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4. Rocks - *Asplenieta trichomanis*

Prodromus

Asplenieta trichomanis (BRAUN-BLANQUET in MEIER & BRAUN-BLANQUET 1934)

OBERD 1977

Androsacetalia multiflorae BRAUN-BLANQUET in MEIER & BRAUN-BLANQUET 1934

Gypsophilium tenuifoliae ONIPCHENKO & GORBACHEVSKAYA all.nov.

Potentilletum divinae ONIPCHENKO & GORBACHEVSKAYA ass.nov.

Astragaletum levieri ONIPCHENKO & GORBACHEVSKAYA ass.nov.

Thalictro foetidi-Asplenion ONIPCHENKO & GORBACHEVSKAYA all.nov.

Galio valantioides-Polypodietum vulgaris ONIPCHENKO & GORBACHEVSKAYA ass.nov.

Thymo-Seseliatum petraei ONIPCHENKO & GORBACHEVSKAYA ass.nov.

Plant communities of this class occupy rock outcrops in all vegetation zones. Except for alpine communities on northern cliffs, which belong to *Salicetea herbaceae*, we consider all other siliceous rock communities within the order *Androsacetalia multiflorae* Braun-Blanquet in Meier et Braun-Blanquet 1934. The diagnostic species set includes species common to Europe (OBERDORFER 1977; MATUSZKIEWICZ 1981; JULVE 1993; MUCINA 1993a), namely *Asplenium septentrionale*, *A. trichomanes*, *Cystopteris fragilis*, *Sedum telephium*, *Polypodium vulgare*, as well as regional rock species (Table 4.1). Rock vegetation is sparse, so the influence of the surrounding closed vegetation on the rock communities is considerable. It seems that elevation is a major factor controlling floristic composition of rock communities. We suggest two new alliances separated according to their elevation position.

4.1. *Gypsophilium tenuifoliae*

The communities occupy siliceous rocks of warm sites from subnival to subalpine zones. We consider the alliance as a geographical vicariant of the European *Androsacion multiflorae* BRAUN-BLANQUET in BRAUN-BLANQUET & JENNY 1926 (MUCINA 1993a). Typical plants of rock fissures (*Campanula saxifraga*, *Gypsophila tenuifolia*, *Saxifraga moschata*, *Draba rigida*) as well as alpine species of windward slopes (*Bromopsis variegata*, *Arenaria lychnidea*, *Aster alpinus*) form the diagnostic set for the alliance. Species composition of the communities varies significantly.

The ratio of total number of species to the mean number of species is about 4:1 for 10 relevés. We distinguish two associations within the alliance and consider *Astragaletum levieri* as a *typus*, or nomenclature type.

4.1.1. *Potentilletum divinae*

Floristic features

A typical rock plant *Potentilla divina* and several alpine species of windward snowfree habitats form the diagnostic set of the association (Table 4.1, 4.2). Floristic richness is not great. We registered 85 vascular plant species, 33 bryophytes and 9 macrolichens in 11 relevés. Mean values per releve were 25, 6 and 2 species respectively. It should be pointed out that only species growing in or around fissures were included in the relevés. The ratio vascular plants/(bryophytes + lichens) is relatively low for this association (2.0), probably because of its severe environment. Vascular plant cover ranges from 2 to 15 % (mean 10%). Cushion plants (*Gypsophila tenuifolia*, *Arenaria lychnidea*, *Saxifraga juniperifolia*) are well-represented here (Table 4.2). *Typus*, or nomenclature type, No. 111/94.

Ecological features

The communities occupy the upper part of the alpine and subnival zones within the elevation range 2750-3100 m (mean 2920 m) on siliceous rocks in warm sites (mainly southern aspect). Slopes with rock outcrops are steep (70-90°, mean 78°), but significant humus accumulation in fissures allows many species to grow there. Due to often limited water supply and strong insolation, many plants have developed xeromorphic features, namely long-lived hard leaves (*Saxifraga juniperifolia*, *S. kolenatiana*), abundant pubescence (*Potentilla divina*, *Eritrichium caucasicum*) or succulent leaves (*Sempervivum pumilum*).

Table 4.1.
Diagnostic table of *Asplenietea trichomanis*

	1	2	3	4
D.sp. <i>Potentilletum divinae</i>				
<i>Potentilla divina</i>	V	-	-	-
<i>Campanula tridentata</i>	V	I	I	-
<i>Carex sempervirens</i>	V	II	I	-
<i>Luzula spicata</i>	IV	-	-	-
<i>Carum caucasicum</i>	IV	-	I	-
<i>Trifolium polyphyllum</i>	IV	I	-	-
<i>Empetrum nigrum</i>	III	-	-	-
<i>Eritrichium caucasicum</i>	III	-	-	-
<i>Cetraria islandica</i>	III	-	-	-
<i>Anemone speciosa</i>	III	-	I	-
<i>Helictotrichon versicolor</i>	III	I	-	-
<i>Grimmia affinis</i>	II	-	-	-
<i>Saxifraga kolenatiana</i>	II	-	I	-
D.sp. <i>Astragaletum levieri</i>				
<i>Ranunculus oreophilus</i>	I	IV	-	-
<i>Alopecurus glacialis</i>	I	IV	-	-
<i>Festuca brunnescens</i>	I	IV	-	I
<i>Astragalus levieri</i>	I	IV	I	-
<i>Encalypta rhamnifolia</i>	-	III	-	-
<i>Thymus nummularius</i>	-	II	-	-
<i>Jurinea coronopifolia</i>	-	II	-	-
D.sp. <i>Gypsophilium tenuifoliae</i>				
<i>Campanula saxifraga</i>	V	V	II	I
<i>Saxifraga moschata</i>	V	IV	-	-
<i>Gypsophila tenuifolia</i>	III	V	I	-
<i>Bromopsis variegata</i>	II	V	I	-
<i>Arenaria lychnidea</i>	IV	II	-	-
<i>Aster alpinus</i>	II	III	-	-
<i>Juniperus communis</i>	II	III	-	-
<i>Draba rigida</i>	I	II	-	-
D.sp. <i>Galio valantioides</i>-<i>Polypodietum vulgare</i>				
<i>Polypodium vulgare</i>	I	I	V	I
<i>Homalothecium sericeum</i>	-	I	IV	I
<i>Galium valantioides</i>	-	-	III	I
<i>Grimmia elatior</i>	I	I	III	-
<i>Homalia besseri</i>	-	-	II	-
<i>Homalothecium philippeanum</i>	-	-	II	-
<i>Frullania dilatata</i>	-	-	II	-
<i>Senecio renifolius</i>	-	-	II	-
<i>Draba supranivalis</i>	I	-	II	-
D.sp. <i>Thymo-Seselietum petraei</i>				
<i>Thymus marschallianus</i>	-	-	-	V
<i>Seseli petraeum</i>	-	-	I	IV
<i>Centaurea salviifolia</i>	-	II	I	IV
<i>Stachys recta</i>	-	-	-	III
<i>Grimmia laevigata</i>	-	-	-	III
<i>Hedwigia ciliata</i>	-	-	-	III
<i>Melica ciliata</i>	-	-	-	III

Table 4.1. (continued)

	1	2	3	4
<i>Grimmia ovalis</i>	-	-	-	III
<i>Sedum telephium</i>	I	-	I	III
<i>Artemisia campestris</i>	-	-	-	II
<i>Onosma caucasica</i>	-	-	-	II
<i>Salvia canescens</i>	-	-	-	II
<i>Sisymbrium lipskyi</i>	-	-	-	II
<i>Veronica multifida</i>	-	-	-	II
<i>Agropyron intermedium</i>	-	-	-	II
<i>Polygonatum odoratum</i>	-	-	-	II
<i>Spiraea hypericifolia</i>	-	-	-	II
<i>Stipa capillata</i>	-	-	-	II
<i>Polygonum convolvulus</i>	-	-	-	II
<i>Carex humilis</i>	-	-	-	II
<i>Rhamnus pallasii</i>	-	-	-	II
<i>Scutellaria orientalis</i>	-	-	-	II
<i>Teucrium chamaedris</i>	-	-	-	II
<i>Cleistogenes bulgarica</i>	-	-	-	II
<i>Teucrium polium</i>	-	-	-	II
D.sp. <i>Thalictro foetidi-Asplenion</i>				
<i>Thalictrum foetidum</i>	-	I	III	IV
<i>Leucodon sciuroides</i>	-	-	II	IV
<i>Campanula sarmatica</i>	-	I	III	III
<i>Bromopsis riparia</i>	-	-	II	III
<i>Silene kubanensis</i>	-	I	II	II
<i>Allium saxatile</i>	-	I	II	III
<i>Parietaria judaica</i>	-	-	I	I
<i>Juniperus sabina</i>	-	I	II	I
D.sp. <i>Asplenietea trichomanis, Androsacetalia multiflorae</i>				
<i>Cystopteris fragilis</i>	I	I	II	-
<i>Asplenium septentrionale</i>	-	I	III	V
<i>Asplenium trichomanes</i>	-	-	III	I
<i>Sedum spurium</i>	-	IV	II	V
<i>Sempervivum pumilum</i>	I	IV	II	III
<i>Silene saxatilis</i>	I	III	II	IV
<i>Saxifraga juniperifolia</i>	IV	III	III	-
<i>Amphidium mougeotii</i>	III	I	II	-
<i>Tortella tortuosa</i>	IV	III	III	I
<i>Poa nemoralis</i>	-	III	IV	II
<i>Paederotella teberdensis</i>	-	III	III	I
<i>Potentilla brachypetala</i>	-	III	II	I

Syntaxa:

1 - *Potentilletum divinae*, 2 - *Astragaletum levieri*, 3 - *Galio valantioides-Polypodietum vulgare*, 4 - *Thymo-Seseliatum petraei*

4.1.2. *Astragaletum levieri*

Floristic features

These are typical rock communities of the low alpine and subalpine zone in the association. The diagnostic species set includes both rock plants (*Astragalus levieri*, *Alopecurus glacialis*, *Jurinea coronopifolia*) and alpine grassland species (*Festuca brunnescens*, *Ranunculus oreophilus*). Species of *Gypsophilion tenuifoliae* are also well represented. Floristic richness is higher than the previous association. There are 99 vascular plant species, 33 bryophytes, and 6 lichens in 10 relevés. Mean species numbers per relevé are 28, 6 and 1 respectively. The role of vascular plants increases in terms of species number as compared with *Potentilletum divinae*.

Typus, or nomenclature type, No. 79/93.

Ecological features

The main ecological difference from the previous association is the lower altitude of this association. The communities are typical for areas above or near the timberline within the elevation range of 2200 to 2950 m (mean 2620 m). They occupy steep (80-85°) siliceous rock outcrops on warm slopes (mainly southern aspect).

Vascular plant cover varies between 2 and 20% (mean 10%); cover of bryophytes is low (up to 5%). Due to strong insolation and high temperature of the substrate, significant water stress can occur. The role of leaf succulents (*Sedum spurium*, *Sempervivum pumilum*) as well as cushion plants is considerable (Table 4.2.).

Table 4.2. (continued)

Releve No.	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	
Year	94	87	93	94	94	94	94	93	94	93	94	94	93	93	93	94	94	95	94	95
<i>Seseli alpinum</i>						+	+								+	+	+			
<i>Taraxacum stevenii</i>						+		+							+	+				
<i>Thamnolia vermicularis</i>	+	+	+					+			1				+					
<i>Tortula ruralis</i>														1		+				+
<i>Vaccinium vitis-idaea</i>		+						+	+	+										
<i>Valeriana alpestris</i>				+				+		+										+
<i>Veronica gentianoides</i>	+		+					+		+	+				+	+				+
<i>Weissia condensata</i>			1											+		+				

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

Aconitum nasutum (81/94), *Allium saxatile* (2/95), *Alopecurus vaginatus* (84/94, 2/95), *Asperula alpina* (164/94), *Asplenium viride* (104/94), *Bartramia ithyphylla* (84/94, 81/94), *Blindia acuta* (111/94), *Bryum caespiticium* (79/93, 90/95), *Bryum imbricatum* (83/93), *Bryum sp.* (80/94), *Calamagrostis arundinacea* (90/95), *Campanula samatica* (79/93, 2/95), *Carum meifolium* (81/94), *Centaurea cheiranthifolia* (85/93), *Cerastium polymorphum* (104/94, 171/94), *Cerastium purpurascens* (84/94), *Cetraria cucullata* (65/93), *Cetraria nivalis* (9/87, 61/93), *Cirsium munitum* (9/87:r), *Cladonia furcata* (111/94), *Cladonia gracilis* (9/87), *Comicularia divergens* (31/93), *Coronilla varia* (83/93), *Cruciata laevipes* (87/93), *Ctenidium procerimum* (84/94, 29/94:1), *Cuscuta sp.* (79/93, 83/93), *Daphne glomerata* (81/94, 104/94), *Desmatodon latifolius* (83/93, 87/93), *Desmatodon systylius* (83/93), *Dianthus cretaceus* (29/94, 2/95), *Dicranoweisia crispula* (80/94), *Ditrichum flexicaule* (84/94, 171/94:1), *Draba nemorosa* (2/95), *Draba scabra* (84/94, 171/94), *Draba supranivalis* (61/93), *Encalypta sp.* (90/95), *Encalypta streptocarpa* (29/94), *Encalypta vulgaris* (83/93, 85/93), *Erigeron alpinus* (81/94), *Euphrasia petiolaris* (104/94, 90/95), *Eurhynchium pulchellum* (81/94), *Festuca sommieri* (164/94, 2/95), *Galium verum* (83/93, 36/94), *Gentiana pyrenaica* (61/93), *Gentiana septemfida* (80/94), *Gentiana verna* (36/94, 164/94), *Geranium platypetalum* (87/93), *Gnaphalium supinum* (61/93:r, 84/94), *Grimmia funalis* (84/94, 31/93), *Grimmia montana* (65/93, 86/94:1), *Grimmia unicolor* (61/93), *Heracleum freynianum* (79/93), *Hieracium macrolepis* (111/94, 65/93), *Homalothecium sericeum* (90/95), *Hypericum linarioides* (83/93), *Hypnum revolutum* (171/94), *Iris aphylla* (79/93), *Juniperus sabina* (90/95), *Juninella moschus* (85/93), *Koeleria eriostachya* (36/94, 35/94), *Leontodon hispidus* (81/94, 104/94), *Leskeella nervosa* (81/94, 36/94), *Linum hypericifolium* (79/93), *Luzula multiflora* (171/94), *Macrotomia echioides* (81/94), *Matricaria caucasica* (61/93, 81/94), *Minuartia imbricata* (84/94), *Murbeckiella huetii* (81/94), *Muscari racemosum* (79/93, 36/94), *Myurella julacea* (86/94, 36/94), *Orthotrichum cupulatum* (79/93), *Orthotrichum rupestre* (2/95), *Peltigera rufescens* (29/94), *Physconia muscigena* (83/93), *Pinus silvestris* (87/93), *Plagiochila porelloides* (111/94), *Poa alpina* (31/93, 36/94), *Pohlia elongata* (85/93), *Pohlia longicollis* (111/94), *Pohlia nutans* (61/93:1), *Polygala alpicola* (79/93, 83/93), *Polygonum alpinum* (83/93, 85/93), *Polygonum bistorta* (85/93), *Polygonum viviparum* (171/94), *Polypodium vulgare* (104/94, 83/93), *Polytrichastrum alpinum* (171/94), *Potentilla crantzii* (87/93), *Potentilla gelida* (84/94), *Primula renifolia* (90/95), *Pterigynandrum filiforme* (31/93), *Rhamnus microcarpus* (79/93:1, 2/95), *Rhododendron caucasicum* (81/94, 80/94), *Rosa tomentosa* (83/93), *Saelania glaucescens* (61/93:1), *Salix kazbekensis* (171/94), *Saxifraga paniculata* (29/94), *Saxifraga sibirica* (104/94), *Scabiosa caucasica* (79/93), *Schistidium apocarpum* (79/93), *Sedum telephium* (84/94), *Senecio caucasicus* (85/93, 87/93:1), *Silene kubanensis* (2/95:1), *Solorina saccata* (29/94), *Sphenolobus minutus* (111/94), *Taraxacum confusum* (111/94, 84/94), *Thalictrum foetidum* (83/93), *Tragopogon brevirostris* (87/93), *Tragopogon reticulatus* (83/93), *Vaccinium myrtillus* (31/93), *Valeriana sisymbriifolia* (2/95), *Veronica peduncularis* (87/93), *Vicia cracca* (83/93, 87/93), *Viola altaica* (81/94), *Viola caucasica* (36/94, 35/94), *Weissia sp.* (36/94).

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

111/94 - 22.07, 25, Goralykol; 9/87 - 17.07, 25, Semenov-Bashi; 61/93 - 17.08, 20, Baduk; 84/94 - 17.07, 25, Khadzhibey (D.Sukhova); 81/94 - 17.07, 7, Bol.Khatipara (D.Sukhova); 104/94 - 21.07, 15, Goralykol; 171/94 - 06.09, 21, Oriuchat; 31/93 - 29.07, 6, Bol.Khatipara; 80/94 - 17.07, 16, Khadzhibey; 65/93 - 17.08, 8, Baduk; 86/94 - 17.07, 10, Khadzhibey; 29/94 - 10.07, 20, Dzhemagat; 79/93 - 22.08, 9, M.Khatipara; 83/93 - 23.08, 16, M.Khatipara; 85/93 - 26.08, 12, M.Khatipara; 87/93 - 26.08, 12, M.Khatipara; 36/94 - 11.07, 20, Kyshkadzher; 35/94 - 11.07, 21, Kyshkadzher; 90/95 - 25.07, 15, Khadzhibey; 164/94 - 06.09, 21, Oriuchat; 2/95 - 29.06, 15, M.Khatipara.

4.2. *Thalictro foetidi-Asplenion*

This alliance, which combines the siliceous rock communities of the forest zone, may be considered as a vicarious altitudinal syntaxon for the previous alliance, and as a geographical vicariant of the European *Asplenion septentrionalis* Oberd. 1938 (MUCINA 1993a). The diagnostic species set of the alliance includes typical rock species (*Campanula sarmatica*, *Silene kubanensis*, *Allium saxatile*, *Parietaria judaica*, *Juniperus sabina*) as well as species common to forest and steppe communities (*Leucodon aff. sciuroides*, *Bromopsis riparia*, *Thalictrum foetidum*). Two associations can be easily distinguished according to their floristic and ecological features. Association *Thymo-Seseliatum petraei* is the typus, or nomenclature type, of the alliance.

4.2.1. *Galio valantioides-Polypodietum vulgaris*

Floristic features

The diagnostic species set includes mosses of shaded habitats (*Homalothecium sericeum*, *H. philippeanum*, *Homalia besseri*, *Frullania dilatata*) and forest forbs (*Galium valantioides*, *Senecio renifolius*). *Polypodium vulgare* as well as other rock ferns are also well represented. There are 95 vascular plant species, 37 bryophytes and 10 lichens in 10 relevés of the association (Table 4.3.). Mean species number per releve is relatively low, namely 20, 8, and 2 species respectively. The role of bryophytes is significant in terms of species number and especially in terms of percentage cover, which ranges between 1 and 60%. Typus, or nomenclature type, No. 87/94.

Ecological features

Communities of shaded rocks between 1350 and 2500 (mean 1670 m) elevation within the forested zone belong to this association. The mainly northern aspect of the rocks and tall tree canopy are responsible for low solar radiation input. Rock slopes are steep (70-90°, mean 82°), but the mean vascular plant cover is similar to other communities of the class (3-20%, mean 9%).

4.2.2. *Thymo-Seselietum petraei*

Floristic features

The diagnostic set of the association includes a significant number of species. The most frequent species are *Thymus marschallianus* s.l., *Seseli petraeum*, and *Centaurea salviifolia*. Many steppe species from *Festuco-Brometea* BRAUN-BLANQUET & TÜXEN, 1943 (for instance, *Artemisia campestris*, *Stipa capillata*, *Carex humilis*) are also common in these communities. On the other hand, diagnostic species of *Asplenieta trichomanis* (especially *Asplenium septentrionale*) are also well represented.

Species richness is very high. We registered 129 vascular plant species, 27 bryophytes and 3 lichens in 11 relevés. Mean values per relevé are 27, 5 and less than 1 respectively. Therefore, the variation in species composition among communities is high. The role of bryophytes is less important than in the previous association. Ratio of vascular plants/(bryophytes+lichens) is the highest among the associations considered in this class (Tab. 4.3.).

Ecological features

The communities occupy rock outcrops on warm sites (mainly southern aspect) within the altitude range of 1100-1850m (mean 1390 m). Steepness of the rocks varies between 45° and 90° (mean 74°). Most of the relevés were obtained from the border and outside of the reserve area among intensively grazed forests and grasslands. The high floristic richness of the communities may be caused by the moderate level of grazing (hard-to-reach areas), and sufficient supply of species diaspores from the surrounding communities.

Communities of this association include some rare and protected species. Special protection is not required now, since the communities are confined to rocky and naturally-inaccessible sites. The only special measure we can recommend is restriction of intensive goat grazing on the rocks near villages.

Table 4.3.

Thalictro foetidi-Asplenion

Releve No.	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	
	88	5	87	4	15	17	17	44	89	36	1	16	2	6	7	8	29	29	45	46	30
Year	94	94	94	94	94	94	95	94	94	95	94	95	94	94	94	94	94	93	95	95	94
Altitude (* 10)	1	1	1	1	1	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
	45	35	45	40	55	35	42	72	45	25	35	38	40	10	20	25	85	40	20	25	90
Steepness	85	80	70	85	80	85	75	85	88	90	70	65	45	65	80	80	80	90	80	70	90
Exposition	nw	n	se	n	nw	nw	nw	e	w	ne	sw	sw	sw	se	se	e	sw	sw	sw	se	se
Vascular plant cover	10	10	10	3	10	15	20	5	5	3	10	10	15	20	10	5	10	10	20	10	1
Bryophyte cover	15	60	60	60	20	10	40	5	20	1	40	30	60	10	5	+	+	30	1	3	0
Lichen cover	4	20	+	40	1	+	10	1	+	+	20	+	20	10	20	5	3	50	0	0	0
Vascular plant species number	23	19	23	14	11	24	38	15	14	15	23	33	20	46	34	22	27	18	37	27	14
Bryophyte species number	9	6	10	7	6	11	9	7	11	4	7	9	5	9	4	4	4	7	3	5	0
Lichen specie number	1	0	2	0	3	1	6	2	0	1	2	1	0	0	0	0	0	0	0	0	0
Total number of species	33	25	35	21	20	36	53	24	25	20	32	43	25	55	38	26	31	25	40	32	14
D.sp. <i>Galio valantioides</i> - <i>Polypodietum vulgare</i>																					
<i>Polypodium vulgare</i>	+	+	+	1	1	+	+	+		+	+										
<i>Homalothecium sericeum</i>	1	1	2				1	1	1	+				+							
<i>Galium valantioides</i>		+	+	+			+		+											+	+
<i>Grimmia elatior</i>	1		1			1	1		1												
<i>Homalia besserii</i>	1	3	2	2																	
<i>Homalothecium philippeanum</i>	+	1								+											
<i>Frullania dilatata</i>			1	1		1	1														
<i>Senecio renifolius</i>		1		+		+															
<i>Draba supranivalis</i>	+		+		+																
D.sp. <i>Thymo-Seseli</i> <i>etum petraei</i>																					
<i>Thymus marschallianus</i>											+	+	+	+	+	+		+	+	+	
<i>Seseli petraeum</i>	+											+		+	+	+	+			+	+
<i>Centaurea salviifolia</i>							+				1		+			+	+		+	+	+
<i>Stachys recta</i>											+		+	+		r			+	+	
<i>Grimmia laevigata</i>													3	2	+	+	1				
<i>Hedwigia ciliata</i>											2	1	+		+			1	+		
<i>Melica ciliata</i>												+	+					+	+	+	
<i>Grimmia ovalis</i>											1	2	+	+	+			1			
<i>Sedum telephium</i>								+			+		+			+		1		+	
<i>Artemisia campestris</i>															+	+			+	+	
<i>Onosma caucasica</i>															1	+			+		+
<i>Salvia canescens</i>															1	+			+	+	
<i>Sisymbrium lipskyi</i>															+		+		+	+	
<i>Veronica multifida</i>															+	+	+		+		
<i>Agropyron intermedium</i>															+	+	+		+		
<i>Polygonatum odoratum</i>											+		+		+						
<i>Spiraea hypericifolia</i>											2		+						+		
<i>Stipa capillata</i>																			+	+	+
<i>Polygonum convolvulus</i>												+		+					+	+	
<i>Carex humilis</i>												+					+		+	+	
<i>Rhamnus pallasii</i>															+				1	1	
<i>Scutellaria orientalis</i>															+	+	+		+		
<i>Teucrium chamaedris</i>											+	+								+	
<i>Cleistogenes bulgarica</i>															+				+	+	
<i>Teucrium polium</i>															+	+				+	

For Table 4.3.

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

Abies nordmanniana (144/94), *Abietinella abietina* (6/94), *Achillea millefolium* (7/94), *Achillea nobilis* (6/94, 7/94), *Acinos arvensis* (45/95), *Aconitum nasutum* (117/94), *Agrostis vinealis* (87/94), *Ajuga orientalis* (2/94), *Allium rupestre* (1/94, 2/94), *Alyssum alyssoides* (6/94), *Alyssum murale* (115/95), *Anaptychia ciliaris* (117/95), *Anemone speciosa* (117/94), *Anoetangium aestivum* (29/94), *Artemisia absinthium* (8/94), *Artemisia chamaemellifolia* (7/94, 45/95), *Artemisia taurica* (6/94, 29/94), *Asperula alpina* (88/94), *Asplenium ruta-muraria* (46/95), *Asplenium viride* (144/94), *Astragalus captiosus* (45/95), *Astragalus demetrii* (1/94), *Astragalus falcatus* (1/94), *Astragalus levieri* (117/95:2), *Astragalus monspessulanus* (6/94, 7/94), *Asyneuma campanuloides* (4/94), *Bartramia ithyphylla* (144/94), *Berberis vulgaris* (1/94, 116/95), *Brachypodium pinnatum* (7/94), *Bromopsis variegata* (87/94), *Bryum capillare* (87/94:1, 116/95:1), *Bupleurum falcatum* (117/95, 6/94), *Campanula collina* (87/94, 136/95), *Campanula tridentata* (87/94), *Carex sempervirens* (117/94), *Carex supina* (6/94), *Carum caucasicum* (117/94), *Cetraria olivetorum* (115/94), *Chamaescidium acaule* (117/94, 136/95), *Chenopodium album* (45/95), *Cicerbita racemosa* (144/94), *Cirsium vulgare* (7/94), *Cladonia chlorophaea* (117/95), *Cladonia* sp. (87/94), *Compositae* g. sp. (6/94, 7/94), *Convallaria majalis* (5/94), *Comicularia muricata* (117/95), *Coronilla varia* (6/94), *Cruciferae* g. sp. (30/94), *Descurainia sophia* (7/94), *Dianthus ruprechtii* (29/94:r), *Dianthus* sp. (29/93), *Distichium capillaceum* (117/94:1, 89/94:1), *Draba nemorosa* (29/93:r), *Draba siliquosa* (136/95), *Dryopteris filix-mas* (5/94, 4/94), *Echinops sphaerocephalus* (29/93), *Encalypta* sp. (89/94), *Encalypta spathulata* (46/95), *Encalypta vulgaris* (88/94), *Erysimum cuspidatum* (116/95), *Erysimum aureum* (6/94), *Euphrasia ossica* (117/95, 136/95), *Evemia divaricata* (1/94), *Fabronia ciliaris* (115/94, 29/93:1), *Festuca brunnescens* (29/93, 30/94), *Frullania* sp. (89/94, 29/93:1), *Fumana procumbens* (45/95), *Galium aparine* (5/94), *Genista angustifolia* (8/94), *Geranium platypetalum* (117/95, 144/94), *Geranium renardii* (116/96), *Geranium robertianum* (5/94, 4/94), *Grimmia funalis* (117/94:1, 136/95), *Grimmia tergestina* (46/95), *Gypsophila elegans* (45/95), *Gypsophila tenuifolia* (88/94, 117/94), *Hemiaria incana* (6/94), *Hieracium macrolepis* (116/95), *Hieracium murorum* aggr. (116/95), *Hieracium umbellatum* (117/95), *Hypericum nummularifolius* (117/95), *Isoetecium alopecuroides* (5/94:2, 4/94:2), *Jurinea alata* (8/94), *Leontodon hispidus* (45/95, 46/95), *Leptogium satuminum* (115/94), *Leucodon immersus* (89/94, 46/95:1), *Lloydia serotina* (117/94:1), *Lotus comiculatus* (6/94, 7/94), *Marrubium parviflorum* (6/94), *Medicago falcata* (45/95, 46/95), *Melampyrum arvense* (117/95), *Melica nutans* (5/94), *Metzgeria conjugata* (87/94:1, 4/94:1), *Metzgeria furcata* (144/94), *Minuartia imbricata* (117/94), *Mnium homum* (117/94), *Muscari racemosum* (2/94), *Mycelis muralis* (4/94), *Neckera complanata* (5/94:2, 117/94:1), *Neckera pennata* (89/94), *Orthotrichum anomalum* (88/94), *Orthotrichum rupestre* (144/94, 1/94:2), *Oxalis acetosella* (5/94, 4/94), *Oxystegus tenuirostris* (6/94), *Pedicularis comosa* (29/94), *Peltigera polydactyla* (117/95), *Peucedanum ruthenicum* (6/94, 29/93), *Phleum phleoides* (7/94, 29/94:r), *Physconia muscigena* (117/95), *Pinus silvestris* (116/95:1), *Plantago atrata* (29/94), *Plantago media* (6/94), *Poa alpina* (136/95), *Pogonatum urmigerum* (117/94), *Pohlia cruda* (144/94), *Polygonatum orientale* (5/94, 4/94), *Polygonum bistorta* (117/94), *Polystichum lonchitis* (117/94), *Polytrichastrum alpinum* (117/94), *Polytrichum piliferum* (117/95:1, 116/95), *Potentilla rupestris* (116/95), *Primula renifolia* (88/94, 89/94), *Pterigynandrum filiforme* (4/94:1), *Pyrethrum corymbosum* (116/95), *Radula complanata* (87/94:1), *Rosa canina* (1/94:1), *Rosa* sp. (6/94, 29/94:r), *Salvia glutinosa* (5/94), *Salvia pratensis* (7/94), *Salvia verticillata* (6/94), *Saxifraga kolenatiana* (117/94, 117/95), *Saxifraga sibirica* (117/94), *Scabiosa ochroleuca* (7/94), *Scorzonera stricta* (29/94), *Selaginella helvetica* (117/95, 89/94), *Senecio propinquus* (5/94, 4/94), *Seseli alpinum* (117/94, 117/95), *Seseli libanotis* (117/95, 144/94:r), *Sideritis montana* (45/89), *Silene compacta* (116/95, 2/94), *Silene pygmaea* (87/94, 89/94), *Solidago virgaurea* (117/95), *Stellaria media* (5/94), *Stipa pulcherrima* (6/94, 45/95), *Taraxacum confusum* (29/94), *Taraxacum officinale* (117/94), *Teucrium orientale* (6/94), *Thesium alpinum* (6/94, 7/94), *Thesium arvense* (1/94, 6/94), *Tortula sinensis* (8/94, 45/95), *Tortula subulata* (116/95:1), *Tragopogon filifolius* (45/95), *Tragopogon reticulatus* (117/95), *Trifolium alpestre* (29/94), *Trifolium canescens* (117/95), *Trifolium pratense* (2/94), *Urtica dioica* (115/94), *Valeriana alliariifolia* (5/94:1, 4/94), *Valeriana officinalis* (115/94), *Valeriana saxicola* (117/94), *Verbascum austriacum* (6/94, 30/94), *Veronica gentianoides* (117/95, 116/95), *Veronica peduncularis* (116/95, 2/94), *Veronica spicata* (29/93), *Veronica verna* (2/94), *Viola arvensis* (116/95), *Viola caucasica* (117/94:1, 116/95), *Viola rupestris* (6/94), *Viola tricolor* (2/94), *Weissia controversa* (45/95, 46/95), *Weissia* sp. (6/94), *Woodsia alpina* (117/94).

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

88/94 - 18.07, 15, Shumka; 5/94 - 02.07, 15, M.Khatipara; 87/94 - 18.07, 12, Shumka; 4/94 - 02.07, 10, M.Khatipara; 115/94 - 23.07, 18, Dzhemagat; 117/94 - 27.07, 15, M.Khatipara; 117/95 - 20.08, 18, Teberda valley; 144/94 - 03.09, 40, M.Khatipara; 89/94 - 18.07, 15, Shumka; 136/95 - 30.08, 24, Ullurudzhu; 1/94 - 02.07, 16, M.Khatipara; 116/95 - 20.08, 24, Teberda valley; 2/94 - 02.07, 12, M.Khatipara; 6/94 - 03.07, 10, Teberda valley; 7/94 - 03.07, 24, Teberda valley (A.Egorov); 8/94 - 03.07, 20, Teberda valley; 29/94 - 10.07, 20, Dzhemagat; 29/93 - 12.07, 20, Teberda valley; 45/95 - 08.07, 15, Teberda valley; 46/95 - 08.07, 15, Teberda valley; 30/94 - 10.07, 20, Epchik.