

Zeitschrift: Veröffentlichungen des Geobotanischen Institutes der Eidg. Tech. Hochschule, Stiftung Rübel, in Zürich

Herausgeber: Geobotanisches Institut, Stiftung Rübel (Zürich)

Band: 130 (2002)

Artikel: Alpine vegetation of the Teberda Reserve, the northwestern Caucasus = Die Alpine Vegetation des Teberda Reservates, Nordwest-Kaukasus

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Kapitel: 12: Elfin : "Loiseleurio-Vaccinietea"

DOI: <https://doi.org/10.5169/seals-308994>

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12. Elfin - *Loiseleurio-Vaccinietea*

Prodromus

Loiseleurio-Vaccinietea EGGLER 1952

Rhododendro-Vaccinietalia BRAUN-BLANQUET in BRAUN-BLANQUET & JENNY
1926

Rhododendron caucasici all.nov.

Lerchenfeldio-Rhododenretum caucasici ONIPCHENKO & SENNOV 1992

L.-R.c. oxalidetosum ONIPCHENKO & SENNOV 1992

L.-R.c. typicum ONIPCHENKO & SENNOV 1992

L.-R.c. pleurozietosum subass.nov.

Aconito nasuti-Juniperion all.nov.

Aconito nasuti-Juniperetum ass.nov.

A.n.-J. typicum subass.nov.

A.n.-J. chaerophylletosum rosei subass.nov.

Salici kazbekensis-Empetrion nigrae all.nov.

Polygono viviparum-Salicetum kazbekensis ass.nov.

Loiseleurio-Vaccinietea, Rhododendro-Vaccinietalia

The class and order combine Arctic and alpine dwarf scrub communities on poor acidic soils (GRABHERR 1993c). Physiognomic features (i.e., dwarf shrub dominance) are important for diagnosis of this community, since the diagnostic species set is represented by a few species with wide ecological ranges. There are two such species in the study area, *Vaccinium vitis-idaea* and *Empetrum nigrum*. We suggest three new alliances within the order (Table 12.1.).

12.1. *Rhododendron caucasici*

Rhododendron causicum scrub communities are widespread in the Caucasus (BUSH 1935, GROSSGEIM 1948, GULISASHVILI *et al.* 1975, BORLAKOV & SABLINA 1985, GADZHIEH *et al.* 1986, IVANOV 1988). Due to many common species we consider this community within the same association (ONIPCHENKO & SENNOV 1992) as *Lerchenfeldio-Rhododenretum caucasici*.

Table 12.1.
Diagnostic table of *Loiseleurio-Vaccinietea*

	1	2	3	4	5	6
D.sp. <i>L.-R.c. oxalidetosum</i>						
<i>Oxalis acetosella</i>	V	-	II	-	-	-
<i>Millium effusum</i>	V	-	-	-	-	-
<i>Athyrium distentifolium</i>	V	-	-	-	-	-
<i>Gymnocarpium dryopteris</i>	III	-	-	-	-	-
<i>Brachythecium graciale</i>	II	-	-	-	-	-
<i>Calamagrostis arundinacea</i>	IV	-	I	IV	III	-
D.sp. <i>L.-R.c. typicum</i>						
<i>Sibbaldia procumbens</i>	I	V	I	-	-	I
<i>Gnaphalium supinum</i>	-	IV	I	-	-	I
<i>Sedum tenellum</i>	I	IV	-	-	-	I
<i>Leontodon hispidus</i>	-	II	-	I	I	-
D.sp. <i>L.-R.c. pleurozietosum</i>						
<i>Pleurozium schreberi</i>	-	I	V	II	I	I
<i>Hylocomium splendens</i>	-	I	V	III	II	I
<i>Dicranoweisia crispula</i>	I	II	IV	-	-	-
<i>Dicranum congestum</i>	-	-	III	-	-	I
<i>Peltigera aphthosa</i>	-	-	III	I	I	II
D.sp. <i>Lerchenfeldio-Rhododenretum caucasici</i>						
<i>Rhododendron caucasici</i>						
<i>Rhododendron caucasicum</i>	V	V	V	I	I	II
<i>Vaccinium myrtillus</i>	V	IV	V	III	-	I
<i>Solidago virgaurea</i>	V	IV	II	I	-	-
<i>Senecio taraxacifolius</i>	II	III	II	-	-	-
<i>Chamerion angustifolium</i>	IV	III	II	I	-	-
<i>Dicranum scoparium</i>	IV	V	V	III	I	IV
<i>Deschampsia flexuosa</i>	V	V	V	IV	IV	-
<i>Anthoxanthum odoratum</i>	II	V	V	II	III	-
D.sp. <i>A.n.-J. typicum</i>						
<i>Cladonia pyxidata</i>	III	V	III	III	-	V
<i>Hypericum linarioides</i>	-	-	-	III	I	-
<i>Sedum spurium</i>	-	-	-	III	-	-
D.sp. <i>A.n.-J. chaerophylletosum rosei</i>						
<i>Chaerophyllum roseum</i>	-	II	I	-	IV	-
<i>Galium verum</i>	-	-	-	I	IV	-
<i>Primula ruprechtii</i>	-	-	-	I	IV	-
<i>Gentiana septemfida</i>	-	-	-	I	IV	I
<i>Poa longifolia</i>	II	I	I	I	IV	-
<i>Ranunculus oreophilus</i>	I	II	III	I	IV	I
<i>Pedicularis comosa</i>	-	-	-	I	III	II
<i>Geranium sylvaticum</i>	II	II	II	I	III	-
D.sp. <i>Aconito nasuti-Juniperion, Aconito nasuti-Juniperetum</i>						
<i>Seseli alpinum</i>	-	II	III	IV	V	I
<i>Aconitum nasutum</i>	-	-	-	IV	IV	-
<i>Juniperus communis</i>	II	-	II	V	V	-
<i>Abietinella abietina</i>	-	-	-	II	III	-
<i>Betonica macrantha</i>	-	-	-	II	IV	-

Table 12.1. (continued)

	1	2	3	4	5	6
<i>Bromopsis variegata</i>	-	-	-	II	IV	I
<i>Tortula ruralis</i>	-	-	-	IV	II	-
<i>Cotoneaster integerrimus</i>	I	-	-	III	I	-
<i>Festuca varia</i>	I	II	I	IV	V	-
<i>Rhytidium rugosum</i>	-	-	-	III	IV	III
<i>Senecio aurantiacus</i>	-	I	-	II	IV	I
<i>Campanula collina</i>	-	II	II	V	V	I
D.sp. <i>Salici kazbekensis</i> - <i>Empetrium nigrae</i> , <i>Polygono viviparum</i> - <i>Salicetum kazbekensis</i>						
<i>Polygonum viviparum</i>	-	-	-	-	-	V
<i>Salix kazbekensis</i>	-	-	II	-	-	V
<i>Lloidia serotina</i>	-	I	-	-	-	IV
<i>Helictotrichon versicolor</i>	-	-	I	II	IV	V
<i>Carex umbrosa</i>	-	I	-	I	III	V
<i>Carex sempervirens</i>	-	-	-	-	-	IV
<i>Comicularia muricata</i>	-	-	-	-	-	III
<i>Eritrichium caucasicum</i>	-	-	-	-	-	III
<i>Tortella tortuosa</i>	-	I	-	-	-	III
<i>Anemone speciosa</i>	-	IV	II	-	II	V
<i>Campanula tridentata</i>	-	III	II	-	I	V
<i>Carum caucasicum</i>	-	IV	II	-	II	V
<i>Cetraria cucullata</i>	-	-	-	I	I	V
<i>Thamnolia vermicularis</i>	-	-	-	-	I	V
<i>Cetraria nivalis</i>	-	-	-	I	I	V
<i>Cladonia gracilis</i>	-	I	II	-	I	V
<i>Luzula spicata</i>	-	I	-	-	I	IV
<i>Arenaria lychnidea</i>	-	-	-	I	-	IV
<i>Fissidens osmundoides</i>	-	-	-	-	-	II
<i>Minuartia circassica</i>	-	II	I	II	II	IV
<i>Cladonia mitis</i>	-	III	V	I	I	V
D.sp. <i>Rhododendro-Vaccinietalia</i> , <i>Loiseleurio-Vaccinietea</i>						
<i>Empetrum nigrum</i>	-	IV	V	I	I	V
<i>Vaccinium vitis-idaea</i>	-	III	V	IV	IV	V
Other species						
<i>Alchemilla vulgaris</i> aggr.	II	I	IV	I	II	-
<i>Anthemis cretica</i>	-	IV	IV	-	I	I
<i>Carex atrata</i>	II	IV	-	-	I	I
<i>Cetraria islandica</i>	II	V	V	IV	V	V
<i>Festuca ovina</i>	-	IV	IV	III	V	V
<i>Geranium gymnocaulon</i>	IV	II	I	-	-	-
<i>Myosotis alpestris</i>	-	II	II	III	IV	II
<i>Polygonum bistorta</i>	-	-	II	III	IV	II
<i>Rumex alpestris</i>	IV	II	-	I	-	-
<i>Sanionia uncinata</i>	II	IV	III	IV	IV	I

Syntaxa:

1 - *Lerchenfeldio-Rhododendretum caucasicum oxalidetosum*; 2 - *L.-R.c. typicum*; 3 - *L.-R.c. pleurozietosum*; 4 - *Aconito nasuti-Juniperetum typicum*; 5 - *A.n.-J. chaerophylletosum rosei*; 6 - *Polygono viviparum-Salicetum kazbekensis*

Floristic features

Except for *Rhododendron caucasicum* and *Senecio taraxacifolium*, other diagnostic species of the association are common boreal species (*Vaccinium*

myrtillus, *Solidago virgaurea*, *Chamaenerion angustifolium*, *Dicranum scoparium*, *Deschampsia flexuosa*, *Anthoxanthum odoratum*). As a rule, *Rhododendron caucasicum* is the main dominant, covering more than 50% of the community area.

The communities are floristically rich (IVANOV 1988). We registered 107 vascular plant species, 53 bryophytes and 12 lichens in 22 relevés of the association. The mean species numbers per relevé were 22, 7 and 3 respectively. The ratio vascular plants/(bryophytes+lichens) was relatively low (1.6). Vascular plant cover ranged between 30 and 95% (mean 76%), the same values for bryophytes and lichens were 2-90%(27%) and 0-30%(6%) respectively. So the role of bryophytes is considerable in terms of species number and plant cover.

The mean number of vascular plant species was estimated as 3.5, 12.5 and 40.4 for 0.01, 1 and 100 sq.m- plots respectively (ONIPCHENKO & SEMENOVA 1995). Three subassociations can be distinguished within the association (Table 12.2.).

L.-R.c. oxalidetosum includes communities of the subalpine zone (2150-2550 m, mean 2410 m), where forest species are well represented (*Oxalis acetosella*, *Athyrium distentifolium*, *Gymnocarpium dryopteris* etc.). The role of lichens is negligible. Typus, or nomenclature type, No. 161/90.

L.-R.c. typicum (= *L.-R.c. cetrarietosum islandicae* ONIPCHENKO & SENNOV 1992) includes the communities of the alpine zone (2400-2700 m a.s.l., mean 2630 m). Alpine snowbed and grassland species form the diagnostic set of the subassociation (*Sibbaldia procumbens*, *Gnaphalium supinum*, *Sedum tenellum*, *Leontodon hispidus*). Typus, or nomenclature type, No. 4/89.

L.-R.c. pleurozietosum combines communities where moss cover is well-developed (5-90%, mean 39%). Boreal mosses (*Pleurozium schreberi*, *Hylocomium splendens*, *Dicranoweisia crispula*, *Dicranum congestum*) and *Peltigera aphthosa* form the diagnostic set of the subassociation.

Typus, or nomenclature type, No. 168/94.

The association can be considered as a geographical vicarious syntaxon of the *Rhododendretum ferruginei* RÜBEL 1911 of the Alps (*Rhododendro* -

Vaccinietum BRAUN-BLANQUET in BRAUN-BLANQUET & JENNY 1926) (HEISELMAYER 1982, ISDA 1985, PIGNATTI *et al.* 1990, GRABHERR 1993c). There are several common species in both associations (*Vaccinium myrtillus*, *Deschampsia flexuosa*, *Hylocomium splendens*, *Peltigera aphthosa*).

Ecological features

Rhododendron caucasicum scrub communities develop within alpine and subalpine zones at altitudes of 2150 to 2700 m a.s.l., mean 2530 m) mainly on steep northern leeward (10-45°, mean 29°) slopes with significant winter snow accumulation. Amount of boulders at the surface varies (0-40%). Soils are acid and humus-rich. We detected from 750 to 2480 viable seeds per sq.m in the soils under the community (SEMENOVA & ONIPCHENKO 1994). *Rhododendron* seeds were rare, while the most common species in the seed bank were *Luzula multiflora*, *Sedum tenellum*, *Phleum alpinum*, *Carex atrata* and *Carex pyrenaica*.

12.2. *Aconito nasuti-Juniperion*

The alliance comprises communities where the dwarf form of *Juniperus communis* is the main dominant. It can be considered as the Caucasian vicarious syntaxon of *Juniperion nanae* BRAUN-BLANQUET *et al.* 1939. Only few species (*Cotoneaster integerrimus*, *Carex sempervirens*) are shared by both syntaxa (GRABHERR 1993). We propose one association within the alliance.

Aconito nasuti-Juniperetum

Floristic features

The diagnostic set includes *Juniperus communis* and several accompanying species (*Seseli alpinum*, *Aconitum nasutum*, *Abietinella abietina*, *Senecio aurantiacus*), including some common alpine species (*Campanula collina*, *Festuca varia*, *Betonica macrantha*, *Bromopsis variegata*) (Table 12.3.). Two subassociations may be distinguished according to differences in floristic composition.

A.n.-J. typicum combines more "warm" communities occupying mainly south slopes. *Sedum spurium*, *Hypericum linarioides*, *Cladonia pyxidata*

are more frequent in the communities. Typus, or nomenclature type, No. 81/93.

A.n.-J. *chaerophylletosum rosei* represents communities developing mainly on west or east slopes. Several species prefer the habitats and can be considered as diagnostic (*Chaerophyllum roseum*, *Galium verum*, *Primula ruprechtii*, *Gentiana septemfida* etc.). Typus, or nomenclature type, No. 95/94.

The communities of the association are floristically rich. We registered 129 vascular plant species, 46 bryophytes and 13 lichens in 20 releves. Average species numbers per releve were 23, 7 and 8 species correspondingly. Cover of vascular plants (mainly *Juniperus*) ranges within 70-100% (mean 88%), the same values for bryophyte and lichen cover are 1-70%(24%) and 0-30%(6%) respectively.

Ecological features

The communities are commonly found in the alpine and subalpine zones at an altitude between 2300 and 2840 m (mean 2510 m), but as a rule they occupy only small areas within these zones. They occur on slopes with various aspects (but never on the northern slopes!) and steepness (2°-35°, mean 16°). As a rule, the communities develop as stripes along the ridge tops, slope bends and transition zones between lee and windward slopes. Snow depth often corresponds to the height of *Juniperus communis* shrubs (20-40 cm), because frost and winds kill exposed branches in winter.

12.3. *Salici kazbekensis-Empetrion nigrae*

The alliance combines so-called "dwarf shrub heaths" (SHIFFERS 1953). Their position in the floristic classification is not obvious. Species of *Carici rupestris-Kobresietea bellardii* and *Juncetea trifidi* are very well represented in the communities, so it is possible to consider the alliance within these classes (LSBIRDIN, personal communication). However, in our work we describe it within *Loiseleurio-Vaccinietea* due to the physiognomic features (dwarf shrub dominance) and high frequency of *Empetrum nigrum* and *Vaccinium vitis-idaea* (Table 12.1., 12.3.). We propose one association within the alliance.

Table 12.2.

Lerchenfeldio-Rhododenretum caucasici

Releve No.	0 0 1 1 0 1 1 1	0 0 0 0 0 0 0 1	0 0 0 0 1 0
	54 55 61 60 41 90 77 99	26 37 38 4 3 45 30 34	75 47 96 99 68 66
Year	91 91 90 90 91 94 94 94	91 83 83 89 89 89 91 95	94 94 94 94 94 95
Altitude (* 10)	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2
	15 20 55 55 55 50 38 41	40 65 70 70 60 68 60 70	45 63 45 55 68 52
Steepness	15 20 35 35 30 30 10 30	35 45 45 30 35 35 25 30	25 30 30 30 30 15
Exposition	n ne ne ne ne ne n n	nw ne n ne n w w n	nw ne nw nw n ne
Vascular plant cover	85 90 85 90 90 85 80 80	60 70 30 60 60 65 55 70	95 90 75 85 75 85
Bryophyte cover	10 2 40 20 5 10 20 30	5 20 40 40 50 20 10 10	40 5 30 90 40 30
Lichen cover	+ + + 0 0 + + +	5 8 8 5 5 10 + 10	0 15 30 3 15 10
Stone cover	0 + 0 0 + 5 + +	+ 5 40 10 5 + + 2	+ 5 + 5 5 5
<i>D.sp. L.-R.c. oxalidetosum</i>			
<i>Oxalis acetosella</i>	1 1 1 1 1 1 + +		1 +
<i>Millium effusum</i>	r r + 1 1 + + +		
<i>Athyrium distentifolium</i>	+ + + 2 + + +		
<i>Gymnocarpium dryopteris</i>	1 1 + 1		
<i>Brachythecium graciale</i>	2 1		
<i>Calamagrostis arundinacea</i>	+ 1 + + 1		+
<i>D.sp. L.-R.c. typicum</i>			
<i>Sibbaldia procumbens</i>	+	2 + 2 + 1 + + 2	+
<i>Gnaphalium supinum</i>		+ + + 1 + +	+
<i>Sedum tenellum</i>	r	r + + + + +	
<i>Leontodon hispidus</i>		+ + + +	
<i>D.sp. L.-R.c. pleurozietosum</i>			
<i>Pleurozium schreberi</i>		+ +	1 + 1 3 3 1
<i>Hylocomium splendens</i>		+ +	+ 1 3 1 1
<i>Dicranoweisia crispula</i>	+	+ +	+ + + +
<i>Dicranum congestum</i>			1 1 1
<i>Peltigera aphthosa</i>			1 + +
<i>D.sp. Lerchenfeldio-Rhododenretum caucasici, Rhododendron caucasici</i>			
<i>Rhododendron caucasicum</i>	5 5 4 4 5 4 4 4	3 3 1 3 3 4 3 3	4 4 3 4 3 3
<i>Vaccinium myrtillus</i>	+ 1 3 1 1 3 2	2 2 1 2 1 2	+ 2 1 1 2
<i>Solidago virgaurea</i>	+ 1 + 1 1 2 +	+ + 1 1 +	+ 1
<i>Senecio taraxacifolius</i>	r r +	1 1 + 1	+ +
<i>Chamerion angustifolium</i>	+ + 1 r +	r + + +	+ +
<i>Dicranum scoparium</i>	2 1 1 1 2	+ + + + + +	1 + 2 1 2
<i>Deschampsia flexuosa</i>	+ r 1 1 1 + 1 1	2 2 + + 2 1 2 2	1 1 2 1 2 1
<i>Anthoxanthum odoratum</i>	+ + +	1 + + 1 + 1 1	+ + 1 + +
<i>D.sp. Rhododendro-Vaccinietales, Loiseleurio-Vaccinietales</i>			
<i>Empetrum nigrum</i>		+ 2 + 2 1 1	1 1 + 2 2
<i>Vaccinium vitis-idaea</i>		1 + 1 +	+ 2 + + +
Other species			
<i>Agrostis vinealis</i>	+ +	1 + +	+ +
<i>Alchemilla vulgaris aggr.</i>	r +	1	+ + + +
<i>Anemone speciosa</i>		+ + 1 + r	+ +
<i>Anthemis cretica</i>		+ + 1 + 1	+ + + +
<i>Astrantia maxima</i>	+		1 +

Table 12.2. (continued)

Releve No.	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	
	54	55	61	60	41	90	77	99	26	37	38	4	3	45	30	34	75	47	96	99	68	66	
Year	91	91	90	90	91	94	94	94	91	83	83	89	89	89	91	95	94	94	94	94	94	94	95
<i>Barbilophozia barbata</i>			+	+											+								
<i>Brachythecium reflexum</i>	1	+					+								+		+					+	+
<i>Brachythecium starkei</i>							+			+		+											+
<i>Campanula collina</i>									r						1	+	+	+					
<i>Campanula tridentata</i>										1	1	1				+		+					+
<i>Carex atrata</i>	r				r				+		+		+		+	+							
<i>Carex pyrenaica</i>								+			+	+				+							
<i>Carum caucasicum</i>									+	+	1	1	1					+	+				
<i>Carum meifolium</i>							+						1			+		+					
<i>Cetraria islandica</i>						+	+	+	1	1	1	2	1	2	+	2		2	2	2	2	2	2
<i>Chaerophyllum roseum</i>														+	+						+		
<i>Cladonia furcata</i>															+				+			+	
<i>Cladonia gracilis</i>													+						+				+
<i>Cladonia mitis</i>									1	1	+	+					2	2	+	2	+		+
<i>Cladonia pyxidata</i>		+	+			+		+	1	1	+	+	+	1	+	+		1			+	1	
<i>Cladonia rangiferina</i>																	1	+				+	
<i>Crepis glabra</i>				+				+					+										
<i>Draba hispida</i>					r										+		+						
<i>Dryopteris carthusiana</i>	+		+			+																	
<i>Festuca brunnescens</i>					+					1	+												
<i>Festuca ovina</i>									1	+	+	+	+			+		+	+	+	+		
<i>Festuca varia</i>		r												+	+		+						
<i>Geranium gymnocaulon</i>				r	+	+	1	+					1			+	3						
<i>Geranium sylvaticum</i>	+					+			r					+				+		1			
<i>Hedysarum caucasicum</i>													1		1		+						2
<i>Hieracium macrolepis</i>			+									+	+	1	1							+	+
<i>Huperzia selago</i>			+					+			+	+	+					1					
<i>Juniperus communis</i>	1	1													+		1						2
<i>Kemulariella caucasica</i>						+	+										+						
<i>Lescurea incurvata</i>					1				+				+										
<i>Lescurea saxicola</i>	+									+					+						+	+	+
<i>Lophozia sp.</i>						+	+									+						+	
<i>Luzula multiflora</i>										+			1		+	1	+						
<i>Minuartia circassica</i>										+					r			+					
<i>Myosotis alpestris</i>												+	+		+		+				+		
<i>Nardus stricta</i>				+	+				1	1		1	1			1	+	+					
<i>Pedicularis condensata</i>													+		r	+		+					
<i>Pedicularis nordmanniana</i>											+	+	+			+					+		
<i>Phleum alpinum</i>						+	+	+					1				+						
<i>Plagiothecium denticulatum</i>	1	+			1					+		+										+	
<i>Poa longifolia</i>					+	+	+		r								+						
<i>Polytrichastrum alpinum</i>				+							+											+	
<i>Polytrichum juniperinum</i>					+					1		+	+	+								+	
<i>Primula meyeri</i>										+	2	+											
<i>Pulsatilla aurea</i>				+		+	+							+			1						
<i>Ranunculus oreophilus</i>								+						+	+						+	+	+

Table 12.2. (continued)

Releve No.	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Year	54	55	61	60	41	90	77	99	26	37	38	4	3	45	30	34	75	47	96	99	68	66
	91	91	90	90	91	94	94	94	91	83	83	89	89	89	91	95	94	94	94	94	94	95
<i>Rhytidadelphus triquetrus</i>						+						+		+			2				3	
<i>Rumex alpestris</i>				+	+	+	+	+						+	+	+						
<i>Sanionia uncinata</i>		+							1			+	+	+		1	+	1	2			
<i>Senecio caucasicus</i>						+								1	+		+				1	
<i>Senecio platyphylloides</i>	+	+	r				+															
<i>Seseli alpinum</i>												+		+	+				+	+		+
<i>Silene vulgaris</i>			r	+	+	+								1	1							
<i>Stereocaulon alpinum</i>									+	+						+						
<i>Taraxacum officinale</i> agg.												+	+	1								
<i>Trisetum flavescens</i>				r			+										+					
<i>Valeriana alpestris</i>																			+	+	+	
<i>Veratrum album</i>						+	+	1						+	+		+	r				
<i>Veronica gentianoides</i>							+		+					+	+		+					
<i>Viola altaica</i>									+	+							+	+				+

Sporadic species (number of releve in parenthesis, abundance is shown after ":", unless it is not "+", Braun-Blanquet scale)

Alopecurus ponticus (190/94), *Anemone narcissiflora* (75/94), *Antennaria dioica* (37/83), *Barbilophozia hatcheri* (96/94, 99/94), *Barbilophozia lycopodioides* (190/94, 66/95), *Bartramia ithyphylla* (37/83, 96/94), *Brachythecium erythrorrhizon* (177/94:2), *Brachythecium latifolium* (75/94), *Brachythecium rivulare* (199/94), *Brachythecium salebrosum* (75/94), *Brachythecium velutinum* (45/89), *Briza marcowiczii* (3/89, 134/95:1), *Carex caryophyllea* (47/94, 96/94), *Carex umbrosa* (26/91), *Catabrosella variegata* (134/95:1), *Cephalozia lunulifolia* (190/94), *Cephalozia* sp. (199/94, 134/95), *Cerastium purpurascens* (75/94, 47/94), *Cetraria pinastri* (96/94, 168/94), *Cirsium munitum* (75/94), *Cotoneaster integerrimus* (55/91), *Daphne glomerata* (30/91:r, 75/94), *Desmatodon latifolius* (3/89, 45/89), *Dicranum muehlenbeckii* (96/94), *Diplophyllum taxifolium* (177/94, 134/95:1), *Dryopteris filix-mas* (190/94), *Euphorbia macroceras* (190/94), *Eurhynchium pulchellum* (37/83), *Festuca djimilensis* (190/94), *Gentiana pyrenaica* (26/91:r, 38/83), *Grimmia elatior* (190/94), *Helictotrichon versicolor* (96/94), *Hieracium lactucella* agg. (168/94), *Hieracium murorum* agg. (54/91, 66/95), *Homalothecium sericeum* (37/83), *Hyalopoa pontica* (38/83), *Hylocomiastrum pyrenaicum* (75/94), *Hypnum callichroum* (199/94:1), *Kiaeria starkei* (134/95:1), *Ligusticum caucasicum* (41/91:r, 199/94), *Lloidia serotina* (38/83), *Lophocolea heterophylla* (190/94, 199/94), *Lophozia longiflora* (161/90:1, 41/91:1), *Lophozia sudetica* (3/89), *Luzula spicata* (38/83), *Minuartia aizoides* (37/83, 4/89), *Minuartia imbricata* (38/83), *Minuartia recurva* (37/83), *Mnium spinosum* (190/94, 75/94:1), *Orthodicranum montanum* (54/91:1), *Paraleucobryum enerve* (37/83), *Paraleucobryum longifolium* (54/91, 38/83), *Peltigera rufescens* (37/83, 38/83:1), *Plagiothecium cavifolium* (190/94, 134/95), *Plantago atrata* (37/83), *Poa caucasica* (55/91:r, 45/89), *Pohlia cruda* (96/94), *Pohlia filum* (134/95), *Pohlia prolifera* (96/94), *Polygonum bistorta* (47/94, 168/94), *Polytrichum commune* (26/91), *Polytrichum piliferum* (37/83:2, 47/94), *Potentilla crantzii* (41/91:1, 4/89), *Pseudoleskea incurvata* (190/94, 199/94), *Psora* sp. (30/91), *Pterigynandrum filiforme* (96/94), *Racomitrium canescens* (66/95), *Ranunculus brachylobus* (134/95:2), *Ranunculus caucasicus* (75/94), *Rubus idaeus* (54/91), *Salix kazbekensis* (96/94:1, 99/94:1), *Saxifraga sibirica* (38/83, 3/89), *Scorzonera cana* (37/83), *Senecio aurantiacus* (45/89), *Senecio kolenatianus* (161/90:r, 190/94), *Silene saxatilis* (177/94, 168/94), *Solorina crocea* (38/83, 96/94), *Taraxacum confusum* (47/94), *Taraxacum stevenii* (134/95:1, 47/94), *Thesium alpinum* (54/91:r), *Tortella tortuosa* (37/83), *Trollius ranunculinus* (190/94, 75/94).

Date (day.month), size (sq.m) and location of the releves.

54/91 - 31.08, 25, Sev.Ptysh; 55/91 - 31.08, 25, Sev.Ptysh; 161/90 - 19.08, 16, Khuty; 160/90 - 19.08, 16, Khuty; 41/91 - 18.08, 25, Ullu-Murudzhu; 190/94 - 10.09, 25, Kichi-Murudzhu; 177/94 - 08.09, 25, Klukhor; 199/94 - 11.09, 25, Klukhor; 26/91 - 16.08, 25, Nazalykol; 37/83 - 31.08, 16, M.Khatipara; 38/83 - 31.08, 25, M.Khatipara; 4/89 - 07.08, 25, M.Khatipara; 3/89 - 07.08, 100, M.Khatipara; 45/89 - 01.09, 25, M.Khatipara; 30/91 - 16.08, 25, Nazalykol; 134/95 - 30.08, 25, Ullu-Murudzhu; 75/94 - 16.07, 25, Bol.Khatipara; 47/94 - 12.07, 12, Kyshkadzher; 96/94 - 20.07, 25, Goralykol; 99/94 - 21.07, 25, Goralykol; 168/94 - 06.09, 25, Nazalykol; 66/95 - 13.07, 25, Baduk.

Polygono viviparum-Salicetum kazbekensis

Floristic features

The diagnostic set of the association includes several groups of species. First, *Salix kazbekensis* (dominant). Second, such common alpine species as *Campanula tridentata*, *Carum caucasicum*, *Carex umbrosa*. Third, a good deal of *Carici rupestris- Kobresietea bellardii* (*Polygonum viviparum*, *Lloydia serotina*) and *Juncetea trifidi* (*Helictotrichon versicolor*, *Luzula spicata*, *Eritrichium caucasicum*, *Anemone speciosa* etc.) among the vascular plant species as well as fruticose lichens (*Cetraria cucullata*, *C.nivalis*, *Cladonia gracilis*, *C.mitis*, *Thamnolia vermicularis*).

Floristic richness of the communities is moderate. We registered 71 vascular plant species, 39 bryophytes and 14 lichens in 11 relevés (Table 12.4.). The mean values per relevé were 23, 7 and 8 species correspondingly. Vascular plant cover ranges between 35% and 75% (mean 50%), the same values for bryophytes and lichens were 1-30%(7%) and 15-50%(35%) respectively. So the role of lichens is very important in term of plant cover as well as species number. Typus, or nomenclature type, No. 108/95

Ecological features

The community occupies mainly steep (5°-30°, mean 23°) northern slopes within the alpine zone (altitude range 2600-2860 m, mean 2710 m). It occurs on ridge tops and windward slopes where thin winter snow cover does not provide adequate protection from deep freezing to the soil. On the other hand, northern exposure leads to low solar radiation. Due to such a stressful environment, the communities have low production. Stones cover up to 30% (mean 10%) of the soil surface.

Table 12.3.

Aconito nasuti-Juniperetum

Releve No.	0 0 1 0 0 1 1 0 0 0	0 0 0 0 0 1 1 0 0 0
	81 77 23 62 64 33 53 20 88 33	14 11 50 91 95 69 47 71 82 32
Year	93 94 95 94 95 94 94 95 93 95	94 94 94 94 94 94 94 94 93 94
Altitude (* 10)	2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2
	35 45 40 30 40 55 84 50 50 60	41 55 65 35 40 68 42 55 75 50
Steepness	25 15 3 30 10 30 2 20 3 30	10 30 2 5 3 30 10 35 20 10
Sxposition	se se s se rw e s s e sw	sw w w nw w se sw ne se w
V.p. cover	95 90 90 90 90 90 85 95 70 90	85 70 95 # 90 95 90 90 80 85
Bryophyte cover	5 40 40 + 40 10 4 5 40 30	70 50 20 30 30 30 5 10 10 15
Lichen cover	3 2 5 0 + 1 20 + 5 30	3 20 5 5 0 5 2 3 20 +
Stone cover	20 30 3 + 2 + 0 3 40 +	+ + 5 + 1 0 2 + 20 +
<i>D.sp. A.n.-J. typicum</i>		
<i>Cladonia pyxidata</i>	1 + + + +	
<i>Hypericum linarioides</i>	+ + + +	+
<i>Sedum spurium</i>	2 + + 1 1 +	
<i>D.sp. A.n.-J. chaerophylletosum rosei</i>		
<i>Chaerophyllum roseum</i>		+ + + + + + +
<i>Galium verum</i>		+ + + + 1 + + 1
<i>Primula ruprechtii</i>	+ 1	+ + + + + + +
<i>Gentiana septemfida</i>		+ + + + + + +
<i>Poa longifolia</i>	1	1 + 1 + 1 1 1
<i>Ranunculus oreophilus</i>		+ + + + + + 1
<i>Pedicularis comosa</i>		+ + + + + + +
<i>Geranium sylvaticum</i>	+ +	+ + + 1 + +
<i>D.sp. Aconito nasuti-Juniperion, Aconito nasuti-Juniperetum</i>		
<i>Seseli alpinum</i>	+ + + + + + 1 +	+ + + + + + + 1 1
<i>Aconitum nasutum</i>	+ + 1 + + + +	1 + + 1 1 1 + +
<i>Juniperus communis</i>	5 4 5 5 4 4 4 5 4 4	4 3 5 5 4 4 4 4 4 4
<i>Abietinella abietina</i>		+ 1 2 + 1 1
<i>Betonica macrantha</i>	+ 1 + +	1 1 1 1 + 1 + +
<i>Bromopsis variegata</i>	+ + + + +	+ + + + 3 + +
<i>Tortula ruralis</i>	1 + + + 1 + 3	1 + + + 1
<i>Cotoneaster integerrimus</i>	1 + 1 1 1	+ + + + + + +
<i>Festuca varia</i>	+ + + + + + 1	+ 1 + 1 + + 1 + + +
<i>Rhytidium rugosum</i>	1 1 + + +	1 + 2 + + 1 1
<i>Senecio aurantiacus</i>	+ + + + +	+ + + + + + +
<i>Campanula collina</i>	+ + + + + + + 1	+ 2 + + + + 1 1 +
<i>D.sp. Rhododendro-Vaccinietales, Loiseleurio-Vaccinietales</i>		
<i>Empetrum nigrum</i>	2 2	2 2 3 2 2 +
<i>Vaccinium vitis-idaea</i>	2 2 2 1 + 2 2 2	2 2 2 2 3 2 2 +
Other species		
<i>Agrostis vinealis</i>	+ + + +	+ + + + 1
<i>Alchemilla caucasica</i>	+ + + +	+ 1 + + + + +
<i>Alchemilla vulgaris aggr.</i>	+ + + +	+ + 1 + + + +
<i>Anemone speciosa</i>		+ + + + + + +
<i>Antennaria dioica</i>	+ + + +	+ + + + + + +
<i>Anthemis marshalliana</i>	+ + + +	+ + + + + + +
<i>Anthoxanthum odoratum</i>	+ + + +	+ 1 + + + + +

Table 12.3. (continued)

Releve No.	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0		
Year	81	77	23	62	64	33	53	20	88	33	14	11	50	91	95	69	47	71	82	32	
	93	94	95	94	95	94	94	95	93	95	94	94	94	94	94	94	94	94	93	94	
<i>Aster alpinus</i>										+										+	
<i>Brachythecium salebrosum</i>								1					+		+	+					
<i>Brachythecium velutinum</i>				+															+	1	
<i>Bupleurum falcatum</i>	+					+				+					+						
<i>Calamagrostis arundinacea</i>	1	1	1	+	2	2		1			+				+		1	+	+	+	
<i>Carex caryophylla</i>						+	+												+		
<i>Carex umbrosa</i>	1		+								+	1	+	+	+					1	
<i>Carum caucasicum</i>												+		+						+	
<i>Centaurea cheiranthifolia</i>															+	+	+	+			
<i>Cerastium purpurascens</i>										+	+				+						
<i>Cetraria islandica</i>	1		1		+	+	2		1	3	1	2	1	1		1	1	1	2	+	
<i>Cladonia mitis</i>							1		+					+						+	
<i>Cruciata laevipes</i>				+		+		+		+					1	+	+			+	
<i>Daphne glomerata</i>					+	1			+	+	1	1							+		
<i>Deschampsia flexuosa</i>	+	+	+	+	+	+			1		+	1	+	+	+		1	+	1		
<i>Dicranum scoparium</i>			1	2		1	+			+	1	1									
<i>Draba sibirica</i>				+		+							+								
<i>Entodon concinnus</i>											+			+			+				
<i>Erigeron caucasicus</i>										+	+								+		
<i>Festuca brunnescens</i>			+							+		+									
<i>Festuca ovina</i>	+		+		+	+	+			+	+	+	+	+	1	+	+	+	1	+	
<i>Geranium renardii</i>				+		1		+											+		
<i>Hedysarum caucasicum</i>		+			+	+			+	+									+	+	
<i>Helictotrichon versicolor</i>			+				+		+	+	+	+	+	1		+			+		
<i>Hieracium macrolepis</i>		+		+	+	+			+	+				+					+		
<i>Hieracium prenanthoides</i>									1	+										+	
<i>Hylocomium splendens</i>		2	2				2		1	+	4			1			1				
<i>Hypnum cupressiforme</i>		+	+											+					1	+	
<i>Hypnum revolutum</i>							1												+	+	
<i>Leontodon hispidus</i>	+			+															+		
<i>Leskeella nervosa</i>		+							+				+		+						
<i>Lotus corniculatus</i>	+									+									+		
<i>Luzula multiflora</i>						+					+			+							
<i>Minuartia circassica</i>	+	+							+	+		+		+						+	
<i>Minuartia recurva</i>									+			+								+	
<i>Myosotis alpestris</i>	+		+	+	+	+	+				+	+	+	+	+		+		1		
<i>Nardus stricta</i>						+					+	+									
<i>Peltigera canina</i>										+						1					
<i>Pleurozium schreberi</i>		2	1		2	+								+							
<i>Poa nemoralis</i>	+	+							1												
<i>Polygonum alpinum</i>	+	+			+					+											
<i>Polygonum bistorta</i>		+	+	+		+		+	1				+	+	+	+	+	+	1	1	+
<i>Potentilla crantzii</i>						+					+		+					+			
<i>Potentilla gelida</i>							1						+							+	
<i>Radula complanata</i>				+					+		+										
<i>Rhododendron caucasicum</i>		2			+							+									
<i>Rhytidadelphus triquetrus</i>									+		1				+						

Table 12.3. (continued)

Releve No.	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	
Year	81	77	23	62	64	33	53	20	88	33	14	11	50	91	95	69	47	71	82	32
Year	93	94	95	94	95	94	94	95	93	95	94	94	94	94	94	94	94	94	93	94
<i>Rosa marschalliana</i>				+					+	+										
<i>Sanionia uncinata</i>			2	+		+	2	1	2	+	1	3	2		+	3	+	1	1	
<i>Saxifraga kolenatiana</i>	+				+					1	+									
<i>Taraxacum stevenii</i>										+	+				+	+				
<i>Thymus nummularius</i>						+				+							+	+		
<i>Trifolium ambiguum</i>													+				+			+
<i>Vaccinium myrtillus</i>					3		+	+	1	2										
<i>Veronica gentianoides</i>							+	+		+	+	+		+						
<i>Vicia cracca</i>	+													+	+					
<i>Viola altaica</i>				+			+	+			+	1		1					+	1

Sporadic species (number of releve in parenthesis, abundance is shown after ":", unless it is not "+", Braun-Blanquet scale)

Achillea millefolium (50/94, 95/94), *Aconitum orientale* (14/94), *Aetheopappus caucasicus* (82/93), *Alopecurus glacialis* (88/93), *Amblystegium varium* (20/95), *Anthemis cretica* (11/94, 82/93), *Arenaria lychnidea* (153/94, 33/95), *Astrantia maxima* (147/94, 32/94), *Barbilophozia barbata* (123/95, 153/94), *Barbilophozia hatcheri* (95/94), *Barbilophozia lycopodioides* (64/95), *Bartramia ithyphylla* (33/95), *Botrychium lunaria* (133/94, 95/94), *Brachythecium albicans* (71/94), *Brachythecium reflexum* (82/93), *Brachythecium starkei* (133/94), *Bryum caespiticium* (33/95), *Bryum capillare* (153/94, 71/94), *Bryum subelegans* (20/95), *Campanula tridentata* (91/94), *Carex atrata* (50/94), *Carex digitata* (64/95), *Carex humilis* (91/94), *Cephalozia sp.* (95/94), *Cetraria cucullata* (153/94, 14/94), *Cetraria nivalis* (153/94, 14/94), *Cetraria pinastri* (50/94), *Chamaescadium acaule* (88/93), *Chamerion angustifolium* (64/95:1, 33/95:2), *Cicerbita racemosa* (95/94), *Cladonia gracilis* (91/94), *Cladonia sp.* (153/94, 11/94), *Clinopodium vulgare* (20/95), *Coeloglossum viride* (91/94), *Corydalis conorrhiza* (77/94), *Dianthus cretaceus* (71/94), *Dicranum spadiceum* (153/94:2, 88/93), *Draba siliquosa* (33/95), *Equisetum hyemale* (123/95), *Euphrasia ossica* (88/93, 82/93), *Eurhynchium pulchellum* (33/95), *Fritillaria lutea* (50/94, 91/94), *Gentiana pyrenaica* (11/94, 82/93), *Gentiana verna* (88/93), *Gymnadenia conopsea* (91/94), *Heracleum asperum* (95/94), *Koeleria eriostachya* (133/94), *Lamium album* (62/94), *Lathyrus cyaneus* (91/94, 147/94), *Lescuraea mutabilis* (33/95), *Lescuraea saxicola* (64/95, 50/94:1), *Linum hypericifolium* (88/93, 147/94), *Lophozia sp.* (95/94, 71/94), *Luzula spicata* (82/93), *Macrotomia echioides* (32/94), *Mnium stellare* (71/94), *Orthotrichum rupestre* (14/94), *Orthotrichum speciosum* (33/95), *Orthotrichum stramineum* (169/94), *Paraleucobryum enerve* (64/95), *Peltigera aphthosa* (64/95, 91/94), *Peltigera malacea* (88/93), *Peltigera sp.* (153/94, 11/94), *Phleum phleoides* (133/94, 147/94), *Plagiomnium cuspidatum* (20/95), *Plantago atrata* (91/94, 82/93), *Polygala alpicola* (33/95, 14/94), *Polygonatum verticillatum* (77/94), *Polypodium vulgare* (77/94), *Polytrichastrum alpinum* (88/93, 82/93:1), *Polytrichum commune* (82/93:1), *Polytrichum juniperinum* (33/95, 82/93), *Polytrichum piliferum* (153/94, 88/93), *Potentilla brachypetala* (77/94), *Primula algida* (11/94), *Primula veris* (20/95), *Pterigynandrum filiforme* (123/95), *Ptilidium ciliare* (153/94), *Rhodobryum roseum* (95/94:1), *Rhododendron luteum* (20/95), *Rosa tomentosa* (88/93), *Rumex alpestris* (81/93), *Saxifraga moschata* (77/94, 88/93), *Scabiosa caucasica* (133/94, 147/94), *Sempervivum caucasicum* (33/95, 71/94), *Sempervivum pumilum* (88/93), *Seseli libanotis* (62/94), *Silene vulgaris* (64/95), *Solidago virgaurea* (88/93), *Taraxacum officinale aggr.* (91/94, 95/94), *Thamnolia vermicularis* (11/94), *Thesium alpinum* (88/93), *Trifolium hybridum* (91/94, 95/94), *Trifolium polyphyllum* (82/93), *Trisetum flavescens* (50/94), *Urtica dioica* (11/94), *Valeriana alpestris* (123/95), *Veratrum album* (95/94).

Date (day.month), size (sq.m) and location of the releves.

81/93 - 22.08, 4, M.Khatipara; 77/94 - 16.07, 6, Bol.Khatipara; 123/95 - 29.08, 12, Nazalykol; 62/94 - 15.07, 12, Bol.Khatipara; 64/95 - 12.07, 10, Baduk; 133/94 - 31.07, 8, Mukhu; 153/94 - 04.09, 24, Oriuchat; 20/95 - 04.07, 10, Alibek; 88/93 - 26.08, 10, M.Khatipara; 33/95 - 07.07, 15, Chuchkhur; 14/94 - 07.07, 15, Azgek; 11/94 - 07.07, 15, Azgek; 50/94 - 12.07, 10, Kyshkadzher; 91/94 - 20.07, 12, Goralykol; 95/94 - 20.07, 10, Goralykol (D.Sukhova); 169/94 - 06.09, 12, Nazalykol; 147/94 - 04.09, 30, Oriuchat; 71/94 - 16.07, 7, Bol.Khatipara; 82/93 - 23.08, 15, M.Khatipara; 32/94 - 11.07, 12, Kyshkadzher.

Table 12.4.

<i>Polygono viviparum-Salicetum kazbekensis</i>											
Releve No.	40	29	11	44	33	51	53	101	107	108	110
Year	83	83	84	89	91	94	94	94	95	95	95
Altitude (* 10)	270	275	275	275	275	265	270	260	260	275	286
Steepness	30	20	20	30	20	30	30	20	20	5	30
Exposition	ne	e	ne	w	nw	nw	nw	ne	n	nne	n
Vascular plant cover	40	35	50	50	70	40	50	50	50	75	40
Bryophyte cover	1	3	15	1	30	2	5	5	5	5	10
Lichen cover	50	40	25	40	15	40	50	20	40	20	40
Stone cover	3	30	5	1	10	1	1	30	5	1	20
<i>D.sp. Salici kazbekensis-Empetron nigrae, Polygono viviparum-Salicetum kazbekensis</i>											
<i>Polygonum viviparum</i>		+	+	+	+	1	+	+	1	1	+
<i>Salix kazbekensis</i>		2	2	2	3	+	1	2	2	4	2
<i>Lloidia serotina</i>		+		+	+	+			+	+	+
<i>Helictotrichon versicolor</i>	1	+	1	1	1	+		+	+	+	
<i>Carex umbrosa</i>	+		1	1	+	+	+		1	+	1
<i>Carex sempervirens</i>		1	1	1	1		+		1	1	
<i>Cornicularia mucicata</i>	1	1	+							1	+
<i>Eritrichium caucasicum</i>		+		+					+	+	+
<i>Tortella tortuosa</i>	+	1		+	+			+			+
<i>Anemone speciosa</i>	1	1	1	1	1	1	+	+	+	+	+
<i>Campanula tridentata</i>	1	+	1	1	1	1	1	1	1	2	1
<i>Carum caucasicum</i>	+	+	+	1	1	+	+	1	+	+	+
<i>Cetraria cucullata</i>	1	1	+		+	1	1	+	1	1	1
<i>Thamnolia vermicularis</i>	2	1	+	2	1	1	1	+	1	1	1
<i>Cetraria nivalis</i>	1	1	+			+	+	+	1	1	1
<i>Cladonia gracilis</i>	+	1	+	+		+	+	+	+	+	
<i>Luzula spicata</i>	+	+	+	+		+			+	+	+
<i>Arenaria lychnidea</i>	+	r	+	1					+	+	+
<i>Fissidens osmundoides</i>				+					+		+
<i>Minuartia circassica</i>	1	1	+	1		+		+		+	+
<i>Cladonia mitis</i>	2	1	1	2		2	3	2	2	1	2
<i>D.sp. Rhododendro-Vaccinietalia, Loiseleuro-Vaccinietea</i>											
<i>Empetrum nigrum</i>	3	1	2	+	1	3	3	3	2	+	+
<i>Vaccinium vitis-idaea</i>	1	1	1	1	1	1	1	1	1	1	1
Other species											
<i>Bryum imbricatum</i>					+				+		+
<i>Cetraria islandica</i>	2	2	2	2	2	2	2	2	2	1	2
<i>Cladonia pyxidata</i>	1	1	1	1	2	+		+		+	+
<i>Dicranum scoparium</i>			2		1	1	1		+	+	1
<i>Draba scabra</i>				1			+		+		+
<i>Euphrasia ossica</i>		+	+	+				+	+	1	+
<i>Festuca ovina</i>	1	1	1	1	1	1	+	1	+	2	+
<i>Gentiana pyrenaica</i>		+	+	+				+	+		+
<i>Huperzia selago</i>	+						+	+			
Table 12.4. (continued)											
Releve No.	40	29	11	44	33	51	53	101	107	108	110
Year	83	83	84	89	91	94	94	94	95	95	95
<i>Myosotis alpestris</i>		+		+	+					+	
<i>Pedicularis comosa</i>		+		+					+	+	
<i>Pedicularis condensata</i>				+					+	+	+
<i>Peltigera aphthosa</i>	+		+	+							

<i>Peltigera rufescens</i>	+	+			+			
<i>Pohlia cruda</i>		+	+			+	+	
<i>Polygonum bistorta</i>	+						+	+
<i>Polytrichastrum alpinum</i>				+	+	+		+
<i>Polytrichum juniperinum</i>	+				+		1	
<i>Polytrichum piliferum</i>		+						+
<i>Potentilla gelida</i>		+	+		1			
<i>Rhododendron caucasicum</i>		1		+			+	+
<i>Rhytidium rugosum</i>					2	1	1	+
<i>Taraxacum stevenii</i>		+	+	+	+	+		
<i>Trifolium polyphyllum</i>		1		1				+
<i>Veronica gentianoides</i>		+	+	+				+

Sporadic species (number of releve in parenthesis, abundance is shown after ":", unless it is not "+", Braun-Blanquet scale)

Aetheopappus caucasicus (29/83), *Alchemilla caucasica* (29/83:1), *Androsace albana* (11/84), *Antennaria dioica* (40/83, 11/84:1), *Anthemis cretica* (40/83, 11/84), *Astragalus levieri* (29/83:1), *Bartramia ithyphylla* (29/83, 33/91), *Blepharostoma trichophyllum* (110/95), *Brachythecium albicans* (44/89), *Bromopsis variegata* (29/83), *Bryoria bicolor* (108/95), *Bryum torquescens* (29/83), *Campanula ciliata* (29/83), *Campanula collina* (40/83:1), *Campanula saxifraga* (29/83), *Campylium radicale* (11/84), *Carex atrata* (33/91), *Carex caryophyllea* (101/94:1), *Carex sp.* (33/91), *Cerastium purpurascens* (33/91), *Ceratodon purpureus* (108/95), *Cetraria laevigata* (40/83:2, 11/84), *Chamaesciadium acaule* (29/83), *Cladonia rangiferina* (40/83), *Climacium dendroides* (33/91), *Coeloglossum viride* (44/89), *Desmatodon latifolius* (33/91, 108/95), *Dicranum bergeri* (53/94:1), *Dicranum bonjeanii* (33/91), *Dicranum congestum* (44/89), *Dicranum spadiceum* (101/94:1), *Distichium capillaceum* (33/91, 110/95), *Erigeron alpinus* (29/83, 108/95), *Eurhynchium pulchellum* (11/84), *Gentiana biebersteinii* (40/83, 29/83), *Gentiana septemfida* (29/83), *Gentiana verna* (29/83), *Gnaphalium supinum* (29/83), *Hedysarum caucasicum* (44/89), *Hylocomium splendens* (51/94, 107/95), *Hypnum cupressiforme* (107/95), *Hypnum imponens* (29/83:1), *Hypnum revolutum* (11/84), *Isopterygiopsis pulchella* (110/95), *Kobresia capilliformis* (33/91), *Kobresia schoenoides* (44/89, 110/95:1), *Lepidozia reptans* (44/89), *Luzula multiflora* (33/91:r), *Minuartia imbricata* (11/84, 33/91), *Mnium thomsonii* (110/95), *Oxytropis kubanensis* (11/84, 108/95), *Paraleucobryum enerve* (40/83, 29/83), *Pedicularis caucasica* (29/83), *Pedicularis nordmanniana* (11/84, 33/91), *Peltigera sp.* (33/91:r), *Pleurozium schreberi* (101/94, 107/95), *Poa nemoralis* (33/91), *Pogonatum urnigerum* (108/95), *Pohlia elongata* (44/89), *Primula algida* (29/83), *Primula meyeri* (11/84), *Ptilidium ciliare* (101/94), *Ranunculus oreophilus* (44/89, 33/91:1), *Rhinanthus minor* (44/89, 101/94:r), *Saelania glaucescens* (11/84, 110/95), *Sanionia uncinata* (33/91), *Saxifraga kolenatiana* (33/91), *Sedum tenellum* (29/83, 11/84), *Senecio aurantiacus* (33/91), *Seseli alpinum* (51/94, 107/95), *Sibbaldia procumbens* (11/84), *Sphenolobus minutus* (51/94, 110/95), *Vaccinium myrtillus* (11/84), *Valeriana alpestris* (29/83:1, 33/91:2), *Viola altaica* (44/89, 107/95), *Weissia sp.* (108/95).

Date (day.month), size (sq.m) and location of the releves.

40/83 - 06.09, 25, M.Khatipara; 29/83 - 31.08, 25, M.Khatipara; 11/84 - 01.09, 15, M.Khatipara; 44/89 - 01.09, 25, M.Khatipara; 33/91 - 16.08, 8, Nazalykol; 51/94 - 12.07, 12, Kyshkadzher; 53/94 - 12.07, 12, Kyshkadzher; 101/94 - 21.07, 12, Goralykol; 107/95 - 05.08, 25, Mukhu; 108/95 - 05.08, 12, M.Khatipara; 110/95 - 18.08, 16, M.Khatipara.