occupies surfaces of few square meters, can therefore be interpreted as a reminiscence of arctic tundra inherited from the Quaternary glaciation. In the north-eastern calcareous Alps, Dullinger *et al*. (2000) emphasize the great competitive ability of *Festuca quadriflora, Agrostis alpina, Agrostis rupestris* and *Oreochloa disticha* which are able to settle down on more or less isolated acidic patches – persistance of tertiary relict brown, loamy soils with a high silt fraction – in the midst of a calcareous environment. They replace the keystone species of the cryorotemperate vegetation (*Carex sempervirens, Sesleria caerulea, Carex firma*) if habitat features deviate from the prevailing environmental conditions of climax stands, originating *Festuca quadriflora-Agrostis alpina* or *Caricion curvulae* coenoses and also *Homogyno discoloris-Loiseleurietum*. *Festuca quadriflora-Agrostis alpina* alpine grasslands and *Caricion curvulae* vegetations were remarked also in the nord side of the Asiago Plateau and with *Homogyno-Loiseleurietum* could very probably represent patterns comparable with those described by Dullinger *et al*. (2000).

Synchorology: The association has its main distribution area in the north-eastern calcareous Alps (Pignatti-Wikus, 1959; Wikus, 1961; Wendelberger, 1962; 1971; Greimler & Dirnböck, 1996; Dirnböck & Greimler, 1997; Dullinger *et al*., 2001) but sporadically occurs also along the southern Alps (Dullinger *et al*., 2000). Its occurence in the outermost southern carbonate alpine chain is here proved and it is likely that its distribution may involves other prealpin mountain ranges with high altitude plateau (e.g. Vette Feltrine, M. Pasubio).

Natura 2000: 4060.

EMPETRO VACCINIETUM-GAULTHERIOIDES MUGETOSUM Oberdorfer 1992 (Tab. 6)

Differential species: *Empetrum nigrum* subsp. *hermaphroditum* (subdom.), *Kalmia procumbens, Arctostaphylos alpina*.

Floristic composition: Also this cenose appears as a thick and prostrate dwarf shrub, whose physiognomy is given by *Empetrum nigrum* subsp. *hermafroditum, Vaccinium uliginosum* subsp. *microphyllum and Kalmia procumbens*. Interposed between the *Ericaceae* and boulders the showy swellings of the rare *Sphagnum quinquefarium* develop, but the community is very rich in other bryophytes and lichen, among which *Hylocomium splendens, Polytrichum strictum, Cladonia rangiferina* and *Cetraria islandica* are distinguishable for constancy and coverage. Also significant is the presence of specimens of *Pinus mugo* constituting a clear dynamic relationship with *Sphagnum*-rich *Pinus mugo* scrubs. The average species number in the stands is 33.7, with bryophytes and lichens well-represented and slightly exceeding 35% (12 per relevé).

Life forms and chorotypes: Among the described phytocoenoses, it is the only in which the chamaephytes prevail over hemicryptophytes as presence/absence data (42.6% vs. 34.4%) and even more on the basis of coverage (50.3% vs. 28.4%). Similarly, nanophanerophytes and phanerophytes attain here the highest values among those reported (4.9 and 13.1% vs. 3.9 and 11.6%). Unique is also the codominance of Arctic-Alpine and eurosiberian/North American chorotypes (31.1% vs. 29.5% presence/absence data, 39.4% vs. 32.9% coverage data), the latter being here at the highest level, comparable only to *Sieverso-Nardetum*. The rate of southern European orophytes are much lower, in particular on the basis of coverage data (19.7% vs. 16.8%).

Syntaxonomy: Despite the few data, the detected vegetation typology can be attributed to *Empetro-Vaccinietum gaultherioides* and more particularly to the subass. mugetosum described by Oberdorfer (1992) on the basis of some relevés from the limestone Berchtesgaden Alps. Of the original formulation, our relevés retain the species listed by the author as characteristics

Tab. 6 - *Empetro-Vaccinietum gaultherioides mugetosum* Oberdorfer 1992

N° of relevé	36	38	37	fr% presences
Altitude (m a.s.l.)	1655	1660	1650	
Exposure	NE	N	NE	
Slope (°)	20	25	20	
Area (m²)	20	20	20	
Coverage (%)	80	80	90	
N° of species	28	33	40	
diff. species of association				
Empetrum nigrum/hermaphroditum (C)	1	2	2	100
Kalmia procumbens (All)	2	+	.	67
Arctostaphylos alpina (All)	.	1	.	33
diff. species of subass. *mugetosum*				
Pinus mugo/mugo	1	1	+	100
Lycopodium annotinum	1	1	+	100
Lonicera caerulea	+	+	+	100
charact. species of *Loiseleurio-Vaccinietea* (C)				
Vaccinium uliginosum/microphyllum	1	2	2	100
Sphagnum quinquefarium	1	1	1	100
Juniperus communis/nana	.	.	+	33
charact. species of *Vaccinio-Piceetea*				
Vaccinium vitis-idaea	1	1	1	100
Vaccinium myrtillus	1	1	+	100
Moneses uniflora	+	.	+	67
Homogyne alpina	.	.	1	33
Rhododendron ferrugineum	.	.	+	33
charact. species of *Elyno-Seslieretea*				
Dryas octopetala/octopetala	+	+	+	100
Sesleria caerulea/caerulea	.	.	+	33
Bartsia alpina	.	.	+	33
Lotus corniculatus s.l.	.	.	+	33
Galium anisophyllon	.	.	+	33
charact. species of *Carici-Kobresietea*				
Carex rupestris	1	+	.	67
Carex atrata/atrata	+	.	+	67
Salix serpillifolia	.	.	+	33
charact. species of *Juncetea trifidi*				
Potentilla aurea	.	.	+	33
other species				
Bistorta vivipara	1	1	1	100
Salix reticulata	1	1	+	100
Salix breviserrata	+	+	+	100
Carex sempervirens	+	+	+	100
Salix hastata	+	+	.	67
Alnus viridis/viridis	+	r	.	67
Viola biflora	.	+	1	67
Salix retusa	.	.	1	33
Leontodon hispidus	.	.	+	33
Campanula scheuchzeri/scheuchzeri	.	.	+	33
Carex capillaris/capillaris	.	+	.	33
Pinguicula alpina	.	+	.	33
mosses and lichens				
Cladonia rangiferina	1	1	1	100
Cetraria islandica	1	1	1	100
Hylocomium splendens	1	1	1	100
Polytrichum strictum	1	1	1	100
Brachythecium salebrosum	+	+	+	100
Pleurozium schreberi	+	+	+	100
Sanionia uncinata	+	+	+	100
Polytrichum commune	1	1	.	67
Cladonia pyxidata	+	.	+	67
Polytrichum juniperinum	.	+	+	67
Dicranum scoparium	.	+	+	67
Rhytiadelphus squarrosus	.	+	+	67
Tortella tortuosa	.	+	+	67

of the association and also those reported as differential of the subassociation: *Pinus mugo, Lycopodium annotinum* and *Lonicera caerulea*, the last two transgressive from class *Vaccinio-Piceetea*. However, the gathering of new original material appears necessary to make clear the syntaxonomical reference of this very rare vegetation typology at the borders of Southern Alpine Chain.

Synecology and synchorology: The three stands refer to a single location (Spitz Keserle) where the coenose colonizes some tens of square meters of Monte Zugna Formation large blocks landslide which originated on the north-facing slope of a wide depression. The altitude (1640-1660 m) is unusually low for the coenoses, but the site is one of the most cold and wet locations of the study area, where the snow remains long. Among the *Sphagnum* species, *S. quinquefarium* better tolerates occasional drought conditions and prefers shaded, relatively nutrient richer substrates (Šibik *et al.*, 2008). The shallow soil is a podsol with a partially decomposed 3 cm-thick litter and a surface layer showing a reaction very strongly acid (4.50). The stands are in dynamic contact with the *Empetrum* variant of the *Pinus mugo* shrub community occupying extremely severe sites, a very rare formation known for a few other locations in the south-eastern Alps (i.e. Razzo-Sauris Plateau; Poldini, 1998).

The association is spread throughout the Alps over downwind bumps of siliceous matrix often in contact with *Cetrario-Loiseleurietum*, but it is very rare on carbonate lithological substrates (Oberdorfer, 1992; Grabherr, 1993b). In the south-eastern Alps there are apparently no other available relevés.

Natura 2000: 4060.

SALICETUM RETUSO-RETICULATAE Br.-Bl. in Br.-Bl. & Jenny 1926 (Tab. 8)

Differential species: *S. reticulata* (subdom.)

Floristic composition: The physiognomy of the phytocoenose is characterized by the two cryophilic eponymous species *Salix retusa*, usually with higher coverage, and *Salix reticulata*. Besides the two willows, also *Silene acaulis* ingressive from *Elyno-Seslerietea, Selaginella selaginoides, Leontodon hispidus, Carex sempervirens* and *Saxifraga aizoides* among the companions, finally, *Sanionia uncinata, Cetraria islandica* and *Distichium inclinatum* among non spermophytes are in V-IV frequency class. The average species number per relevé amount to 29.1.

Life forms and chorotypes: Hemicryptophytes (67.9% presence/absence data, 59.4% coverage data) and chamaephytes (26.6% vs. 35.8%) account for about 95% of total biological spectrum. With respect to the other cenosis, it should be noted the high rate of southern European orophytes, here at the highest values both in terms of presence/absence data and in relation to coverage data (43.8% and 46.8%; Fig. 17). It is the only Salix-dominated chamaephytic association in which the Arctic-Alpine contingent is subordinate to the southern European orophytes.

Syntaxonomy: The *S. retusa*- and *S. reticulata*-dominating relevés developing in the bottom of depressions are attributed to *Salicetum retuso-reticulatae* also on the basis of the comparison with similar *S. retusa*-predominating communities from neighboring Alpine areas. Multivariate analysis puts our relevés in the cluster that includes the lectotype of the plant community

Tab. 7 – Chorological spectra of *Salicetum retuso-reticulatae* from different alpine provenances. For data provenances see Fig. 12. Some chorotypes are grouped according to Appendix II. Presence/absence data. Mosses and lichens excluded.

	Asiago Plateau	Vette di Feltre	Val Venegia	Carnic Prealps and Alps	Erera-Brendol-Campotorondo	Mt. Baldo	Dachstein	Rhaetian Alps
alp	3,3	0,8	7,9	5,9	3,3	3,9	7,5	8,3
art-alp	22,4	25,6	22,5	19,0	26,7	19,6	18,9	20,8
cosmop	1,1	0,0	1,1	0,0	3,3	1,0	0,9	0,0
e-alp	7,2	4,8	12,4	12,3	18,3	8,8	8,5	0,0
eur	6,1	1,6	4,5	3,3	1,7	4,9	4,7	8,3
eurosib/n-am	12,2	12,8	6,7	10,0	6,7	8,8	11,3	3,3
se-eur-m	2,2	1,6	2,2	5,6	1,7	2,0	3,8	4,2
s-eur-m	43,2	52,8	40,4	40,5	38,3	51,0	44,3	49,2
sw-eur-m	0,8	0,0	0,0	2,6	0,0	0,0	0,0	4,2

(English, 1999) coming from Rhaetian Alps (Braun-Blanquet & Jenny, 1926; Fig. 11). English (1999) reaffirms the occurrence of the coenoses also in the Southern Alps in the light of some of the relevés carried out by Poldini & Martini (1994), though the author attributes most of them to *Homogyno-Salicetum*. Instead, the relevés from Friuli – except two (Carnic Prealps; rel. 1 and 2 in Tab.1 in Poldini & Martini, 1994) that do not join the *Homogyno-Salicetum* but the recently described *Salici-Geranietum argentei* from Julian Alps (Surina, 2005a) – are groupped in the cluster representing *Salicetum retuso-reticulatae* (Fig. 11). Even the hypothesized placement in *Homogyno-Salicetum* (English, l.c.) of the relevés originally attributed by Pignatti-Wikus (1959) to *Salicetum retuso-reticulatae* would not confirmed by our processing that however takes into account fewer and later pubblished data. Indeed, they are grouped in cluster A containing the lectotype of *Salicetum retuso-reticulatae* and not aggregated to the cluster B which includes the lectotype of *Homogyno-Salicetum*. Finally, also the stands from M. Baldo (Gerdol & Piccoli, 1982), very close to our, are separated from *Salicetum retuso-reticulatae* by English (l.c.) without putting forward an alternative syntaxonomical interpretation. Thus, the syntaxonomical relationships existing between the mentioned plant communities in the Southern Alps still appear susceptible of clarification. This remark does not preclude a temporary attribution of the phytocoenoses from Asiago Plateau to the classical snow-bed association on carbonate rocks. The inclusion in *Soldanello-Salicion* is proved by the sharing of numerous entities contained in the typical species combination of the alliance (English, l.c.). Besides the dominant and characteristics *Salix retusa* and *S. reticulata*, the most abundant and frequent are *Elyno-Seslerietea* species (*Silene acaulis, Festu-*

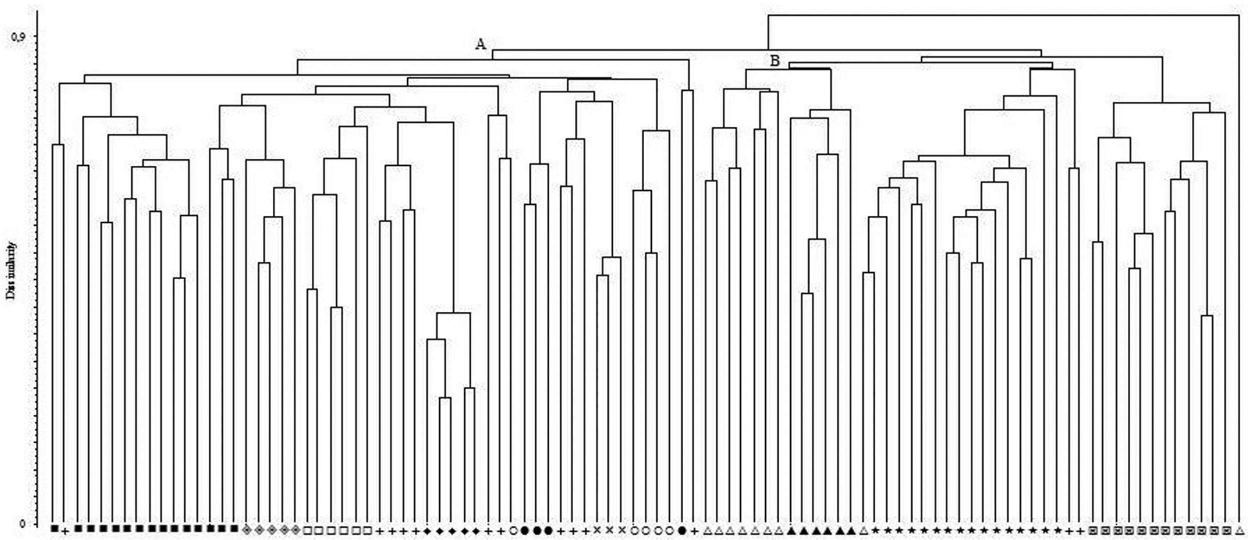


Fig. 11 – Dendrogram of *Salix retusa* and/or *S. reticulata*-dominated relevés from the Alps. (UPGMA, Jaccard index, binary data). Mosses and lichens excluded. ■: Asiago Plateau (this study); +: Carnic Prealps and Alps (Tab. 1 in Poldini & Martini, 1994); ◇: Mt. Baldo (Tab. 4 in Gerdol & Piccoli, 1982); □: Vette Feltrine (Tab. III in Tomaselli *et al*., 2005); ×: Erera-Brendol-Campotorondo (Lasen, 1983); •: Val Venegia (rel. 120, 123, 148, 173 in Boiti *et al*., 1989); △: Mt. Krn-Julian Alps (Tab. 12 in Surina, 2005a); ▲: Karawanks (Aichinger, 1933); ★: Mt. Krn-Julian Alps (Tab. 11 in Surina, 2005a); ○: Dachstein (Pignatti-Wikus, 1959); ◆: Rhaetian Alps (Braun-Blanquet & Jenny, 1926); ⊠: *Diantho alpinae-Salicetum retusae* (English, 1999). A: *Salicetum retuso-reticulatae*; B: *Homogyno discoloris-Salicetum retusae*.

Tab. 8 – *Salicetum retuso-reticulatae* Br.-Bl. in Br.-Bl. & Jenny 1926

N° of relevé	41	42	43	44	52	45	48	47	55	53	54	46	49	51	50	presences
Altitude (m a.s.l.)	2140	2205	2120	2122	1985	2100	2140	2100	2062	2015	2035	2105	1853	1783	1790	
Exposure	N	N	NW	N	NW	N	NNE	N	N	NW	NW	NW	W	N	N	
Slope (°)	10	30	0-10	15	10	15	15	15	10	10	5	10	10	5	10	
Area (m^2)	10	20	6	20	10	6	6	6	6	10	10	6	4	3	4	
Coverage (%)	60	90	90	90	100	80	90	90	60	80	60	80	100	90	100	
N° of species	19	40	33	26	49	25	30	25	25	30	28	21	27	28	31	
																fr%
diff. species of association																
Salix reticulata (All)	1	2	+	1	2	2	1	2	1	2	2	+	2	1	1	100
charact. species of *Soldanello-Salicion retusae* and *Arabidetalia*																
Salix retusa (All)	2	2	4	4	3	2	4	3	3	2	2	4	4	3	3	100
Galium baldense	.	+	+	+	+	+	1	.	+	+	+	.	.	+	+	73
Carex parviflora	.	.	+	1	+	.	.	+	+	+	+	.	.	+	.	53
Soldanella minima	.	+	.	1	.	+	1	1	+	+	.	+	.	.	.	53
Carex ornithopodioides	.	+	+	.	.	.	.	.	+	+	+	.	.	.	.	33
Anemone baldensis	.	1	.	.	+	.	.	1	.	+	+	.	.	.	.	33
Gnaphalium hoppeanum/hoppeanum	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	20
Saxifraga androsacea	.	+	.	.	+	.	.	.	.	.	.	.	.	.	+	20
Arabis caerulea	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	13
Potentilla brauneana	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	7
charact. species of *Thlaspietea rotundifolii*																
Pohlia cruda	.	+	.	.	+	.	+	.	.	.	.	.	+	+	+	40
Moehringia ciliata	+	+	.	.	.	.	.	.	.	+	+	.	+	.	.	33
Minuartia sedoides	+	.	.	+	+	1	.	.	.	.	.	.	.	.	.	27
Cerastium carinthiacum/austroalpinum	.	.	.	.	+	.	1	.	+	.	1	.	.	.	.	27
Hornungia alpina/alpina	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	20
Veronica alpina	.	.	.	+	.	.	.	.	.	.	.	1	.	.	+	20
Arabis alpina	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	13
Doronicum grandiflorum	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	7
Minuartia austriaca	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	7
charact. species of *Elyno-Seslerietea*																
Silene acaulis/longiscapa	+	+	1	+	+	1	1	+	+	+	+	+	+	+	+	100
Festuca quadriflora	+	+	.	.	+	1	+	1	+	1	+	.	.	.	.	60
Dryas octopetala/octopetala	.	.	+	.	+	+	.	+	+	+	.	+	.	.	.	47
Ranunculus carinthiacus	.	+	.	+	+	+	.	.	.	.	.	.	+	+	.	40
Bellidiastrum michelii	.	+	.	.	+	.	.	.	+	+	.	+	.	.	.	33
Helianthemum oleandicum/alpestre	+	+	+	.	.	.	.	+	+	.	.	.	.	.	.	33
Myosotis alpestris	.	+	+	.	+	.	+	.	.	.	.	.	.	.	+	33
Anthyllis vulneraria/alpestris	.	.	+	+	+	.	.	+	.	.	.	.	.	.	.	27
Bartsia alpina	.	+	.	.	+	.	.	.	.	+	.	1	.	.	.	27
Carex firma	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	27
Potentilla crantzii/crantzii	.	+	.	.	.	+	.	.	.	.	.	.	+	.	+	27
Saxifraga exarata/moschata	.	.	.	.	.	+	.	1	+	.	+	.	.	.	.	27
Erigeron glabratus	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	20
Juncus trifidus/monanthos	.	.	r	.	+	.	r	.	.	.	.	.	.	.	.	20
Sesleria caerulea/caerulea	.	.	.	.	.	r	.	.	.	+	+	.	.	.	.	20
Trifolium thalii	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	20
Carex ornithopoda	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	13
Draba aizoides	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	13
Lotus corniculatus s.l.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	13
Pedicularis rostratocapitata	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	13
Saxifraga caesia	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	13
Achillea clavenae	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	7
Euphrasia salisburgensis	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	7
Galium anisophyllon	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	7
Gentiana verna/verna	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	7
Pedicularis verticillata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	7
Veronica aphylla	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	7
charact. species of *Jucetea trifidi*																
Euphrasia minima	1	+	1	+	+	.	.	.	.	.	.	.	+	.	.	40
Soldanella alpina/alpina	.	+	.	.	+	.	.	.	.	.	.	.	+	+	+	33
Agrostis rupestris	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	13
Luzula spicata/mutabilis	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	13
Botrychium lunaria	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	7
Ligusticum mutellinoides	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	7
Potentilla aurea	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	7
charact. species of *Carici-Kobresietea*																
Carex atrata/atrata	.	+	+	.	+	1	+	.	.	.	.	.	.	.	.	33
Salix serpillifolia	2	.	.	.	.	.	.	.	.	+	.	.	.	.	.	13
Gentiana nivalis	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	7
charact. species of *Salicetea herbaceae*																
Alchemilla fissa	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	13
Salix herbacea	.	.	.	.	.	.	.	.	.	.	.	.	.	+		13
Sagina saginoides	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	7
other species																
Selaginella selaginoides	.	.	+	1	+	1	1	1	+	+	1	+	1	1	1	87
Carex sempervirens	.	.	+	+	+	+	+	+	.	+	+	.	+	+	+	73
Leontodon hispidus	.	.	+	+	1	.	.	1	+	+	+	+	+	.	+	67
Saxifraga aizoides	+	+	1	.	+	.	+	+	.	.	+	+	.	+	+	67
Viola biflora	.	.	1	+	+	+	+	+	+	+	.	+	.	.	.	60
Carex capillaris/capillaris	+	.	.	.	+	+	+	.	.	.	+	.	+	+	.	47
Silene pusilla	.	+	.	.	+	.	+	.	+	+	+	+	.	.	.	47
Homogyne alpina	.	+	.	.	.	.	.	.	.	+	+	.	+	+	+	40
Parnassia palustris/palustris	.	+	.	.	+	.	.	.	.	.	+	.	+	+	+	40
Asplenium viride	.	.	+	.	.	.	+	.	r	+	+	.	.	.	.	33
Campanula scheuchzeri/scheuchzeri	.	.	+	.	.	+	+	+	.	.	.	+	.	.	.	33
Vaccinium uliginosum/microphyllum	.	.	.	.	1	.	.	.	.	+	.	+	+	.	.	27
Cystopteris fragilis	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	20
Festuca alpina/alpina	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	20
Salix breviserrata	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	20
Thymus praecox/polytrichus	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	20

Poa alpina/alpina	.	1	.	.	.	.	.	.	r	.	.	.	.	.	.	13
Alchemilla connivens	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	13
Alchemilla glaucescens	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	13
Pinguicula alpina	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	13
Salix waldsteiniana	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	13
Saxifraga paniculata	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	13
mosses and lichens																
Sanionia uncinata	+	+	+	+	+	+	+	+	+	+	+	+	1	2	1	100
Cetraria islandica	.	+	+	+	+	.	+	+	+	.	.	.	+	+	+	67
Distichium inclinatum	+	.	.	+	+	+	+	+	+	+	+	+	.	.	.	67
Cladonia convoluta	+	.	.	+	+	+	.	+	+	.	.	.	.	.	+	47
Brachythecium glareosum	+	.	+	.	.	+	+	.	.	+	.	+	.	.	.	40
Cladonia furcata	+	+	.	.	.	.	+	.	.	.	.	.	+	.	.	27
Polytrichum juniperinum	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	27
Climacium dendroides	.	.	.	.	.	+	+	.	.	.	.	.	1	1	.	27
Cladonia digitata	+	.	.	.	.	.	.	+	.	.	.	.	.	+	.	20
Distichium capillaceum	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	13

ca quadriflora), whereas the majority of the entities belonging to the upper syntaxonomical ranks comes from the diagnostic species group of *Arabidion*, with the exception of *Carex ornithopodioides, C. parviflora* and *Saxifraga androsacea*, the latter two shared by the two alliances.

Synecology: The plant community exhibits evident chionophilous features. The stands located on the left side of the first RDA axis (Fig. 18) and the associate inter-set correlation values (Tab. 15) suggest that, with respect to the other two willow chamaephitic coenoses *Carici-Salicetum breviserratae* and *Potentillo dubiae-Homogynetum discoloris, Salicetum retuso-reticulatae* occurs at higher altitudes (mean: 2307 m) and on wetter soils, i.e in sites with prolonged snow cover. Their positioning in the negative part of the second axis is correlated with higher pH values. These are the consequence of a preferential position on the side of hollows or depressions where geomorfological aspects favoring removal phenomena instead of accumulation ones induce a more marked influence of the carbonate lithological matrix. However, the cenosis grows in sites characterized by the the cumulation of thin clasts, a situation that results in its presence also as catenal contact with *Salici reticulato-breviserratae*. In the dolina environment there are scarce available small-size clasts suitable for the association, as the landscape is dominated by large-size scree. Only in correspondence of small landslide channels inside wider depressions, especially where White or Dolomitic Limestones emerge, in the north-west of the subcontinental enclave, take place soil conditions suitable for the cenosis development.

Synchorology: The plant community is widely distributed throughout the Alps. Based on the results of the classification of Fig. 11 and after grouping suitably some chorotype elements (Appendix II), the chorological spectra of *Salicetum retuso-reticulatae* from different alpine provenances (Tab. 7) were compared using a PCA (Fig. 12). The result is a certain homogeneity of the coenose especially with regard to the rate of both the most significant arctic-alpine group appearing little different between the various locations (range 18.9% -26.7%; Asiago Plateau: 22.4%) and the most represented orophytic southern European contingent (range 38.3% -52.8%; Asiago Plateau: 43.2%). Nevertheless, the sites are distributed along the first axis with a weak gradient E-W with the Erera-Brendol-Campotorondo group in the Alpi Feltrine set on the left of the diagram and Rhetian Alps on the right side. The first provenance displays an higher percentage of eastern Alpine components (18.3%; conversely null in the second provenance), the second one is affected by orophytic south-western species (4.2%; conversely null in the first provenance). Yet, the strong discrepancy in east-Alpine species weight between the two contributions centered in the Alpi Feltrine appears unclear (4.8% vs. 18.3%; Tomaselli *et al*., 2005; Lasen, 1983). Moreover, the Alpine contingent differs among the provenances being higher in the inner Alps than in the outer Alps. Both the classification (Fig. 11) and the ordination (Fig. 12) reveal a greater affinity of the relevés from the Asiago Plateau with those from Mt. Baldo (Gerdol & Piccoli, 1982). In dolinas and glaciokarst depressions of the study area the coenoses can therefore be interpreted as extrazonal, uncommon and impoverished in its typical floristic composition due to the marginality of the area itself, but also to the negative selection on plants caused by coarse debris derived from Calcari Grigi dissolution.

Natura 2000: 4080.

POTENTILLO DUBIAE-HOMOGYNETUM DISCOLORIS Aich. 1933 (Tab. 9)

Local differential species: *Salix herbacea* (subdom.), *Potentilla brauneana*.

Floristic composition: The physiognomy of the coenose is characterized by *Salix herbacea* whose coverage however is almost never very high and in some relevés it is lesser or equalling the values of *Salix reticulata*. Remarkable is the contribution in numbers and covering of mosses and lichens with *Sanionia uncinata, Polytrichum juniperinum* and *Pohlia cruda* constantly represented, the first species reaching even high coverage values. Among vascular species, *Salix retusa, Bistorta vivipara* and *Poa alpina* occur with absolute fidelity. Very common are also *Carex parviflora, Sibbaldia procumbens, Agrostis rupestris* and *Distichium inclinatum*. The mean species number for relevé ave-

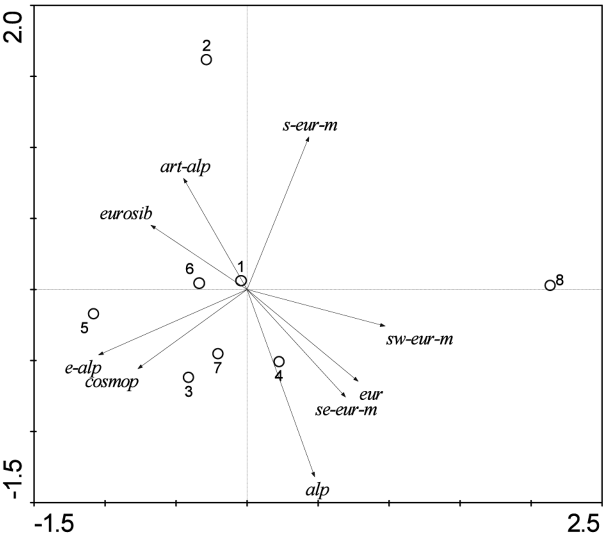


Fig. 12 – PCA of *Salicetum retuso-reticulatae* different provenences in relation to chorotypes (1° axis accounts for 59.7% of total variance; 2°axis: 19.1%). Presence/absence data and some chorotype grouped according to Appendix II. Mosses and lichens excluded. 1: Asiago Plateau (this study); 2: Vette Feltrine (Tomaselli *et al*., 2005); 3: Val Venegia (Boiti *et al*., 1989); 4: Carnic Prealps and Alps (only rel. in cluster A of Fig. 11; Poldini & Martini, 1994); 5: Erera-Brendol-Campotorondo (Lasen, 1983); 6: Mt. Baldo (Gerdol & Piccoli, 1982); 7: Dachstein (Pignatti-Wikus, 1959); 8: Rhaetian Alps (Braun-Blanquet & Jenny, 1926).

rages at 30.7.

Life forms and chorotypes: Hemicryptophytes constitute the framework of the association with 63.4% and 58.3% of species and coverage respectively, but chamaephytes are fairly well represented too (26% vs. 32.4%). Among the chionophilous *Salix* dwarf shrubs of the Asiago Plateau, *Potentillo-Homogynetum* is the one with the highest rate of Arctic-Alpine species (35.2% presence/absence data; 41.3% coverage data), which is by far the the element most represented, followed by southern European orophytes (30.3% vs. 27.8%) and euro-siberian/North American species group (18%).

Syntaxonomy: The *Salix herbacea*-rich relevés are characterized by a balanced sharing of acidophilous species, characteristic of snow bed on siliceous substrates (*Salicetea herbaceae*), and calcicolous elements characteristic of snow bed on limestone rocks (*Soldanello-Salicion, Arabidion*). To seal this peculiar combination, already known in the literature, English (1999) established for the Alps the *Salici herbaceae-Arabidion* alliance, which includes the snow bed vegetation on limestone substrates rich in humus and separating it from the Salicion herbaceae thriving on siliceous substrates. Although belonging to *Arabidetalia*, the alliance constitutes, to some extent, a term of transition between *Arabidion* and *Salicion herbaceae* (English, 1999; Surina, 2005b). The separation between synthetic tables with a predominant *Salix herbacea* from carbonate matrix (cluster 1) rather than siliceous one (cluster 2) is confirmed by the dendrogram of Fig. 13. Cluster 1 can be divided in two subclusters: subcluster 1a includes synthetic tables from Asiago Plateau, Vette Feltrine, Dachstein and Wettersteingebirge in northern calcareous Alps. The relevés from Dachstein are referred by English (1999) to *Potentillo-Homogynetum discoloris* (*Soldanello-Salicion*) and more precisely to a *Soldanella pusilla-Salix herbacea* community (Ausbildung) whose syntaxonomical ranking, maybe subassociation, has to be investigated (English in litt.). The subcluster 1b comprehends the relevés originally ascribed by Wikus (1960) to *Arabidetum coeruleae* typicum. Later they were attributed to *Salici herbaceae-Arabidetum caeruleae* that English (1999) formalized inside *Salici-Arabidion* and placed in synonymy with *Salicetum herbaceae* sensu Söyrinchi 1954 and *Salicetum herbaceae potentilletosum brauneanae* Oberdorfer 1992. The latter is grouped together to the subcluster 1a in our analysis, which however consists of partial data for number of included relevés/coenoses and considering also the absence of moss and lichen species in Oberdorfer's original table. Therefore, the relevés from the Asiago Plateau can be attributed to *Potentillo-Homogynetum*, as the comparison with analytical data also highlights (Fig. 14). As it was maintained with regard to *Homogyno-Loiseleurietum,* the absence of Homogyne discolor is due to biogeographical reasons. With respect to *Salici-Arabidetum*, there are many *Arabidetalia* diagnostic species missing, such as *Saxifraga androsacea, Moehringia ciliata, Ranunculus alpestris, Gentiana bavarica, Gnaphalium hoppeanum, Arabis caerulea* ecc. The several acidophilous species shared with *Soldanella pusilla-Salix herbacea* Ausbildung (English, 1999) include, besides *Salix herbacea* (V frequency class), *Sibbaldia procumbens* and *Agrostis rupestris* (V), *Potentilla brauneana* and *Euphrasia minima* (IV), *Veronica alpina* (III), *Sagina saginoides*. Most of these are in common also with Aichinger's relevés (1933). The framework in *Soldanello-Salicion* is first of all ensured by *Salix retusa* and *Salix reticulata*, then by *Silene acaulis, Campanula scheuchzeri, Dryas octopetala* (English, 1999). The connection with higher syntaxonomical ranks is suggested by *Polytrichum juniperinum, Pohlia cruda, Carex parviflora* and *Galium baldense* occurring in V and IV frequency class.

Synecology: In the hollows placed at the bottom of the dolines, the long-lasting snow accumulation induces a lowering of CO_3^{2-} ion concentration and at the same time it collects a considerable amount of fine soil particles resulting from the marly intercalations of the Formazione di Fonzaso group. According to Ellenberg (1988), the best calcareous snow patches are formed

Tab. 9 – *Potentillo dubiae-Homogynetum discoloris* Aich. 1933

N° of relevé	56	57	58	59	60	61	
Altitude (m a.s.l.)	1785	1780	1860	1980	1978	2004	
Exposure	N	N	/	/	N	/	
Slope (°)	10	20	0	0	5	0	
Area (m^2)	2	6	3	2	4	2	
Coverage (%)	95	90	90	90	100	100	
N° of species	34	38	23	25	24	40	presences
							fr%
loc. diff. species of association							
Salix herbacea	2	2	2	3	3	4	100
Potentilla brauneana	.	+	.	+	+	+	67
charact. species of *Soldanello-Salicion*, *Arabidetalia*, *Thlaspietea*							
Sanionia uncinata	2	2	1	1	1	1	100
Salix retusa (All)	+	1	1	+	1	1	100
Pohlia cruda (C)	+	+	+	+	+	+	100
Carex parviflora (O)	.	+	+	+	+	+	83
Salix reticulata (All)	3	2	+	+	.	.	67
Galium baldense (O)	.	+	.	+	+	+	67
Oncophorus virens (C)	.	1	.	+	+	.	50
Veronica alpina (C)	.	.	+	+	.	+	50
charact. species of *Salicetea herbaceae*							
Sibbaldia procumbens	.	+	+	+	+	+	83
Kiaeria starkei	r	.	r	.	.	.	33
Alchemilla fissa	.	+	.	.	.	+	33
Sagina saginoides	.	.	.	+	.	.	17
charact. species of *Jucetea trifidi*							
Agrostis rupestris	+	+	1	+	.	+	83
Euphrasia minima	.	+	+	.	+	+	67
Ligusticum mutellinoides	+	1	.	.	.	.	33
Botrychium lunaria	.	.	.	.	.	+	17
Luzula spicata/mutabilis	.	.	.	.	.	+	17
Potentilla aurea	.	.	.	.	.	+	17
Soldanella alpina/alpina	.	.	.	.	.	+	17
charact. species of *Nardetea strictae*							
Nardus stricta	.	.	.	+	1	1	50
Carex brunnescens	+	.	.	.	.	1	33
Festuca rubra/commutata	.	.	+	.	+	.	33
charact. species of *Elyno-Seslerietea*							
Potentilla crantzii/crantzii	+	+	.	+	.	+	67
Ranunculus carinthiacus	.	r	.	r	+	+	67
Silene acaulis/longiscapa	+	+	+	.	.	+	67
Festuca quadriflora	.	.	.	.	r	+	33
Dryas octopetala/octopetala	+	+	.	.	.	.	33
Carex firma	.	+	.	.	.	.	17
Pedicularis verticillata	.	.	+	.	.	.	17
Trifolium thalii	.	.	.	.	.	1	17
charact. species of *Carici-Kobresietea*							
Carex atrata/atrata	1	+	.	.	+	.	50
Gentiana nivalis	.	+	.	.	.	.	17
Salix serpillifolia	.	+	.	.	.	.	17
other species							
Bistorta vivipara	1	1	+	1	1	1	100
Poa alpina/alpina	+	1	2	1	1	+	100
Parnassia palustris/palustris	.	+	+	+	.	.	50
Vaccinium uliginosum/microphyllum	+	+	.	.	+	.	50
Cirsium spinosissimum	.	.	.	r	1	.	33
Trifolium pratense	.	.	.	+	+	.	33
Viola biflora	+	.	+	.	.	.	33
Campanula scheuchzeri/scheuchzeri	.	+	.	.	.	+	33
Alchemilla flabellata	.	.	+	.	.	.	17
Carex capillaris/capillaris	+	.	.	.	.	.	17
Cerastium fontanum	.	.	.	.	.	+	17
Homogyne alpina	.	.	.	.	.	+	17
Kalmia procumbens	+	.	.	.	.	.	17
Leontodon hispidus	.	.	+	.	.	.	17
Pinus mugo/mugo	.	.	.	.	.	+	17
Pyrola rotundifolia	.	.	.	.	.	+	17
Salix breviserrata	+	.	.	.	.	.	17
Selaginella selaginoides	.	.	.	.	.	+	17
Vaccinium vitis-idaea	+	.	.	.	.	.	17
other mosses and lichens							
Polytrichum juniperinum	+	+	+	+	1	+	100
Distichium inclinatum	+	.	+	+	+	+	83
Bryum elegans	+	+	.	+	.	+	67
Cetraria islandica	.	1	.	+	+	+	67
Brachythecium glareosum	+	+	.	.	.	+	50
Bryum pallescens	+	+	.	.	+	.	50
Climacium dendroides	+	+	.	.	.	+	50
Ptilidium ciliare	+	+	.	.	.	+	50
Bryum pseudotriquetrum	+	+	.	.	.	.	33
Cladonia digitata	+	+	.	.	.	.	33
Cladonia furcata	+	+	.	.	.	.	33
Cladonia rangiferina	1	.	.	.	.	+	33
Polytrichum commune	+	.	+	.	.	.	33

on clay marls which morphologically behave in a similar way to the silicate rocks. The slow and partial decomposition of organic residues induces humus accumulation which in turn results in soil acidification. It should also be emphasised the loess contribution which, during the deglaciation time, had enriched with sediment other than carbonate the soils of the Asiago Plateau which is located next to the siliceous Lagorai Group. Where these conditions are particularly marked, humus-rich soils with a A-C profile and suitable for hosting the Salix herbacea-dominating vegetation locally develop. Multivariate analysis opposes Potentillo-Homogynetum to Salicetum reticulato-breviserratae and Salicetum retuso-reticulatae relating it to slightly acidic soils (Tab. 14; Tab. 15; Fig. 18), that show in the upper 3-4 cm measured pH values approximately 5.20 (SISS, 1985). The second canonical axis is also associated with negative values of light parameter, which is consistent with a more prolonged snow cover stagnation. The increased acidification results in the presence of ingressive species from *Salicetea herbaceae* (*Sibbaldia procumbens, Kiaeria starkei*) and *Juncetea trifidi* (*Agrostis rupestris, Euphrasia minima*). *Nardus stricta* is an element competing with and with trend towards replacing *Salix herbacea* by taking advantage of reduced duration of snow cover. The bryophytic component emphasizes the humus-rich content of these small snowy basins through the presence of humicolous species such as *Pohlia cruda, Ptilidium ciliare, Kiaeria starkei* and *Polytrichum commune*, as well as by the occurrence of waterlogging phenomena underlined by *Sanionia uncinata* and *Oncophorus virens*. This latter colonizes the rocky microhabitat of frosty draught holes which allow the water derived from the snow melting to emerge.

Synchorology: Aichinger (1933) described the association on the basis of relevés coming from south-eastern Alps (Karawanken and Dobratsch), but its occurring in central- and north-eastern Alps is documented by English (1999). By virtue of the distribution data regarding the Asiago Plateau and the Vette Feltrine (Tomaselli *et al*., 2005) it can be extended to the carbonate mountainous massifs occurring in the south-eastern Prealps.

Natura 2000: 6150.

SIEVERSIO MONTANAE-NARDETUM STRICTAE typicum Peppler-Lisbach et Petersen 2001 var. geogr. *Galium baldense* (Tab. 10)

Diagnostic species: *Nardus stricta* (dom.), *Anthoxanthum odoratum/nipponicum* (dom.), *Luzula alpina, Geum montanum, Leontodon helveticus, Arnica montana, Campanula barbata*.

Floristic composition: The coenose is characterized by the strong dominance of *Nardus stricta* constituting closed pastures toghether with other grasses or graminoids that reach high cover values and/or high frequencies: *Luzula alpina, Anthoxanthum odoratum/nipponicum, Festuca rubra/rubra* and *Poa alpina*. Other species, such as *Geum montanum, Potentilla aurea, Campanula scheuchzeri, Cerastium holosteoides* and *Bistorta vivipara* ocurr regularly. With respect to the floristic composition of the typical aspect on siliceous bedrock it locally differs in the absence (*Avenula versicolor, Gentiana punctata*) or sporadic occurrence (*Juncus trifidus / trifidus, Leontodon helveticus, Campanula barbata*) of acidophilous species. The average species number per relevé is 33.2.

Life forms and chorotypes: In the association prevail largely the hemicryptophytes, here at the highest levels (77.3% presence/absence data, 81.3% coverage data), followed by chamaephytes (14.3% vs. 11.8%). With regard to the chorological spectrum southern European orophytes prevail (37.6% presence/absence data; 34.2% coverage data) on the euro-siberian/North American element (27.9% vs. 32.3%). Moreover, Arctic-Alpine species, even though present, are at lowest levels among the found plant communities (10.5% vs. 11.3%).

Syntaxonomy: Despite the lack of differential species (Oberdorfer, 1978; Poldini & Oriolo, 1997) the cenose is easily identificable on the basis of the above cited diagnostic group of species and of the respective dominance relationships. More difficulties are instead encountered in referring it to the higher syntaxonomical ranks. The conflicting views on the most appropriate way of framing the *Nardus*-rich grasslands have resulted in the adoption of different phytosociological interpretations over time, which were recently summarized by Poldini & Oriolo (1997). They come to embrace for the Carnic Alps, with a few modifications, the choice of Austrian vegetationists (Grabherr, 1993c; Ellmauer, 1993) who prefer to ascribe the *Nardus*-rich grasslands to two classes: *Calluno-Ulicetea* for the secondary formations of lower altitudes that are affected by oceanic climatic conditions and *Juncetea trifidi* for the subalpin primary ones. The approach of Theurillat *et al*. (1995) and Aeschimann *et al*. (2004), which here we follow, although suggests the inclusion of secondary *Nardus*-swards widespread at lower altitudes in a third class, *Nardetea strictae*, retains the subalpine *Sieversio-Nardetum* inside the alliance *Nardion strictae* and this last into *Juncetea trifidi*. The connection with *Nardion strictae* is assured by *Luzula alpina, Arnica montana* and other rarer entities. More recently, a large data set analysis of the plant community in the Eastern Alps (Lüth *et al*., 2010), proposes again its classification into *Nardetalia* and *Calluno-Ulicetea*, supporting the interpretation already advanced by Oberdorfer (1978). Among the produced reasons, the anthropogenic and anthropo-zoogenic influences which affect its origin are highlighted, a factor that would justify the exclusion from the list of natural vegetation, a conclusion moreover supported by the predominance of *Calluno-Ulicetea* species vs. *Juncetea trifidi* ones. The distinguishing features of *Sieversio-Nardetum* in the Asiago Plateau are the primary origin as well as the prevalence of characteristic species of the class *Juncetea trifidi*, this last shared with other relevés from the southern Alps. Hence, we prefer its inclusion in the class *Juncetea trifidi*. On the other hand, it was already observed (Pignatti & Pignatti, 1983) that the importance of the species of the atlantic order *Nardetalia* inside the coenose becomes evident only in northern Alps, where most of the data presented by Lüth *et al*. (2010) were collected. These authors describe the subass. seslerietosum albicantis for calcareous substrates, but the classification of synthetic tables (Fig. 15) and the comparison with the indicated differential species let us to ascribe our relevés to the subass. *typicum* typified for base-poor soils by Peppler-Lisbach & Petersen (2001). Important ecological characteristics shared with eastern alpine stands which Lüth *et al*. (2010) placed in the latter subassociation, such as the absolute absence of management and the location above the timber line, reinforce this interpretation. The absence of manure and mowing and the lower biodiversity exclude the possibility to refer relevés from Asiago Plateau to the subass. *trifolietosum pratensis*, despite some affinities in floristic composition. A local, but ecologically remarkable aspect, occurs in areas affected by soliflic-

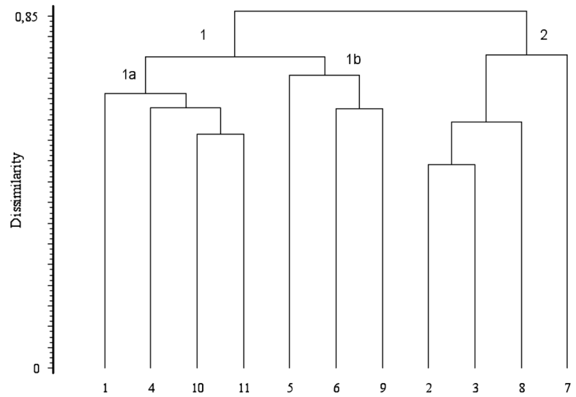


Fig. 13 – Dendrogram of synoptic table of *Salix herbacea*-rich formations from different provenances (UPGMA-similarity ratio, frequency data). Mosses and lichens included. 1: Asiago Plateau (this study); 2: Lagorai (rel. 18-19 and 21-23 in Gerdol, 1990); 3: Lagorai (rel. 34 and 44 in D'Alterio, 2000); 4: Vette Feltrine (Tomaselli *et al*., 2005); 5: Val Venegia (rel. 156-156bis in Tab. 12 in Boiti *et al*., 1989); 6: Lienz Dolomites (rel. 1-2 in Wikus, 1960); 7: N-Apennines (Petraglia & Tomaselli, 2007); 8: Valle del Braulio (rel. 1-13 in Tab. 11 in Giacomini & Pignatti, 1955); 9: Lienz Dolomites (rel. 4-15 in Tab. 10 in Wikus, 1960); 10: Dachstein (rel. 284-289 in Tab. F in English, 1999); 11: Wettersteingebirge (Oberdorfer, 1992).

tion phenomena and temporary water runoff resulting from snow melting which can be described as a *Juncus jacquinii* variant (rel. 82).
Synecology: *Nardus*-rich pasture is one of the most typical plant communities to be found on the bottom of the glaciokarst system, the most widespread and characterizing acidophilous association occurring in the subcontinental enclave of the northern sector of the Asiago Plateau. The coenose develops on subflat depressions where the prolonged snow cover and the accumulation of fine pedogenetic material originate deep soil with pH ranging between 5 and 6.5. In these contexts, its origin is certainly primary and the relations with above located *Pinus mugo* scrubs and subalpine spruce forest, induced by thermal inversion, are in catenal terms. Thus, despite the close proximity to the aforementioned coniferous formations, the *Sieversio-Nardetum* is free from colonization of pre-forest stages so that the only phanerophytes occurring in the stands are limited to rare *Pinus mugo* and *Juniperus nana plantulae*. The numerous ingressive species from *Molinio-Arrhenatheretea* has been elsewhere interpreted as a consequence of the positioning of the association in the friction area between two altitudinal belts (Poldini & Oriolo, 1997), but in the study area this explanation appears inadequate. Their occurrence is probably due to high soil moisture and to nutrient supplies coming from the environment above the dolina.
Synchorology: The *Sieversio-Nardetum* is distributed throughout the Alpine Chain resulting in the most common pasture coenoses in the Eastern Alps (Grabherr, 1993c). It was already observed as part of the data published sub *Nardetum alpigenum* s.l. from different south-eastern Italian alpine sectors is likely to include relevés that had to be ascribed to other *Nardus* communities (Poldini & Oriolo, 1997). Taking into account this limit, the classification of synthetic tables derived from each investigated area once again highlights the existence of the highest affinity between the Asiago Plateau relevés and the stands coming from the near Dolomiti Bellunesi (Fig. 15).
Natura 2000: 6150.

CAMPANULO SCHEUCHZERI-FESTUCETUM NORICAE GEETOSUM MONTANAE Isda 1986 var. geogr. *Galium baldense* (Tab. 11)

Differential species: *Festuca norica* (dom.)
Floristic composition: The physiognomy of this not very dense and short-height perennial grassland is due to the predominance of *Festuca norica*. This species is accompanied by a numerous group of species with

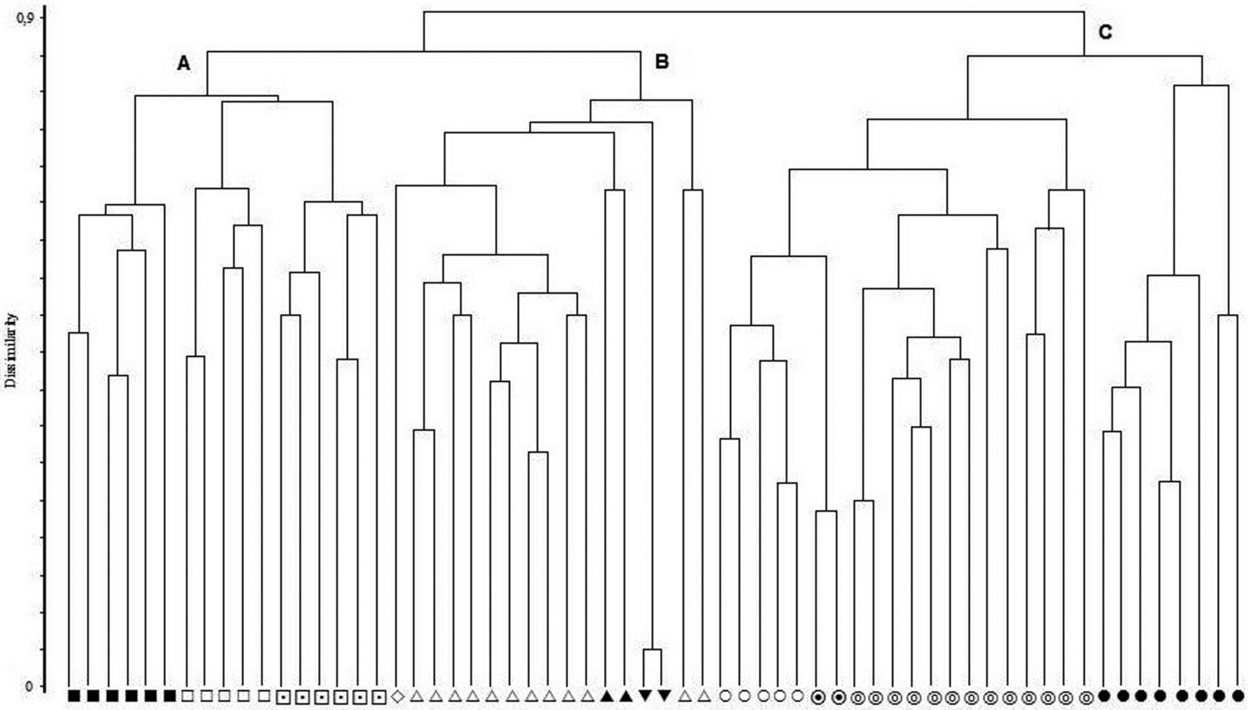


Fig. 14 – Classification of *Salix herbacea*-rich relevés from the Alps and northern Apennines (UPGMA, Jaccard index, binary data). Mosses and lichens included. ■: Asiago Plateau (this study); □: Vette Feltrine (Tomaselli *et al*., 2005); ⊡: Dachstein (rel. 284-289 in Tab. F in English, 1999); ◇: Dachstein (Pignatti-Wikus, 1959); △: Lienz Dolomites (rel. 4-15 in Tab. 10 in Wikus, 1960); ▲: Lienz Dolomites (rel. 1-2 in Wikus, 1960); ▼: Val Venegia (rel. 156-156bis in Tab. 12 in Boiti *et al*., 1989); ○: Lagorai (rel. 18-19 and 21-23 in Gerdol, 1990); ⦿: Lagorai (rel. 34 and 44 in D'Alterio, 2000); ◎: Valle del Braulio (rel. 1-13 in Tab. 11 in Giacomini & Pignatti, 1955); ●: N-Apennini (Petraglia & Tomaselli, 2007). A: *Potentillo dubiae-Homogynetum discoloris*; B: *Salici herbaceae-Arabidetum caeruleae*; C: *Salicetum herbaceae*.

Tab. 10 – *Sieversio montanae-Nardetum strictae* typicum Peppler-Lisbach et Petersen 2001 var. geogr. *Galium baldense*

N° of relevé	82	83	87	84	88	89	86	85	90	92	91	
Altitude (m a.s.l.)	1800	1824	1958	2000	2075	1948	1762	1625	1810	1607	2010	
Exposure	S	SSE	E	N	NW	N	E	SSE	SSW	E	SSW	
Slope (°)	5	10	10	5	5	5	10	5	10	10	10	
Area (m^2)	20	80	50	50	100	100	100	100	100	50	20	
Coverage (%)	100	100	100	100	100	100	100	100	100	100	100	
N° of species	29	39	41	35	25	36	30	41	32	25	32	presences
												fr%
charact. species of *Nardion strictae*												
Luzula alpina	1	1	1	1	1	1	1	1	1	2	+	100
Arnica montana/montana	.	+	1	.	.	+	.	+	+	1	.	55
Gentiana acaulis	+	+	.	.	.	.	.	.	.	+	.	27
Campanula barbata	.	.	+	.	.	.	.	.	.	.	.	9
Carex brunnescens/brunnescens	1	.	.	.	.	.	.	.	.	.	.	9
Festuca rubra/commutata	.	.	.	.	.	.	.	.	.	.	2	9
charact. species of *Caricetalia curvulae*												
Soldanella alpina/alpina	.	+	+	.	+	.	.	.	.	.	+	36
Ajuga pyramidalis	.	+	.	.	.	.	.	.	+	.	.	18
Veronica bellidioides	+	.	.	.	.	+	.	.	.	.	.	18
Juncus jacquinii	2	.	.	.	.	.	.	.	.	.	.	9
Ligusticum mutellinoides	.	.	.	.	.	.	.	.	+	.	.	9
charact. species of *Juncetea trifidi*												
Geum montanum	1	+	+	1	1	1	+	1	2	+	2	100
Potentilla aurea/aurea	+	+	1	1	1	1	+	1	1	1	1	100
Anthoxanthum odoratum /nipponicum	+	.	+	1	2	2	2	2	1	2	+	91
Luzula spicata/mutabilis	1	.	+	+	+	+	.	.	.	.	1	55
Leontodon helveticus	.	+	.	+	.	.	.	.	+	+	.	36
Phyteuma hemisphaericum	.	+	+	.	.	.	.	.	+	.	.	27
Euphrasia minima	.	.	+	.	.	+	.	.	.	.	.	18
Hypochaeris uniflora	.	.	.	.	.	.	.	+	.	1	.	18
Pulsatilla vernalis	+	.	+	.	.	.	.	.	.	.	.	18
Agrostis rupestris	.	.	+	.	.	.	.	.	.	.	.	9
Juncus trifidus/trifidus	.	.	1	.	.	.	.	.	.	.	.	9
Phyteuma betonicifolium	.	.	.	.	.	.	.	.	.	+	.	9
charact. species of *Nardetea strictae*												
Nardus stricta	4	5	4	5	4	4	4	4	4	4	2	100
Antennaria dioica	+	+	+	+	+	.	.	+	.	+	.	64
Hieracium lactucella	+	+	+	+	+	1	.	+	.	.	.	64
Potentilla erecta	+	1	.	.	.	.	+	1	.	1	.	45
Carex pallescens	.	.	.	.	.	.	.	+	.	+	.	18
Coeloglossum viride	.	.	.	.	.	.	.	+	.	.	.	9
charact. species of *Calluno-Ulicetea*												
Carex pilulifera/pilulifera	.	.	.	.	.	.	.	+	.	1	.	18
charact. species of *Vaccinio-Piceetea*												
Homogyne alpina	+	+	.	+	+	+	+	+	+	.	.	73
Luzula sylvatica/sieberi	.	+	.	+	+	+	+	.	+	.	.	55
Vaccinium vitis-idaea	+	+	.	.	.	.	.	+	.	.	.	27
Vaccinium myrtillus	.	.	+	.	.	+	.	.	.	.	.	18
charact. species of *Loiseleurio-Vaccinietea*												
Calluna vulgaris	.	.	+	.	.	.	+	+	.	.	.	27
Vaccinium uliginosum/microphyllum	.	.	.	+	.	.	.	+	.	.	.	18
Juniperus communis/nana (pl)	.	.	.	.	.	.	.	.	.	.	r	9
charact. species of *Molinio-Arrhenatheretea*												
Festuca rubra/rubra	1	+	+	+	1	1	1	1	.	+	+	91
Cerastium holosteoides	.	+	+	1	1	+	1	+	.	+	+	82
Poa alpina/alpina	.	+	+	+	1	+	+	+	1	.	1	82
Crocus vernus/albiflorus	.	+	1	+	+	.	+	1	+	.	+	73
Agrostis capillaris	.	.	.	+	.	+	+	1	1	1	.	55
Trifolium pratense/nivale	.	+	+	.	+	+	+	.	.	+	.	55
Trifolium badium	.	.	.	+	.	+	.	+	1	.	+	45
Leontodon hispidus	.	.	.	.	+	+	+	.	+	.	.	36
Deschampsia cespitosa/cespitosa	.	.	.	.	+	.	+	+	.	.	.	27
Phleum rhaeticum	.	.	.	.	+	+	.	.	+	.	.	27
Trollius europaeus/europaeus	.	.	.	.	.	.	.	+	r	.	.	18
Leontodon autumnalis	.	.	+	.	.	.	.	.	.	.	.	9
Galium boreale	.	.	.	.	.	.	.	+	.	.	.	9
Stellaria graminea	.	.	.	.	.	.	+	.	.	.	.	9
charact. species of *Elyno-Seslerietea*												
Senecio abrotanifolius/abrotanifolius	+	.	+	+	+	+	+	.	.	.	+	64
Potentilla crantzii/crantzii	+	.	.	+	+	.	+	+	.	.	1	55
Carex ornithopoda	.	+	.	+	.	+	.	+	+	.	.	45
Pedicularis verticillata	+	+	.	+	.	.	.	+	.	+	.	45
Biscutella levigata/laevigata	.	.	+	.	.	.	+	+	+	.	.	36
Lotus corniculatus/alpinus	.	.	1	+	.	+	+	.	.	.	.	36
Polygala alpestris	.	+	+	.	.	.	.	.	+	.	+	36
Bartsia alpina	.	.	+	.	.	.	+	+	.	.	.	27
Nigritella rhellicani	.	.	.	+	.	.	.	.	+	+	.	27
Carduus defloratus/tridentinus	+	.	.	.	.	.	+	.	.	.	+	27
Festuca norica	.	.	.	+	.	.	.	.	.	.	+	18
Ranunculus carinthiacus	.	.	.	.	.	.	.	.	+	.	+	18
Dianthus superbus/alpestris	.	.	.	.	.	.	.	+	.	.	.	9
Galium anisophyllon	.	.	.	.	.	.	.	.	.	+	.	9
Myosotis alpestris	.	.	.	.	.	.	.	.	.	.	+	9
Trifolium thalii	.	.	.	.	.	.	.	.	+	.	.	9
other species												
Campanula scheuchzeri/scheuchzeri	+	.	+	+	+	1	.	+	1	+	+	82
Bistorta vivipara	+	+	+	+	+	1	.	+	+	.	+	82
Carex sempervirens	.	+	+	+	+	+	+	.	+	.	+	73
Galium baldense	+	.	+	+	.	+	+	+	.	.	+	64
Parnassia palustris/palustris	+	.	+	r	.	+	.	+	.	.	+	55
Selaginella selaginoides	.	+	.	+	.	+	.	+	+	.	.	45

Thymus praecox/polytrichus	.	+	+	.	+	+	.	.	.	.	+	45
Carex atrata/atrata	.	+	.	+	.	+	.	.	+	.	.	36
Alchemilla connivens	.	.	.	.	.	+	.	+	.	.	+	27
Alchemilla glaucescens	+	.	.	+	.	.	.	.	+	.	.	27
Carex montana	.	1	1	.	.	.	1	.	.	.	.	27
Deschampsia flexuosa	.	.	+	.	.	+	.	.	.	2	.	27
Gnaphalium sylvaticum	.	.	.	.	.	+	+	.	.	+	.	27
Pinus mugo/mugo (pl)	.	.	r	.	.	.	.	r	.	.	r	27
Salix breviserrata	+	+	.	+	.	.	.	.	.	.	.	27
Salix retusa	.	+	+	.	.	.	.	.	.	.	+	27
Veronica chamaedrys/chamaedrys	.	.	.	.	.	.	+	+	+	.	.	27
Carex caryophyllea	.	+	.	.	.	r	.	.	.	.	.	18
Cirsium spinosissimum	.	.	.	r	.	.	.	.	.	.	r	18
Veronica officinalis	.	.	.	.	.	.	+	.	.	+	.	18
mosses												
Polytrichum juniperinum	+	+	+	.	.	.	.	+	.	.	.	36

high frequency but low coverage, with the only partial exception represented by *Carduus defloratus/tridentinus*. *Carex sempervirens* and *Sesleria caerulea*, which are differential species of *Seslerio-Semperviretum* s.l., occur in the stands with high fidelity but with low cover values. The average species number in the stands is 27.0.

Life forms anch chorotypes: The coenoses frame largely consists of hemicryptophytes (71% presence/absence data; 72.8% coverage data) and secondarily of chamaephytes (22.1% vs. 21%), whereas the other components prove to be of no importance. As regards the chorological spectrum, southern European orophytes prevail (43.7% presence/absence data; 40% coverage data), followed by the other chorotypes all with comparable weight: European (13.1% vs. 12.3%) and east-Alpine (8.5% vs. 14.2%) groups, both here at the highest values, as well as Arctic-Alpine, Alpine and eurosiberian/North American elements.

Syntaxonomy: The *Festuca norica* grasslands detected on the Asiago Plateau is attributed to the association *Campanulo scheuchzeri-Festucetum noricae* on the basis of the presence of the characteristic and physiognomically relevant *F. norica* as well as in consequence of a good correspondence with the highly constant species according to Isda (1986): *Campanula scheuchzeri, Trifolium pratense/nivale, Carex sempervirens* and *Lotus alpinus+corniculatus* (V), *Silene vulgaris* (III), *Anthoxanthum odoratum/nipponicum, Leontodon hispidus* and *Galium anisophyllum* (II). Its attribution to the upper hierarchical level poses some difficulties because of the absolute absence of species of the alliance which the coenoses was referred (*Caricion ferrugineae*) – if we exclude P*otentilla crantzii/crantzii, Trifolium pratense/nivale, Leontodon hispidus* and *Horminum pyrenaicum* that are considered differential species of the alliance in south-eastern Alps (Buffa & Sburlino, 2001) – which contrasts with the high frequencies and coverages of *Seslerion variae* species like *Potentilla crantzii/crantzii, Senecio abrotanifolius/tiroliensis, Oxytropis jacquinii, Helianthemum oleandicum/alpestre, Biscutella levigata/laevigata* occurring in V and IV frequency class. Isda (1986) points out that the plant community should be attributed to *Caricion ferrugineae* because of floristic and ecological reasons, given that the alliance includes associations thriving on deeper and more stabilized substrates and in sites with more prolonged snow cover than coenoses belonging to *Seslerion variae*. In the study area, these site conditions are highlighted in the sharing of numerous acidophilic elements belonging to *Juncetea trifidi, Nardetea strictae, Soldanello-Salicion, Poion alpinae* and *Piceion excelsae*. Moreover, the coenose from the Asiago Plateau can be attributed to the subass. *geetosum montanae* for the occurring of the differential entities *Geum montanum, Luzula multiflora* and *Botrychium lunaria*, subassociation that is just distinguished by a reduced contribution of *Caricion ferrugineae* species in the presence of a variability that is divided into at least 7 subassociations (Isda, 1986). The inclusion in *Elyno-Seslerietea* class is supported by the constant occurrence of *Carex ornithopoda, Lotus corniculatus* s.l. and *Sesleria caerulea/caerulea* (V class).

Sinecology: The coenose develops over medium deep and mineral-rich soils, well supplied but not water soaked, on medium steep and prevalently south-facing

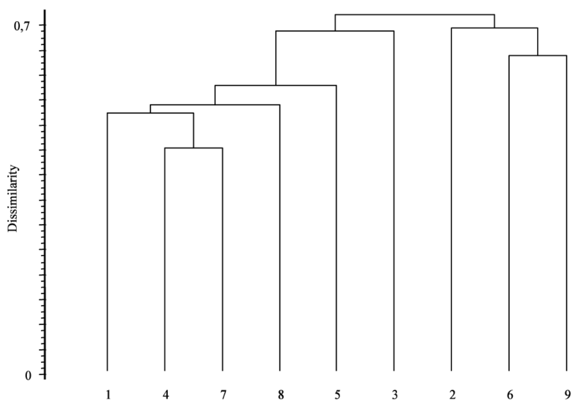


Fig. 15 – Classification of some *Nardus* grassland (synthetic tables; UPGMA-similarity ratio). 1: Asiago Plateau (this study); 2: Mt. Cadria – TN (Caniglia & Rigobello, 1995); 3: Mt. Bondone – TN (Bonomi & Buffa, 2000); 4: Vette Feltrine (Pignatti & Pignatti, 1983); 5: Valle del Braulio (Giacomini & Pignatti, 1955); 6: Mt. Baldo (Gerdol & Piccoli, 1980); 7: Erera-Brendol-Campotorondo (Lasen, 1983); 8: Friuli (Tab. 4: typical and subalpine forms in Poldini & Oriolo, 1997); 9: Eastern Alps (*Sieversio-Nardetum seslerietosum albicantis* in Tab. 6 in Lüth *et al*., 2010)

Tab. 11 – *Campanulo scheuchzeri-Festucetum noricae geetosum montanae* Isda 1986 var. geogr. *Galium baldense*

N° of relevé	93	94	95	96	97	98	presences
Altitude (m a.s.l.)	1978	1980	2075	2060	2061	2070	
Exposure	SSE	E	SW	SE	SW	SE	
Slope (°)	30	40	35	15	20	25	
Area (m^2)	80	50	100	30	25	25	
Coverage (%)	90	90	80	100	80	90	
N° of species	31	28	25	26	31	21	
							fr%
diff. species of association							
Festuca norica (O)	3	3	3	3	3	3	100
charact. species of *Seslerion variae*							
Potentilla crantzii/crantzii	1	1	+	+	+	+	100
Senecio abrotanifolius/tiroliensis	1	+	+	1	+	+	100
Oxytropis jacquinii	1	+	+	+	+	.	83
Helianthemum oleandicum/alpestre	1	+	1	.	+	.	67
Biscutella levigata/laevigata	+	+	+	.	+	.	67
Silene acaulis/longiscapa	+	+	+	.	.	.	50
Erigeron glabratus	+	+	.	.	.	.	33
Festuca quadriflora	.	.	+	+	.	.	33
Juncus trifidus/monanthos	.	+	.	.	+	.	33
Thesium alpinum	.	.	.	.	+	.	17
Pulsatilla alpina/austroalpina	.	.	.	.	+	.	17
Draba aizoides	.	.	.	.	.	+	17
charact. species of *Seslerietalia variae*							
Ranunculus carinthiacus	.	+	.	+	+	+	67
Galium anisophyllon	.	.	+	.	.	+	33
charact. species of *Elyno-Seslerietea*							
Carex ornithopoda	1	+	+	+	+	+	100
Lotus corniculatus s.l.	+	+	+	+	+	+	100
Sesleria caerulea/caerulea	+	+	+	.	+	+	83
Gentiana anisodonta	+	.	+	+	+	.	67
Acinos alpinus	+	+	.	.	.	+	50
Agrostis alpina	.	+	+	.	+	.	50
Bellidiastrum michelii	+	.	+	+	.	.	50
Euphrasia salisburgensis	.	+	+	+	.	.	50
Anthyllis vulneraria/alpestris	+	.	+	.	.	.	33
Myosotis alpestris	+	.	.	.	.	+	33
Polygala alpestris	+	.	+	.	.	.	33
Hieracium villosum	+	.	.	.	.	.	17
Nigritella rhellicani	.	+	.	.	.	.	17
Gentiana verna/verna	.	.	+	.	.	.	17
Horminum pyrenaicum	.	.	.	.	1	.	17
Dryas octopetala/octopetala	.	.	.	.	+	.	17
charact. species of *Juncetea trifidi*							
Geum montanum	+	+	+	+	+	.	100
Soldanella alpina/alpina	+	+	+	+	1	+	100
Luzula spicata/mutabilis	+	+	.	.	.	+	50
Potentilla aurea	+	.	.	+	+	.	50
Anthoxanthum odoratum/nipponicum	.	.	.	+	+	.	33
Agrostis rupestris	.	.	.	+	.	.	17
Botrychium lunaria	.	.	.	.	.	+	17
Hypochaeris uniflora	.	.	.	.	.	+	17
Leontodon helveticus	.	.	.	+	.	.	17
Ligusticum mutellinoides	.	+	.	.	.	.	17
charact. species of *Nardetea strictae*							
Hieracium lactucella	+	1	.	+	+	.	67
Luzula alpina	+	+	.	+	.	.	50
Nardus stricta	+	.	.	1	+	.	50
Luzula multiflora	+	+	.	.	.	.	33
Arnica montana/montana	.	.	.	+	.	.	17
Festuca rubra/commutata	+	.	.	.	.	.	17
charact. species of *Molinio-Arrhenatheretea*							
Trifolium pratense/nivale	1	+	+	+	.	+	83
Agrostis capillaris	+	+	.	+	.	+	67
Poa alpina/alpina	+	.	+	1	.	+	67
Festuca rubra/rubra	+	.	.	.	1	.	33
Leontodon hispidus	.	.	.	.	+	1	33
Cerastium holosteoides	+	.	.	.	.	.	17
Phleum rhaeticum	.	.	.	.	.	+	17
charact. species of *Thlaspietea rotundifolii*							
Galium baldense	+	+	+	+	+	.	83
Salix reticulata	.	+	.	.	+	.	33
Salix retusa	.	+	.	+	+	.	50
other species							
Carduus defloratus/tridentinus	1	1	1	+	+	1	100
Thymus praecox/polytrichus	+	+	+	+	+	+	100
Carex sempervirens	1	1	+	+	+	+	100
Campanula scheuchzeri/scheuchzeri	+	+	1	+	+	+	100
Bistorta vivipara	+	+	+	+	+	.	83
Alchemilla glaucescens	+	+	.	.	+	+	67
Selaginella selaginoides	.	+	+	+	+	.	67
Parnassia palustris/palustris	+	1	.	.	+	.	50
Salix serpillifolia	.	+	+	+	.	.	50
Viola biflora	.	.	+	.	+	+	50
Gentiana nivalis	.	+	.	.	+	.	33
Homogyne alpina	.	.	+	.	+	.	33

slopes (25-40 °), in sites located in the subalpine belt (Isda, 1986). The same author points out that the plant association occurs in the calcareous Alps only over clayey-marly soils. In the study area the *Campanulo-Festucetum* is found in the glacio-karst depressions in the highest northern sector of the carbonatic plateau, where it occupies narrow surfaces in correspondence of south-facing dolina slopes and on quite deep and not subject to drying up soils with neutral or moderately acid pH. In this sector of the Asiago Plateau little rises alternate with hollows in an articulate and close way so that plant communities develop on small surfaces, favouring species penetration from neighboring vegetational mosaic. This micromorphology and the surrounding continental climate may partially explain the preponderance of *Seslerion variae* species at the expense of *Caricion ferrugineae* ones in our relevés.
Synchorology: The distribution area of the association closely follows that of *Festuca norica* – an east-Alpine element – which includes the Northern and Southern sides of Central-Eastern Alps. Its occurrence was already verified in the Dolomites and the Carnic Alps at the moment of association description (Isda, 1986).
Natura 2000: 6170.

RANUNCULO HYBRIDI-CARICETUM SEMPERVIRENTIS Poldini *et* Feoli Chiapella in Feoli Chiapella *et* Poldini 1994 (Tab. 12)

Floristic composition: The physiognomy of this association arises from the dense coverage of two caespitose hemicryptophytes, a largely predominating *Carex sempervirens* and *Sesleria caerulea/caerulea*; in the lower herbaceous layer constantly occur *Potentilla crantzii/crantzii, Carex ornithopoda, Bistorta vivipara, Carduus defloratus/tridentinus* and *Parnassia palustris/palustris*. The average species number per relevé is 39.2.
Life forms and chorotypes: The *Ranunculo-Caricetum* framework is similar to that of *Campanulo-Festucetum* with the only important variation represented by geophytes that are here at maximum levels among the detected coenose, both in terms of presence/absence and coverage data (7.3% vs. 6.5%). The incidence of chorotypes is in the same way quite similar, with the prevalence of southern European orophytes (34.9% presence/absence data vs. 37.8% coverage data); however, there are some differences concerning a more pronounced incidence of the eurosiberian/North American elements (19% vs. 18%) and of south-western European orophytes (3.9% vs. 4.2%).
Syntaxonomy: The syntaxonomical attribution of this type of *Sesleria caerulea* pasture appears not easy. Ecological, structural and phytosociological features argue for the attribution to *Ranunculo hybridi-Caricetum sempervirentis*: the high altitude, the Arctic-Alpine

species rate (12.5%) that is closest to this association (10.5%; Feoli Chiapella & Poldini, 1994) than to *Carici orithopodae-Seslerietum* (6.6%; Feoli Chiapella & Poldini, 1994) just as the frequency of camephytes (21.8% vs. 17.1% vs. 14.1%), finally the scarcity of *Festuco-Brometea* species including the total absence of *Bromus erectus* which in Friuli is indicated as differential species of *Carici ornithopodae-Seslerietum*. However, the characteristic species of the coenose as reported in the original diagnosis are absent in the study area relevés, if we exclude the sporadic occurrence of *Oxytropis jaquinii* that is furthermore under-represented with respect to *Campanulo-Festucetum*. Also the numerical analysis does not provide tools to resolve the doubts, by grouping the synthetic tables of *Ranunculo-Caricetum sempervirentis* and *Carici orithopodae-Seslerietum* from Friuli at the expense of the one representing *Ranunculo-Caricetum* in Asiago Plateau that gets isolated.The occurrence of *Pedicularis elongata* and *Pulsatilla alpina/austroalpina,* with a frequent *Oxytropis jacquinii*, in neighboring extra-dolina *Sesleria* pastures appears to argue for an interpretation of this vegetation type as an impoverished aspect of *Ranunculo-Caricetum sempervirentis*, aspect which develops in close sites between the climatophi-

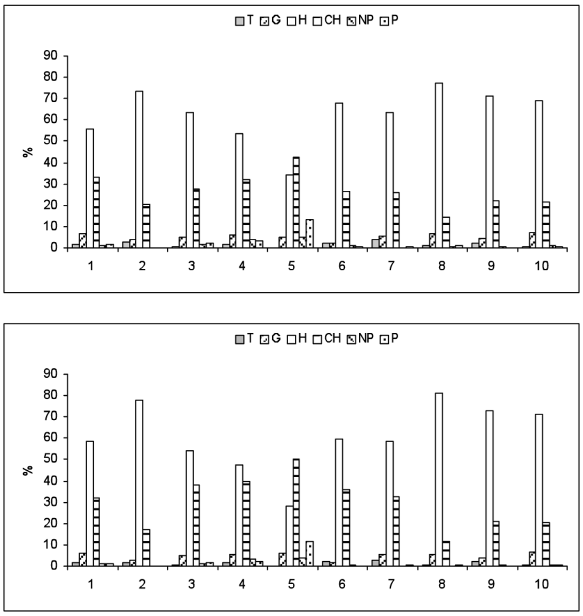


Fig. 16 – Life forms of the glaciokarst system coenoses from northern sector of the Asiago Plateau (Vicenza Province, south-eastern Prealps). Mosses and lichens excluded. Above presence/absence data, below cover data. 1: *Salici reticulatae-Caricetum rupestris*; 2: *Elynetum myosuroides* fragm.; 3: *Salicetum reticulato-breviserratae*; 4: *Homogyno discoloris-Loiseleurietum procumbentis*; 5: *Empetro-Vaccinietum gaultherioides*; 6: *Salicetum retuso-reticulatae*; 7: *Potentillo dubiae-Homogynetum discoloris*; 8: *Sieversio montanae-Nardetum strictae*; 9: *Campanulo scheuchzeri-Festucetum noricae*; 10: *Ranunculo hybridi-Caricetum sempervirentis*

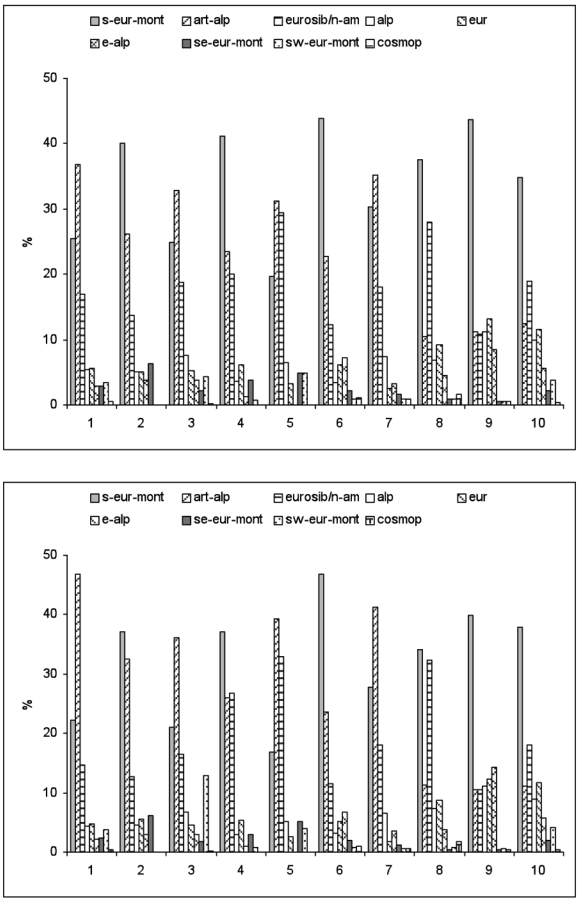


Fig. 17 – Chorological spectra of the glaciokarst system coenoses from northern sector of the Asiago Plateau (Vicenza Province, south-eastern Prealps). Mosses and lichens excluded. Above presence/absence data, below cover data. For correspondence number-coenoses see Fig. 16.

lous *Pinus mugo* scrubs in the dolina edge and the cryophilic coenoses in the bottom of the depression. The framing in *Seslerion variae* is assured by *Potentilla crantzii, Biscutella laevigata, Helianthemum oleandicum/alpestre* and *Senecio abrotanifolius/tiroliensis* occurring with the highest frequency.

Sinecology and synchorology: The marked stoniness and the prolonged snow cover of the sites result in the presence of glareicolous-chionophilous species belonging to *Soldanello-Salicion* (*Salix reticulata, S. retusa, Galium baldense*) or locally gravitating round it (*Salix breviserrata*), acidophilous ones characteristics of *Juncetea trifidi* (*Geum montanum, Potentilla aurea*) and *Nardetea strictae* (*Luzula alpina, Antennaria dioica*), as well as of *Poion alpinae* elements (*Trifolium pratense/nivale*). All these elements, which are absent in the original description of the association, indicate specific site conditions that could also imply a syntaxonomical autonomy deserving of the subassociation rank. The *Ranunculo-Caricetum* establishes catenal relationships with the coenose of the glacio-karst depressions and in particular with *Sieversio-Nardetum*

Tab. 12 – *Ranunculo hybridi-Caricetum sempervirentis* Poldini et Feoli Chiapella in Feoli Chiapella et Poldini 1994

N° of relevé	99	104	100	101	102	103	
Altitude (m a.s.l.)	1830	1800	1770	1780	1930	1985	
Exposure	NW	W	NE	S	E	N	
Slope (°)	30	40	40	30	40	35	presences
Area (m^2)	50	100	100	100	100	100	
Coverage (%)	90	80	100	90	90	100	
N° of species	41	38	48	37	33	38	
							fr%
charact. species of *Seslerion variae*							
Potentilla crantzii/crantzii	+	+	+	+	+	+	100
Biscutella levigata/laevigata	+	.	+	+	+	+	83
Helianthemum oleandicum/alpestre	.	+	+	+	+	+	83
Senecio abrotanifolius/tiroliensis	.	+	+	+	+	+	83
Juncus trifidus/monanthos	+	+	.	.	.	.	33
Silene acaulis/longiscapa	+	+	.	.	.	.	33
Bupleurum ranunculoides	.	.	.	+	.	.	17
Leucanthemum heterophyllum	.	.	.	+	.	.	17
Oxytropis jacquinii	.	+	.	.	.	.	17
Ranunculus thora	.	.	.	+	.	.	17
Thesium alpinum	.	.	+	.	.	.	17
charact. species of *Seslerietalia variae*							
Festuca norica	1	1	1	.	+	1	83
Galium anisophyllon	+	+	.	.	+	.	50
charact. species of *Elyno-Seslerietea*							
Sesleria caerulea/caerulea	1	1	1	2	+	+	100
Carex ornithopoda	+	+	+	+	+	+	100
Lotus alpinus+corniculatus	.	+	+	+	+	+	83
Anthyllis vulneraria/alpestris	+	.	1	+	+	.	67
Horminum pyrenaicum	1	.	.	1	+	1	67
Myosotis alpestris	.	.	.	.	+	+	33
Nigritella rhellicani	.	.	.	+	.	+	33
Pedicularis verticillata	+	.	+	.	.	.	33
Dryas octopetala/octopetala	+	+	.	.	.	.	33
Ranunculus carinthiacus	.	+	.	.	.	+	33
Gentianella anisodonta	+	+	.	.	.	.	33
Agrostis alpina	.	+	.	.	.	.	17
Bartsia alpina	+	.	.	.	.	.	17
Bellidiastrum michelii	.	+	.	.	.	.	17
Hieracium villosum	.	+	.	.	.	.	17
Koeleria eryostachya	.	.	+	.	.	.	17
Polygala alpestris	.	.	+	.	.	.	17
charact. species of *Molinio-Arrhenatheretea*							
Festuca rubra/rubra	.	+	+	1	1	+	83
Trifolium pratense/nivale	.	+	+	+	+	+	83
Poa alpina/alpina	+	+	.	.	+	+	67
Trollius europaeus/europaeus	1	.	1	+	+	.	67
Crocus vernus/albiflorus	.	.	+	+	.	+	50
Agrostis capillaris	.	.	.	+	+	1	50
Phleum rhaeticum	.	.	.	.	+	+	33
Leontodon hispidus	1	.	.	.	.	.	17
charact. species of *Nardetea strictae*							
Luzula alpina	+	.	+	+	.	+	67
Antennaria dioica	+	.	+	+	.	.	50
Coeloglossum viride	+	.	+	.	.	.	33
Luzula multiflora	.	+	.	.	.	+	33
Potentilla erecta	.	.	+	+	.	.	33
Arnica montana/montana	.	.	+	.	.	.	17
Festuca rubra/commutata	.	.	.	+	.	.	17
Nardus stricta	.	.	.	.	.	+	17
charact. species of *Juncetea trifidi*							
Anthoxanthum odoratum/nipponicum	+	.	.	+	+	.	50
Geum montanum	.	.	+	+	.	+	50
Potentilla aurea	.	.	.	.	+	+	33
Hypochaeris uniflora	.	.	.	.	.	r	17
Leontodon helveticus	.	.	+	.	.	.	17
Luzula spicata/mutabilis	.	.	.	.	.	+	17
charact. species of *Thlaspietea rotundifolii*							
Galium baldense	.	+	+	+	.	.	50
Salix reticulata	+	+	.	.	.	.	33
Anemone baldensis	1	+	.	.	.	.	33
Salix retusa	.	+	.	.	.	.	17
charact. species of *Festuco-Brometea*							
Carex montana	.	.	.	+	.	+	33
Hippocrepis comosa	.	.	+	+	.	.	33
Carlina acaulis	.	.	+	.	.	+	33
Plantago media	.	.	+	.	.	+	33
Cirsium acaule/acaule	.	.	+	.	.	.	17
other species							
Bistorta vivipara	+	+	+	+	+	+	100
Carduus defloratus/tridentinus	+	+	+	+	+	+	100
Parnassia palustris/palustris	+	+	+	+	+	+	100
Carex sempervirens	3	3	3	3	3	4	100
Daphne striata	1	.	1	+	+	+	83
Salix breviserrata	1	+	+	+	+	.	83
Campanula scheuchzeri/scheuchzeri	+	.	+	+	+	+	83
Asplenium viride	+	+	+	.	+	.	67
Soldanella alpina/alpina	.	+	+	.	+	+	67
Homogyne alpina	+	+	+	.	.	.	50
Salix serpillifolia	.	+	+	.	.	+	50
Selaginella selaginoides	1	+	+	.	.	.	50
Thymus praecox/polytrichus	1	.	1	+	.	.	50
Alchemilla vulgaris agg.	+	.	.	.	.	+	33
Erica carnea	.	.	+	+	.	.	33
Luzula sylvatica/sieberi	.	.	+	.	.	+	33
Vaccinium uliginosum/microphyllum	+	.	+	.	.	.	33
Vaccinium vitis-idaea	+	.	+	.	.	.	33
Viola biflora	+	+	.	.	.	.	33

that locally represents the more widespread dolina prairie. The association as a whole is distributed in the subalpine belt of the southeastern Alps.
Natura 2000: 6170.

ARABIDETUM CAERULAE Br.-Bl. 1918 fragm. (Tab. 13)

Differential species: *Arabis caerulea* (subom.)
Floristic composition: In the only relevé the physiognomy is determined by the predominance of *Veronica alpina* over *Arabis caerulea*, i.e. the only other element occurring with a fair coverage; *Salix* species are completely absent.
Syntaxonomy, sinecology and synchorology: Multivariate analysis clearly separates this relevé from all the others. The ecology of the site and the presence of *Arabis caerulea* would suggest to refer it to *Arabidetum caeruleae*, though are present only the same *Arabis caerulea, Hornungia alpina/alpina* and *Arabis alpina* among the diagnostic species combination of the association (English, 1999). This stand is therefore interpreted as a fragment of *Arabidetum caeruleae,* which like other coenoses occurs in a sporadic and piecemeal way in the higher sector of the Asiago Plateau, as a consequence of the marginal location of the study area with respect to the Alpine chain. The framework in *Arabidion* – alliance that includes plant communities on less stabilized debris and on sites with lower lenticular accumulations of soil than *Soldanello-Salicion* – is proved by a large group of species belonging to the diagnostic species combination of the syntaxon (Englisch, 1999): *Arabis alpina, A. caerulea, Cerastium carinthiacum, Sanionia uncinata, Hornungia alpina/alpina, Veronica alpina*. Many of them are considered characteristics of *Thlaspion* (*Cerastium carinthiacum/austroalpinum, Hornungia alpina/alpina, Papaver alpinum/rhaeticum*) or *Androsacetalia alpinae* (*Veronica alpina*), syntaxa that, highlighting the ground stoniness, are far more represented in plant communities belonging to *Arabidion* (Surina, 2005a). Compared with *Salicetum retuso-reticulatae*, that is the other dolina coenose on soil of neutral-slightly basic pH but relating to *Soldanello-Salicion*, the absence of *Salix retusa* and *S. reticulata* due to a more prolonged snow cover also stands out. The herbaceous stand colonizes the bottom of a deep hollow placed in the highest part of the glacio-karst enclave between M.

Tab. 13 – *Arabidetum caeruleae* Br.-Bl. 1918 fragm.

N° of relevé	40
Altitude (m a.s.l.)	2143
Exposure	N
Slope (°)	10
Area (m^2)	6
Coverage (%)	50
N° of species	20
diff. species of association	
Arabis caerulea (All)	1
charact. species of *Arabidion, Arabidetalia*	
Soldanella minima	+
Galium baldense	+
Saxifraga androsacea	+
charact. species of *Thlaspietea rotundifolii*	
Veronica alpina	2
Cerastium	+
Hornungia alpina/alpina	+
Papaver alpinum/rhaeticum	+
Minuartia sedoides	+
Arabis alpina	+
charact. species of *Elyno-Seslerietea*	
Silene acaulis/longiscapa	+
Festuca quadriflora	+
Veronica aphylla	+
Saxifraga caesia	+
other species	
Carex atrata/atrata	+
Poa alpina/alpina	+
Festuca alpina	+
mosses and lichens	
Sanionia uncinata	+
Distichium inclinatum	+
Cladonia convoluta	+

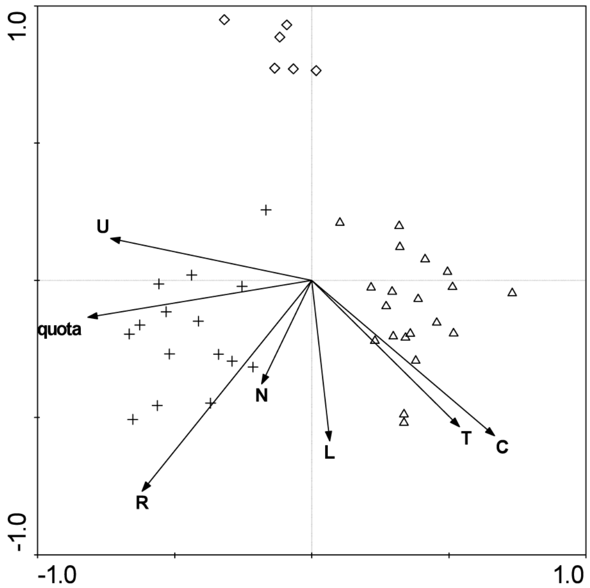


Fig. 18 – RDA ordination diagram of *Salix* relevés in dolina bottom. Coverage data. Mosses and lichens included. ◇: *Potentillo dubiae-Homogynetum discoloris*; +: *Salicetum retuso-reticulatae*; △: *Salicetum reticulato-breviserratae*. Quota: altitude; L: light; T: temperature; C: continentality; U: moisture; R: reaction; N: nutrients.

Tab. 14 – Ellenberg's bioindicator values (Pignatti, 2005; Düll 1992; Wirth, 1992) of *Salicetum reticulato-breviserratae* (S r-b), *Salicetum retuso-reticulatae* (S r-r) and *Potentillo dubiae-Homogynetum discoloris* (P-H) on the basis of presence/absence (p/a) and coverage (cov) data. Mosses and lichens included. L: light; T: temperature; C: continentality; U: moisture; R: reaction; N: nutrients

	S r-b (p/a)	S r-r (p/a)	P-H (p/a)	S r-b (cov)	S r-r (cov)	P-H (cov)
L	7,46	7,54	7,22	7,48	7,52	7,21
T	2,66	2,52	2,20	2,70	2,45	2,19
C	5,03	4,83	4,69	5,04	4,77	4,53
U	4,70	4,96	4,98	4,64	5,10	4,98
R	5,68	6,57	4,85	5,54	6,74	4,69
N	2,18	2,20	1,88	2,24	2,34	2,05

Tab. 15 – Inter-set correlations of the environmental variables with the first two RDA axes.

	1° axis corr.	2° axis corr.
altitude	**- 0,07761**	-0.1274
L	0.0618	-0.5535
T	0.5114	-0.5045
C	0.6335	-0.5364
U	**-0.6973**	0.1444
R	-0.5876	**-0.7271**
N	-0.1731	-0.3574

Trentin and Cima XII, at the foot of a large and debris-rich slope, in catenal contact with *Papaveretum rhaetici*. The soil is an alpine protorendzina with A/C profile, medium-size clast rich and with interspersed 5-6 cm-thick clay deposits, resulting in a pH value of 6.8.
The association occurs in the alpine belt of the central-Eastern Alps (Englisch, 1999).
Natura 2000: 6170.

Syntaxonomic scheme

Carici rupestris-Kobresietea bellardii Ohba 1974
Oxytropido-Elynetalia Oberdorfer ex Albrecht 1969
Oxytropido-Elynion Br.-Bl. 1949
Salici reticulatae-Caricetum rupestris ass. nova hoc loco
Elynetum myosuroides Rübel 1911 fragm.

Elyno-Seslerietea variae Br.-Bl. 1948
Seslerietalia variae Br.-Bl. in Br.-Bl. *et* Jenni 1926

Seslerion variae Br.-Bl. in Br.-Bl. *et* Jenni 1926
Caricenion firmae (Gams 1936) Theurillat in Theurillat, Aeschimann, Küpfer *et* Spichiger 1995
Homogyno discoloris-Loiseleurietum Aichinger 1933 var. geogr. *Galium baldense*
Ranunculo hybridi-Caricetum sempervirentis Poldini *et* Feoli Chiapella in Feoli Chiapella *et* Poldini 1994
Caricion ferrugineae Br-Bl. 1931
Campanulo scheuchzeri-Festucetum noricae geetosum montanae Isda 1986 var. geogr. *Galium baldense*

Thlaspietea rotundifolii Br.-Bl. 1948
Arabidetalia caeruleae Rübel ex Nordhagen 1936
Soldanello alpinae-Salicion retusae Englisch 1999
Salicetum reticulato-breviserratae ass. nova hoc loco
Salicetum retuso-reticulatae Br.-Bl. in Br.-Bl. *et* Jenny 1926
Potentillo dubiae-Homogynetum discoloris Aichinger 1933
Arabidion caeruleae Br.-Bl. in Br.-Bl. *et* Jenni 1926 em. Englisch 1999
Arabidetum caeruleae Br.-Bl. 1918 fragm.

Loiseleurio-Vaccinietea Eggler ex Schubert 1960
Rododendro-Vaccinietalia Br.-Bl. in Br.-Bl. *et* Jenni 1926
Loiseleurio-Vaccinion Br.-Bl. in Br.-Bl. *et* Jenni 1926
Empetro-Vaccinietum gaultherioides Br.-Bl. in Br.-Bl. *et* Jenny 1926 corr. Grabherr 1993
Empetro-Vaccinietum gaultherioides mugetosum Oberdorfer 1992

Juncetea trifidi Hadač 1946
Caricetalia curvulae Br.-Bl. in Br.-Bl. *et* Jenni 1926
Nardion strictae Br.-Bl. 1926
Sieversio montanae-Nardetum strictae Lüdi 1948
Sieversio montanae-Nardetum strictae typicum Peppler-Lisbach *et* Petersen 2001 var. geogr. *Galium baldense*
Juncus jacquinii variant

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Appendix 1: other syntaxa quoted in the text

Androsacetalia alpinae Br.-Bl. in Br.-Bl. et Jenny 1926
Asplenietea trichomanis Br.-Bl. in Meier et Br.-Bl. 1934 corr. Oberdorfer 1977
Calluno-Ulicetea Br.-Bl. et Tüxen ex Klika 1948
Caricetum rupestris Pignatti et Pignatti 1985
Caricion curvulae Br.-Bl. in Br.-Bl. et Jenny 1926
Caricion ferrugineae G. Br.-Bl. 1931
Caricion firmae Gams 1936
Carici ornithopodae-Seslerietum Poldini et Feoli Chiapelle in Feoli Chiapella et Poldini 1994
Cetrario-Loiseleurietum Br.-Bl. 1926
Diantho alpinae-Salicetum retusae Englisch 1999
Elynetum myosuroides loiseleurietosum Hartmann 1971
Elynetum myosuroides seslerietosum variae Albrecht 1969
Elynetum myosuroides helictotrichetosum versicoloris Albrecht 1969
Homogyno discoloris-Salicetum retusae Aichinger 1933
Molinio-Arrhenatheretea Tüxen 1937
Nardetalia Preising 1949
Nardetea strictae Rivas Goday et Borja Carbonell 1961
Papaveretum rhaetici Wikus 1959
Piceion excelsae Pawlowski in Pawlowski, Sokolowski et Wallisch 1928
Poion alpinae Gams ex Oberdorfer 1950
Salicetea herbaceae Br.-Bl. 1948
Salicion herbaceae Br.-Bl. in Br.-Bl. et Jenny 1926
Salici retusae-Geranietum argentei Surina 2005
Scheuchzerio-Caricetea fuscae Tüxen 1937
Sieversio montanae-Nardetum strictae seslerietosum albicantis Lüth, Tasser, Niedrist, Dalla Via et Tappeiner 2010
Sieversio montanae-Nardetum strictae trifolietosum pratensis Braun-Blanquet 1949
Thlaspion rotundifolii Jenni-Lips 1930
Vaccinio-Picetea Br.-Bl. in Br.-Bl., Sissingh et Vlieger 1939

Appendix 2: sporadic species

Tab. 1: rel. 1: Peltigera aphthosa, Pleurozium schreberi; rel. 4: Festuca alpina/alpina, Silene pusilla, Hornungia alpina/alpina; rel. 5: Alchemilla glaucescens, Geum montanum, Luzula campestris, Trifolium badium; rel. 6: Campanula cohleariifolia, Sedum alpestre; rel.7: Carex montana, Luzula spicata/mutabilis; rel. 9: Salix herbacea, Veronica alpina; rel. 12: Euphrasia minima, Minuartia sedoides; rel. 15: Avenula versicolor, Campanula scheuchzeri/scheuchzeri, Potentilla aurea 1, Minuartia cherlerioides/cherlerioides, Saxifraga paniculata; rel. 16: Cladonia deformis, Salix waldsteiniana; rel. 17: Dicranum scoparium; rel. 19: Distichium inclinatum, Pulsatilla vernalis, Soldanella alpina/alpina; rel. 20: Thamnolia vermicularis
Tab. 4: rel. 62: Aposeris foetida r, Festuca alpina/alpina 1, Valeriana saxatilis; rel. 63: Salix glabra (pl) r, Salix hastata (pl) r, Salix waldsteiniana (pl); rel. 64: Veratrum album/lobelianum; rel. 65: Pinguicula leptoceras 1, Soldanella alpina/alpina; rel. 68: Cystopteris fragilis; rel. 74: Lonicera caerulea; rel. 75: Ptilidium ciliare, Thymus praecox/polytrichus; rel. 77: Climacium dendroides, Silene pusilla; rel. 78: Alectoria ochroleuca, Nardus stricta; rel. 79: Festuca rubra/rubra, Leontodon hispidus, Pyrola rotundifolia, Tofieldia calyculata, Vaccinium myrtillus; rel. 80: Bryum pallescens; rel. 81: Brachythecium salebrosum, Bryum

elegans, Mnium thomsonii, Campylium protensum, Cladonia coniocraea
Tab. 5: rel. 22: Primula spectabilis; rel. 23: Poa alpina/alpina; rel. 29: Alchemilla fissa, Salix herbacea; rel. 33: Veronica alpina; rel. 39: Galium boreale 1, Onchophorus virens, Viola biflora
Tab. 8: rel. 42: Bistorta vivipara 1, Cladonia rangiferina, Luzula multiflora, Trifolium badium; rel. 43: Vaccinium vitis-idaea; rel. 45: Oncophorus virens, Valeriana saxatilis; rel. 47: Bryum elegans; rel. 48: Cerastium strictum; rel. 49: Festuca rubra/rubra, Mnium thomsonii; rel. 50: Pyrola rotundifolia; rel. 51: Brachythecium salebrosum, Pinus mugo/mugo (pl); rel. 52: Coeloglossum viride, Festuca rubra/commutata, Rhododendron hirsutum (pl); rel. 53: Doronicum columnae, Phyteuma sieberi
Tab. 9: rel. 56: Carex capillaris/capillaris, Kalmia procumbens, Salix breviserrata, Vaccinium vitis-idaea, Solorina saccata; rel. 57: Cladonia arbuscula 1; rel. 58: Alchemilla flabellata, Leontodon hispidus; rel. 61: Cerastium fontanum, Homogyne alpina, Pinus mugo/mugo (pl), Pyrola rotundifolia, Selaginella selaginoides, Cladonia convoluta
Tab. 10: rel. 82: Cladonia convoluta; Ril. 83: Carex ericetorum, Cetraria islandica, Cirsium acaule/acaule, Cladonia forcata, Cladonia rangiferina; Ril. 87: Daphne striata; Ril. 91: Gentiana nivalis
Tab. 11: rel 95: Daphne striata, Saxifraga paniculata; rel 97: Erica carnea, Juniperus communis/nana, Vaccinium myrtillus; Ril 98: Valeriana montana
Tab. 12: rel. 99: Cetraria islandica, Juniperus communis/nana, Pinus mugo/mugo; rel. 100: Antennaria carpathica, Carex ericetorum; rel. 101: Gentiana utriculosa; rel. 102: Aposeris foetida, Daphne mezereum, Deschampsia flexuosa, Peucedanum ostruthium; rel. 104: Carex capillaris/capillaris, Pinguicula alpina

Appendix 3: chorotype grouping in statistical analysis

Alpine group: including Alpine, Alpine/Apenninic, Alpine/Carpatic, Alpine/Illyrian, Alpine/Pyrenean, south-Alpine/Apennine and north-European-Alpine chorotypes
cosmopolitan group: including cosmopolitan and subcosmopolitan chorotypes
east-Alpine group: including east-Alpine, east-Alpine/Illyrian and east-Alpine/Apennine chorotypes
European group: including European, European/North-American and European/west-Asiatic chorotypes
Eurosiberian/North-American group: including Eurosiberian/North-American, Eurosiberian, Euroasiatic and euroasiatic/North-American chorotypes
orophytic south-European group: including orophytic south-European and orophytic-European chorotypes