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9. Alpine grasslands - *Calluno-Ulicetea*

Prodromus

Calluno-Ulicetea BRAUN-BLANQUET & TÜXEN ex KLIKA & HADAC 1944

Nardetalia OBERDORFER ex PREISING 1949

Viola altaicae-Festucion variae all.nov.

Viola altaicae-Festucetum variae RABOTNOVA & ONIPCHENKO ass.nov.

V.a.-F.v. typicum subass.nov.

V.a.-F.v. geranietosum renardii subass.nov.

V.a.-F.v. nardetosum subass.nov.

Hedysaro caucasicae-Geranium gymnocauli ONIPCHENKO all.nov.

Hedysaro caucasicae-Geranietum gymnocauli RABOTNOVA &
ONIPCHENKO ass.nov.

H.c.-G.g. senecionetosum kolenatiani subass.nov.

H.c.-G.g. typicum subass.nov.

Nardetalia

The order combines mountain and lowland grasslands on poor acidic soils. The position of the alpine grasslands within the order and the class has been a matter of extensive discussion by different authors (OBERDORFER 1978, KRAHULEC 1983, 1988, PEPPLER 1992, GRABHERR 1993b, ELLMAUER 1993, JULVE 1993, KRAHULEC & MORAVEC 1995, POTT 1995). Due to the high frequency of the diagnostic species of the order and considerable ecological and floristic dissimilarity from the *Anemonion*, we treat alpine grasslands of the northwestern Caucasus within *Nardetalia*. *Anthoxanthum odoratum*, *Nardus stricta*, *Luzula multiflora*, *Antennaria dioica*, *Deschampsia flexuosa*, *Phleum alpinum* are all well represented as diagnostic species in the grasslands of Teberda. The communities have been exposed to different intensities of grazing. They occupy the most favourable slopes within the alpine zone, where winter snow accumulation is moderate (1-3 m). Therefore, production of the grasslands is relatively high. We suggest two new alliances with significant degrees of floristic and ecological specificity.

Table 9.1.
Diagnostic table of *Calluno-Ulicetea*

	1	2	3	4	5
D.sp. <i>Viola altaicae-Festucetum variae</i> , <i>Viola altaicae-Festucion variae</i>					
<i>Festuca varia</i>	V	V	I	V	II
<i>Scorzonera cana</i>	III	IV	III	-	II
<i>Ajuga orientalis</i>	II	II	I	-	-
<i>Galium verum</i>	I	II	I	-	-
<i>Viola altaica</i>	II	III	III	-	-
<i>Carex umbrosa</i>	II	III	III	-	-
<i>Alchemilla caucasica</i>	IV	II	III	I	-
<i>Helictotrichon versicolor</i>	III	II	II	-	-
<i>Minuartia circassica</i>	III	II	II	-	-
<i>Silene saxatilis</i>	III	II	II	I	-
<i>Calamagrostis arundinacea</i>	II	II	I	-	-
D.sp. <i>Hedysaro caucasicae-Geranium gymnocauli</i> , <i>Hedysaro caucasicae-Geranion gymnocauli</i>					
<i>Geranium gymnocaulon</i>	I	II	II	V	V
<i>Pulsatilla aurea</i>	I	-	-	IV	III
<i>Hedysarum caasicum</i>	III	I	II	V	V
<i>Carum meifolium</i>	I	II	I	V	IV
<i>Pedicularis condensata</i>	II	I	-	IV	II
D.sp. <i>V.a.-F.v. geranietosum renardii</i>					
<i>Geranium renardii</i>	IV	-	-	I	-
<i>Bupleurum falcatum</i>	IV	-	I	II	-
<i>Aetheopappus vvedenskii</i>	III	-	-	II	-
<i>Sedum tenellum</i>	IV	I	I	II	I
<i>Thymus nummularius</i>	IV	-	-	-	-
<i>Centaurea cheiranthifolia</i>	II	-	-	-	-
<i>Alyssum murale</i>	II	-	-	-	-
<i>Eurhynchium pulchellum</i>	III	-	-	-	I
<i>Gentiana verna</i>	III	-	-	-	-
<i>Hypericum linarioides</i>	III	-	I	-	-
<i>Primula algida</i>	II	-	-	-	-
<i>Brachythecium velutinum</i>	III	I	I	I	I
<i>Bartramia ithyphylla</i>	II	-	-	I	I
<i>Tragopogon reticulatus</i>	II	-	-	-	-
D.sp. <i>V.a.-F.v. typicum</i>					
<i>Cladonia mitis</i>	-	IV	I	-	I
<i>Gentiana pyrenaica</i>	-	V	II	-	II
<i>Minuartia aizoides</i>	I	IV	II	I	V
<i>Sibbaldia procumbens</i>	I	V	III	II	V
D.sp. <i>V.a.-F.v. nardetosum</i>					
<i>Agrostis vinealis</i>	II	I	IV	I	II
<i>Dicranum scoparium</i>	-	-	II	-	-
<i>Barbilophozia lycopodioides</i>	-	-	II	-	-

Table 9.1. (continued)

	1	2	3	4	5
<i>D.sp. H.c.-G.g. senecionetosum kolenatiani</i>					
<i>Poa longifolia</i>	I	-	I	IV	-
<i>Senecio kolenatianus</i>	I	II	-	IV	-
<i>Cirsium munitum</i>	-	-	I	IV	-
<i>Rumex alpestris</i>	-	I	I	V	II
<i>Silene vulgaris</i>	I	-	-	III	-
<i>Sempervivum caucasicum</i>	II	II	-	II	-
<i>Trollius ranunculinus</i>	-	I	-	II	-
<i>D.sp. H.c.-G.g. typicum</i>					
<i>Campanula tridentata</i>	-	III	III	-	V
<i>Anthemis cretica</i>	III	IV	II	I	V
<i>Senecio taraxacifolius</i>	-	-	-	-	IV
<i>Pedicularis nordmanniana</i>	-	-	II	-	IV
<i>Gnaphalium supinum</i>	-	I	II	-	IV
<i>Catabrosella variegata</i>	-	-	I	-	III
<i>D.sp. Nardetalia, Calluno-Ulicetea</i>					
<i>Anthoxanthum odoratum</i>	V	V	IV	IV	V
<i>Nardus stricta</i>	-	IV	V	I	IV
<i>Luzula multiflora</i>	I	II	IV	I	V
<i>Deschampsia flexuosa</i>	III	V	III	II	V
<i>Phleum alpinum</i>	-	II	III	V	IV
<i>Antennaria dioica</i>	I	IV	II	I	I
<i>Coeloglossum viride</i>	-	-	I	I	-
<i>Hieracium lactucella</i>	I	-	II	-	-
<i>Botrychium lunaria</i>	IV	-	-	-	-
<i>Solidago virgaurea</i>	-	I	I	I	II
<i>Veratrum album</i>	-	I	I	I	I
<i>Polygala alpicola</i>	II	-	I	I	-
Other frequent species					
<i>Campanula collina</i>	V	V	V	IV	II
<i>Carex atrata</i>	II	V	III	IV	V
<i>Carum caucasicum</i>	I	IV	IV	-	I
<i>Cetraria islandica</i>	II	V	III	-	II
<i>Cladonia pyxidata</i>	III	IV	III	I	IV
<i>Erigeron caucasicus</i>	IV	II	I	II	III
<i>Euphrasia ossica</i>	IV	I	III	I	III
<i>Festuca brunnescens</i>	V	III	III	II	V
<i>Festuca ovina</i>	I	IV	III	I	-
<i>Gentiana septemfida</i>	II	IV	I	II	II
<i>Leontodon hispidus</i>	V	V	IV	III	IV
<i>Matricaria caucasica</i>	IV	III	II	III	III
<i>Minuartia recurva</i>	IV	III	II	I	II
<i>Myosotis alpestris</i>	III	III	III	IV	I
<i>Ranunculus oreophilus</i>	IV	II	IV	III	II
<i>Veronica gentianoides</i>	V	V	IV	IV	III

Syntaxa:

1 - *Violo altaicae-Festucion variaae geranietosum renardii*, 2 - *V.a.-F.v. typicum*, 3 - *V.a.-F.v. nardetosum*, 4 - *Hedysaro caucasicae-Geranietum gymnocauli senecionetosum kolenatiani*, 5 - *H.c.-G.g. typicum*

9.1 *Violo altaicae-Festucetum variae*

The alliance includes alpine grasslands with dense tussock grasses (*Festuca varia*, *Nardus stricta*) as the main dominants. These communities are widespread in the Caucasus (GROSSGEIM 1948, SHIFFERS 1953; GULISASHVILLI *et al.* 1975, PYSEK & SRUTEK 1989, BEDOSHVILI 1988a). The alliance may be considered as a Caucasian vicarious syntaxon of *Festucion variae* GUINOCHET 1938 (GRABHERR 1993b). Because of the limited area of our investigation, all the communities studied fit into one association.

Violo altaicae-Festucion variae

Synonym: *Violo oreadis-Festucetum variae* RABOTNOVA 1987 in ONIPCHENKO *et al.* (1987)

Floristic features

The diagnostic species set of the association includes *Scorzonera cana*, *Viola altaica*, *Silene saxatilis*, as well as the species common to *Anemonion* (*Carex umbrosa*, *Alchemilla caucasica*, *Helictotrichon versicolor*, *Minuartia circassica*). As a rule, dense tussock grasses (*Festuca varia* or/and *Nardus stricta*) are dominants.

General floristic richness is high. We registered 161 vascular plant species, 38 bryophytes and 8 lichens in 30 relevés (Table 9.2.). Mean values per releve were 35, 3 and 2 species respectively. More detailed study of the floristic richness showed that average numbers were 4.6, 24.4, and 56.8 vascular plant species in 0.01, 1 and 100 sq. m - plots (ONIPCHENKO & SEMENOVA 1995). The last figure was the highest for all investigated alpine communities.

Vascular plant cover ranges between 40% and 90% (mean 64%). As a rule, the role of bryophytes and lichens is low in terms of species richness, plant cover and biomass.

We distinguished 3 subassociations in the syntaxon:

V.a.-F.v. typicum (Typus, or nomenclature type, No. 15/81). *Festuca varia* and *Nardus stricta* dominate the communities of this combination. *Cladonia mitis*, *Gentiana pyrenaica*, *Minuartia aizoides*, and *Sibbaldia procumbens* form the diagnostic set of the subassociation. The communities occupy mainly moderate southern slopes (5°-30°, mean 15°).

V.a.-F.v. geranietosum renardii (Typus, or nomenclature type, No. 8/93) consists of *Festuca varia* - dominated grasslands where *Nardus stricta* is absent. Xeromorphic species with dense pubescence or succulent leaves (*Geranium renardii*, *Aetheopappus vvedenskii*, *Sedum tenellum*, *Centaurea cheiranthifolia*, *Alyssum murale*) form the diagnostic set of the subassociation. The communities occupy steep (5°-35°, mean 29°) southern slopes.

V.a.-F.v. nardetosum (Typus, or nomenclature type, No. 127/94) are matgrass communities that arose as a result of overgrazing former *Festuca varia*-grasslands. Diagnostic species of the association are still present, but the role of *Agrostis vinealis* and mosses (*Dicranum scoparium*, *Barbilophozia lycopodioides*) increases.

General ecological features of the association

The communities occupy extensive areas within the alpine zone (at elevation 2410-3100 m, mean 2710 m). As a rule, they occur on southern slopes ranging from moderate to steep. The dense and durable roots of *Festuca varia* allow this species to stabilize screes and to form dense communities on steep slopes. The species is well adapted to a dry and hot environment due to the xeromorphic structure of its leaves. Some authors suggest the steppe genesis of the communities during the late tectonic uplift of the Caucasian mountains (KONONOV 1957).

As a whole, bare soil and stones cover only a small area within the community (0-20%, mean 4%). Winter **snowpack accumulation** is not great (0.5-1.5 m), but snow cover is essential: it prevents deep freezing of soils. As a rule the communities become free from snow in the second half of May or the first half of June.

Aboveground **biomass** is about 350 g/sq.m (d.w.), belowground - 640 g/sq.m. Net annual productivity of the community was estimated at 400 g/sq.m. An important feature of the grasslands is dense litter accumulation (900 g/sq.m) caused by slow decomposition rate. *Festuca varia* often constitutes over the half of the total biomass of the community (ONIPCHENKO 1990).

The soil seed bank of the community is rather large (about 1190 seed/sq.m) (SEMENOVA & ONIPCHENKO 1994). The most common species contributing seeds to the bank are *Nardus stricta*, *Carex atrata*, *Gentiana spp.*, *Euphrasia ossica*, and *Cerastium purpurascens*. It is important to note that large seeds

of *Festuca varia* were practically absent from the seed bank despite very high seed production by this species.

Moderate grazing does not have a negative effect on the composition and floristic richness of the grassland. Severe grazing leads to exclusion of *Festuca varia* and to an increase in abundance of *Nardus stricta* on gentle slopes, or development of bare spots on steep slopes.

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

60/93 - 17.08, 25, Baduk; 10/93 - 08.07, 25, Ullu-Murudzhu; 72/95 - 13.07, 25, Baduk; 86/95 - 24.07, 25, Bol.Khatipara; 130/95 - 30.08, 25, Ullu-Murudzhu; 15/88 - 17.08, 25, Kynyrchat; 15/94 - 08.07, 16, Azgek; 8/93 - 08.07, 25, Ullu-Murudzhu; 15/85 - 17.08, 25, Azgek; 36/93 - 30.07, 25, Azgek; 9/81 - 30.07, 25, M.Khatipara; 13/81 - 31.07, 25, M.Khatipara; 12/94 - 07.07, 25, Azgek (A.Egorov); 40/81 - 08.09, 25, M.Khatipara; 15/81 - 31.07, 25, M.Khatipara; 10/87 - 17.08, 25, Alibek; 26/83 - 30.08, 25, M.Khatipara; 105/94 - 21.07, 25, Goralykol; 1/84 - 22.08, 100, M.Khatipara; 16/83 - 24.08, 25, M.Khatipara; 22/94 - 08.07, 25, Azgek (A.Egorov); 134/94 - 31.07, 16, Mukhu; 119/94 - 29.07, 25, Mukhu; 19/94 - 08.07, 16, Azgek; 24/94 - 08.07, 25, Azgek; 140/94 - 31.07, 25, Mukhu; 128/94 - 30.07, 16, Mukhu; 12/81 - 31.07, 25, M.Khatipara; 127/94 - 30.07, 16, Mukhu; 123/94 - 30.07, 25, Mukhu

9.2. *Hedysaro caucasicae-Geranium gymnocauli*

The alliance combines highly productive grasslands, developing on slopes and in small depression with considerable snowpack accumulation (2-3 m). We consider all these communities within one association (ONIPCHENKO *et al.* 1987).

Hedysaro caucasicae-Geranium gymnocauli

Floristic features

Five forb species (*Geranium gymnocaulon*, *Hedysarum caasicum*, *Carum meifolium*, *Pulsatilla aurea*, and *Pedicularis condensata*) form the diagnostic set of the alliance and the association (Table 9.3). Some dense tussock grasses (*Festuca varia*, *F. brunnescens*, *Nardus stricta*) are also common, but they are not dominants in the communities.

Floristic richness is slightly lower than in the previous association. We registered 112 vascular plant species, 23 bryophytes and 5 lichens in 20 relevés of the association. The mean values per releve were 28, 2, and 1 species respectively. Overall the role of bryophytes and lichens was negligible. Average floristic richness was estimated as 5.3, 19.5, and 35.0 species per 0.01, 1, and 100 sq.m-plots respectively. Vascular plant cover in this community is denser than in the previous association (50-97%, mean 81%). Cover of lichens and bryophytes is low.

We distinguish two subassociations within the association:

H.c.-G.g. typicum (Typus, or nomenclature type, No. 43/83) unites more moist communities that have significant floristic similarity with *Salicetea herbacea* - communities. *Campanula tridentata*, *Anthemis cretica*, *Gnaphalium supinum*, *Pedicularis nordmanniana*, *Catabrosella variegata* and *Senecio taraxacifolius* form the diagnostic set of the subassociation.

H.c.-G.g. senecionetosum kolenatianii (Typus, or nomenclature type, No. 159/90) consists of the less moist communities of the association. *Poa longifolia*, *Senecio kolenatianus*, *Cirsium munitum*, *Rumex alpestris*, and *Silene vulgaris* represent the diagnostic species set.

SEMAGINA (1992) added one more subassociation (*H.c.-G.g. trollietosum ranunculinus* SEMAGINA 1992), with *Trollius ranunculinus* and *Veratrum album* as diagnostic species. She presented 5 releves of the subassociation from the Caucasian biosphere reserve.

Ecological features

Generally the association is typical of the Western and Central Caucasus (VOROB'EVA 1977b, KIMERIDZE & MARDALEISHVILI 1980, KIMERIDZE 1985). In Teberda reserve the communities occupy the lower part of slopes of different aspect and steepness (3°-35°, mean 22°) within the alpine zone (altitude range 2600-3000 m, mean 2720 m). Due to considerable snowpack accumulation, the growing season here begins only in the second half of June or in the first half of July.

The communities have the highest **annual production** among all the alpine communities studied (about 550 g/sq.m). The aboveground vascular plant biomass is about 320 g/sq.m, belowground - 1390 g/sq.m (ONIPCHENKO 1990). These communities have high rate of soil respiration, nitrogen fixation and denitrification (STEPANOV & ONIPCHENKO 1989).

Burrowing and grazing activity of voles as well as wild boars has a profound impact on both community structure and composition. Population density of the vole *Pitymys (Microtus) majori* Thomas (*Glires, Microtinae*) can reach 940 animals per hectare during the "peak-years" in these communities (FOMIN *et al.* 1989). The animals can consume approximately 15% of the annual net production and dig up to 14,300 holes per hectare in such years. Such severe disturbances leave clearly visible "gaps" in the structure of the communities. Vascular plant species differ in their reaction to the different size of gaps (ONIPCHENKO & RABOTNOVA 1994).

About 3850 seed/ sq.m were detected in the soil **seed bank** (SEMENOVA & ONIPCHENKO 1994). *Luzula multiflora*, *Matricaria caucasica*, *Nardus stricta*, *Veronica gentianoides*, *Phleum alpinum*, *Anthoxanthum odoratum* and *Sibbaldia procumbens* were the main components of the seed bank, whereas seeds of the dominants (*Geranium gymnocaulon*, *Hedysarum caucasicum*) were completely absent.

Table 9.3. (continued)

Releve No.	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Year	1	68	43	59	42	59	37	19	88	80	42	20	43	4	3	8	16	7	30	61
Year	83	93	93	90	93	93	93	95	94	94	83	83	83	84	84	87	88	83	89	80
Other species																				
<i>Aetheopappus vvedenskii</i>		1					+		1											
<i>Agrostis vinealis</i>				+							+			+			1			
<i>Astrantia maxima</i>					1				2	+										
<i>Betonica macrantha</i>		1		1	+				1	+										
<i>Brachytecium velutinum</i>		1								+										+
<i>Briza marcowiczii</i>										+	+	+	+			1				
<i>Bupleurum falcatum</i>				+		1				+										
<i>Campanula collina</i>	+	1	+	1			+	+	+	1			+			1	+			
<i>Carex atrata</i>	1	+	1	1	+	+			+	+	1		+	1	1	1	1	1	+	1
<i>Cerastium purpurascens</i>	1	1		+					+				+			1				+
<i>Cetraria islandica</i>												+	1	1	1					
<i>Cirsium simplex</i>									+	+							2			
<i>Cladonia pyxidata</i>		+	+								+	+	+	+	1	+	+			
<i>Coronilla orientalis</i>	1	+							2											
<i>Daphne glomerata</i>		+				+	+													
<i>Draba hispida</i>	1	+	+	+					+	+		+				+				
<i>Erigeron caucasicus</i>		+		+		+	+				+	+	+	1						+
<i>Euphrasia ossica</i>				+							+	+	+	+		1	+			
<i>Festuca brunnescens</i>	1	+	+		+						1	1	1	1	2		1	1	1	1
<i>Festuca varia</i>	2	1	1	2	1	1	1	1	1	+					1	1	2			
<i>Gentiana pyrenaica</i>													+	+	+		+			
<i>Gentiana septemfida</i>		1		+					+			+	1			+				+
<i>Kemulariella caucasica</i>					+		+						+							
<i>Leontodon hispidus</i>		1	1	1		1	1		1		1	1	1	1	1	+	1			1
<i>Matricaria caucasica</i>	+	1	1		1	+			+			+		1	1	1		1	1	
<i>Minuartia aizoides</i>					+						1		+	1	1	1	1	+	+	1
<i>Minuartia recurva</i>		+												+	+					+
<i>Myosotis alpestris</i>	1	+		+		+		+	+	+		+				+				
<i>Polytrichum juniperinum</i>											1				+	+	+			
<i>Potentilla crantzii</i>	1								1	+	1	1	+		+	2		1		1
<i>Primula ruprechtii</i>		+		+										1	+					
<i>Ranunculus oreophilus</i>		2	1		2	+	+							1	+					1
<i>Scorzonera cana</i>														1	1					+
<i>Sedum tenellum</i>	+	+	+													1				+
<i>Sibbaldia procumbens</i>	+		1		+						2	1	1	1	1	2	2	1	1	2
<i>Stereocaulon alpinum</i>													+	1	1					
<i>Taraxacum stevenii</i>											+	+				1	1			2
<i>Trisetum flavescens</i>									1	+						+				
<i>Veronica gentianoides</i>				1	+	1	1	+	1	1	+	1		1	1	+	1			

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

Aconitum nasutum (37/93), *Alchemilla caucasica* (43/93, 42/93), *Alchemilla vulgaris* (1/83:1, 180/94:2), *Alopecurus glacialis* (1/83), *Alopecurus ponticus* (19/95), *Anemone narcissiflora* (19/95), *Anemone speciosa* (43/83), *Anthemis marshalliana* (59/93), *Arenaria rotundifolia* (68/93, 43/93), *Barbilophozia barbata* (16/88), *Bartramia ithyphylla* (188/94, 8/87), *Brachytecium salebrosum* (68/93:1), *Bryum caespiticium* (8/87), *Bryum capillare* (59/93), *Bryum sp.* (188/94), *Carex nigra* (180/94), *Carex pyrenaica* (43/83, 61/80), *Carex sempervirens* (8/87), *Carum causicum* (16/88:1, 61/80:1), *Chaerophyllum roseum* (37/93), *Chamerion angustifolium* (19/95), *Cicerbita racemosa* (19/95), *Cladonia mitis* (43/83, 4/84), *Corydalis conorrhiza* (61/80), *Crocus reticulatus* (19/95), *Cruciata laevipes* (159/90, 19/95), *Desmatodon latifolius* (37/93:1, 19/95), *Empetrum nigrum* (43/83), *Encalypta vulgaris* (188/94), *Eurhynchium pulchellum* (8/87), *Festuca ovina* (188/94), *Fritillaria latifolia* (19/95), *Fritillaria lutea* (68/93, 159/90), *Gagea fistulosa* (30/89), *Geranium renardii* (159/90, 59/93:2), *Geranium sylvaticum* (19/95),

Hieracium macrolepis (43/93, 59/93), *Hieracium umbellatum* (4/84), *Hyalopoa pontica* (8/87:1), *Inula orientalis* (159/90:1), *Leskea polycarpa* (159/90), *Ligusticum caucasicum* (188/94:1, 180/94:1), *Luzula spicata* (4/84, 8/87:1), *Millium effusum* (180/94), *Minuartia imbricata* (37/93), *Orobanche purpurea* (59/93), *Pedicularis comosa* (4/84), *Peltigera rufescens* (8/87), *Philonotis fontana* (188/94), *Plagiothecium denticulatum* (16/88), *Plantago atrata* (43/93), *Pohlia cruda* (68/93), *Pohlia obtusifolia* (188/94), *Polygonum bistorta* (19/95:2), *Polytrichum piliferum* (16/88), *Primula veris* (19/95), *Pseudoleskea incurvata* (37/93:1, 188/94), *Pseudoleskea patens* (19/95), *Racomitrium canescens* (68/93, 188/94), *Ranunculus brachylobus* (180/94, 61/80), *Rhododendron caucasicum* (42/83, 43/83:1), *Rhynchosorys elephas* (19/95), *Rumex alpinus* (180/94:1), *Scabiosa ochroleuca* (68/93, 159/90), *Senecio aurantiacus* (19/95), *Senecio caucasicus* (37/93), *Seseli alpinum* (37/93), *Silene saxatilis* (37/93, 188/94), *Tetraplodon mnioides* (43/93), *Tortula ruralis* (43/93), *Vaccinium myrtillus* (37/93), *Veronica filiformis* (180/94), *Weissia* sp. (188/94).

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

1/83 - 16.07, 25, Klukhor pass; 68/93 - 17.08, 16, Baduk; 43/93 - 10.08, 16, M.Khatipara; 159/90 - 19.08, 16, Khutyy; 42/93 - 10.08, 16, M.Khatipara; 59/93 - 17.08, 16, Baduk; 37/93 - 30.07, 25, Azgek; 19/95 - 04.07, 25, Alibek; 188/94 - 09.09, 25, Kichi-Murudzhu; 180/94 - 09.09, 25, Kichi-Murudzhu; 42/83 - 06.09, 25, M.Khatipara; 20/83 - 24.08, 25, M.Khatipara; 43/83 - 06.09, 25, M.Khatipara; 4/84 - 23.08, 100, M.Khatipara; 3/84 - 23.08, 100, M.Khatipara; 8/87 - 17.08, 25, Alibek; 16/88 - 17.08, 25, Kynyrchat; 7/83 - 20.08, 15, M.Khatipara; 30/89 - 20.08, 25, M.Khatipara (I.Pavlova); 61/80 - 26.07, 5, Uzunkol.