

The association *Carici albae* - *Piceetum*, a new forest community from the Western Carpathians

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Abstract. During the period of 1988 - 1990 a vegetation inventory was done in the National Nature Reserve Demänovská dolina (the Nízke Tatry Mts.). The research was focused on a study of spruce stands dominated by *Carex alba* in the understorey. A new association, the *Carici albae* - *Piceetum* (the *Abietion albae*, *Vaccinio-Piceetea*) was described. It is characterized from ecological and coenological points of view. The differences compared to other communities with dominating *Carex alba* are discussed.

Key words: Nízke Tatry Mts., phytosociology, *Vaccinio-Piceetea*

Sillinger (1933) described the "*Piceeto* - *Fagetum* *carpaticum calcicolum*" as a representative unit of typical beech woods stands occurring on the north slopes of the Nízke Tatry Mts. This syntaxon comprises mixed stands of four main tree species, namely *Picea abies*, *Acer pseudoplatanus*, *Abies alba* and *Fagus sylvatica*. The importance of coniferous varies widely, and the proportion of *Fagus sylvatica* in the stands is also very varied. *Fagus sylvatica* is absent in the Demänovská dolina Valley as well as in the eastern part of the Nízke Tatry Mts.

Phytosociological study done in the Demänovská dolina Valley revealed, that stands floristically related to the *Piceeto* - *Fagetum* *carpaticum calcicolum* lacking *Fagus sylvatica* are widespread in the areas dominated by dolomites. Nearly half of the nature reserve is covered by such woods as well as grasslands of the *Carlino-Calamagrostidetum varia* (Sill.) Hadač in Mucina and Maglocký (1985). The woodland community differs substantially from the *Piceeto*-*Fagetum* *carpaticum calcicolum* discussed of Sillinger (1933), in particular by the cover of *Carex alba*. Earlier (Školek 1994) classified this community as *Piceeto* - *Fagetum* *carpaticum calcicolum caricetosum albae*. Now an upranking of this syntaxon as an association is suggested.

The vegetation was sampled by 17 phytosociological relevés (Braun-Blanquet 1964). Analytical and syntetical elaboration follows Zürich - Montpellier methods. In order to make our results clear, the differential table shows the following associations: *Piceeto* - *Fagetum* *carpaticum calcicolum* (Sillinger 1933), *Carici albae* - *Fagetum* (Fajmonová 1972) and *Carici albae* - *Abietetum*

(Šomšák 1986). In order to compare floristical richness of individual phytocenoses the average numbers of species was calculated. The nomenclature follows Dostál and Červenka (1992).

Description of the new association

As mentioned previously, Sillinger (1933) described an association of *Piceeto* - *Fagetum* *carpaticum calcicolum* in the northern part of the Nízke Tatry Mts., taking the place of missing typical beech forests. Our phytocenose shows striking differences from that described by Sillinger (1933) and we have decided to classify these phytocenoses as belonging to the new association titled *Carici albae* - *Piceetum* ass. nova. The following arguments were decisive:

- Entire absence of beech (*Fagus sylvatica*), see Table 1
- High dominance and constant presence of *Carex alba* (see Table 1 - characteristic species)
- Presence of many herbaceous species which were not found in Sillinger's association (see Table 1 - differential species)
- Absence of herbaceous species showing high presence in the Sillinger's association
- In our association *Aconitum variegatum* is listed, while Sillinger (1933) noticed *Aconitum moldavicum* (Table 1 - differential species)
- Slight mixture of *Abies alba* (distinct from the Sillinger's association, see Table 1)
- High abundance of *Picea abies* (see Table 1 - E_3, E_2, E_1)
- Some aberration in the composition of shrub layer compared with Sillinger's (1933) association, mainly non-presence of *Rosa pendulina*.

The name of the new association was derived as follows: The first part is ascribed to the characteristic species (*Carex alba*), and the second to the dominant species *Picea abies*.

The variant with *Pinus sylvestris* was also determined, in which besides *Pinus sylvestris*, some of differential herb species were found (Table 1). The negative differential species are indicated by a broken line.

Ordination to higher syntaxonomical units

Association *Piceeto*-*Fagetum* Sill. 33 [according to Mucina and Maglocký (1985), the correct name is *Clematido* *alpinae*-*Fagetum* (Sill. 33) Fajmonová et Šimeková 1981], belongs to the suballiance *Cephalanthero*-*Fagenion* R.Tx. in R.Tx. et Oberd. 1958 and alliance *Fagetalia* Pawlowski 1928 and classis *Querco*-*Fagetea* Br.-Bl. et Vlieger 1937.

The comparison of the number of species of the classis Quercu-Fagetea with the number of species of the classis Vaccino-Piceetea (Table 1) shows that in spite of higher absolute number of species in the first classis the relative number (ratio between the number of characteristic species and maximum number of characteristic species) is lower, approximately 30 % less than in classis Vaccino-Piceetea (the first classis has app. 60% and second app. 90 %). This is the reason why the community is ordinated to the classis Vaccinio - Piceetea Br.- Bl. 1939. The ordination to the ordo Piceetalia excelsae Pawlowski 1928 is excluded and therefore the ordination is restricted to the order Athyrio - Piceetalia Hadač 1962 and only the alliance Abietion albae Březina et Hadač 1962 is considered. The total number of species (Table 1) in this alliance greatly exceeds the number of species of alliance Fagion and other related alliances.

The syntaxa can be summarized as follows:

Vaccinio - Piceetea Br.-Bl. 1939
 Athyrio - Piceetalia Hadač 1962
 Abietion albae Březina et Hadač 1962
 Carici albae - Piceetum ass. nova

Characteristics of the Association Carici albae - Piceetum ass. nova

Syn.: Piceeto - Fagetum carpaticum calcicolum Sill. 33
 caricetosum albae Školek 1994

Diagnostic species of the association:

Picea abies and *Acer pseudoplatanus* (E₁), *Daphne mezereum* (E₂), *Carex alba* (characteristic and differential species), *Cirsium erisithales*, *Valeriana tripteris*, *Campanula rapunculoides*, *Carex digitata*, *Melica nutans*, *Mycelis muralis*, *Viola reichenbachiana*, *Melampyrum sylvaticum*, *Mercurialis perennis*, *Acer pseudoplatanus*, *Tithymalus amygdaloides*, *Galium schultesii*, *Clematis alpina*, *Rubus saxatilis*, *Calamagrostis varia*, *Fragaria vesca*, *Hieracium bifidum*.

Nomenclatural type: relevé No 9, Table 1, holotypus

a. Ecological characteristics

Stands of this association are mainly found on east or west facing slopes, especially at their bases. They also cover concave slope areas below rock walls and cliffs (or below the chains and range from altitudes of around 750 m above sea level up to 1,200 m a.s.l. Soils are always inundated, fresh wet to wet, humus - calcaric rendzinas or debris rendzinas.

b. Community structure

The association Carici albae - Piceetum is dominated by capit white spruce (*Picea abies*) in E₃ level. This is the main feature. In addition, *Acer pseudoplatanus* and *Pinus sylvestris* (only in the relevant Variant), are also frequent. The shrub layer is poorly developed and the most common species are *Daphne mezereum*, *Lonicera xylosteum* and *Grossularia uva-crispa*.

The herb layer has a grassy appearance. This layer is mainly composed of *Carex alba*, *Calamagrostis varia* and *Melica nutans*. Sometimes herbs like *Melampyrum sylvaticum*, *Mercurialis perennis* or *Mycelis muralis* can be found at higher density. *Calamagrostis varia*, which is usually characterized by lower dominance, can be more luxurious under a more open canopy, or in stands close to forest edge and also if the forest composition was in the past influenced by management practices, e.g. felling.

c. Phytocoenological characteristic

The characteristic species is *Carex alba*, which is also the differential species compared to the association Piceeto - Fagetum carpaticum calcicolum Sill. 33. The other differential species are listed in Table 1. The most important are *Aconitum variegatum* ssp. *variegatum*, *Campanula carpatica* and *Monotropa hypopitys*.

From the number of characteristic species of the classis Quercu - Fagetea, mainly *Campanula rapunculoides*, *Carex digitata*, *Viola reichenbachiana*, *Mycelis muralis* and *Melica nutans*, the last posses high frequency and also occurs in high abundance. For this new association, the high presence of the species of the classis Vaccinio - Piceetea (90 % of all possible), and the high number of characteristic species of the alliance Abietion albae is typical (to 16, Table 1). The high constancy (IV) is characteristic for the following species: *Carex alba*, *Carex digitata*, *Clematis alpina*, *Melampyrum sylvaticum*, *Melica nutans*, *Rubus saxatilis* and *Viola reichenbachiana*.

A large number of the characteristic species of beech forests (order Fagetalia) are present, and listed in Table 1. The high constancy (IV) and higher abundance (1 - 2) is typical only for *Mercurialis perennis*.

Besides the close relation to beech communities, the new association shows a free relation to communities of the alliance Carpinion betuli and Tilio - Acerion, while the alliance Piceion excelsae is represented by only one species (Table 1).

High diversity of herb species (mean = 44 per one relevé) occurs in Carici albae - Piceetum. The high range of constancy (III - V) is achieved by 30% of the total species which suggests a high homogeneity of the community. Distribution to constancy is as follows: I - 85; II - 31; III - 26; IV - 17; V - 5.

Association	Carici albae - Piceetum ass. nova																Piceeto-Fagetum carp. calc. Sill.33*			Carici albae - Fagetum Klhka 49 in Fajmonová 1972	Carici albae- Abietetum (Březina et Hadač 1969) Šomšák 1986		
Variante/Forest type	with <i>Pinus sylvestris</i>																I	II	III	I	I		
Code of relevés/Sum of relevés	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	5	6	8	49	1986	
Altitude (m a.s.l.)	820	820	760	800	810	840	840	800	910	840	820	890	890	880	1060	980	790	780-950	880-1,050	1,000-1,150			
Exposition	E	N	E	E	E	E	E	E	W	E	E	E	E	W	N	ESE	S-SE-NE	S-E-N	S-E-N				
Slope (°)	45	30	15	35	35	35	45	35	30	35	25	40	40	45	35	10	20						
Cover (%) E ₃	100	80	100	90	95	95	50	70	70	60	80	100	90	60	60	95	60						
E ₂	50	+	20	1	0	25	6	0	+	2	1	0	5	+	15	5	0						
E ₁	50	60	50	40	50	50	80	85	75	85	80	50	60	80	75	100	80						
E ₀	30	30	50	40	40	0	60	60	50	40	10	40	75	5	60	5	20						
Number of species	60	57	43	52	46	34	35	41	58	39	27	42	41	52	39	35	52						
E ₃ <i>Picea abies</i>	2	3-4	4	4	5	5	3	4	4	4	5	5	5	2	4	4-5	2	V	V ^(b-vb)	V ^(b-vb)		IV ^{r-3}	
E ₂ <i>Picea abies</i>	1	+	1	-	-	2	1	-	-	-	-	-	1	+	2	1	-	III				II ^r	
E ₁ <i>Picea abies</i>	+	1	+1	+	+	-	-	-	+	-	+	1-2	1-2	-	+	+1	+	IV				III ^{r-2}	
E ₃ *** <i>Acer pseudoplatanus</i>	4-5	3	2-3	2	2	2	2	+	+	+	+	-	-	-	-	-	-	IV	V ^(b-vb)	V ^(b-vb)	V ^r	I ^r	
E ₂ *** <i>Acer pseudoplatanus</i>	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	I			II ^r	I ^r	
E ₁ *** <i>Acer pseudoplatanus</i>	+	+1	1	1	+1	-	+	1	1	-	-	-	1	+	-	+	-	IV	IV ^(ab-vb)	V ^(ab-vb)	III ^{r-1}	II ^r	
E ₃ <i>Abies alba</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I				V ^{r-2}	
E ₁ <i>Abies alba</i>	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	I					
E ₃ <i>Sorbus aria</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	I					
E ₂ <i>Sorbus aria</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		V	V			
E ₁ <i>Sorbus aria</i>	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	II	IV	IV	V ^r		
E ₂ <i>Sorbus aucuparia</i>	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	I				III ^{r-1}	
E ₁ <i>Sorbus aucuparia</i>	+	+	+	+	+	-	-	-	+	+	-	-	-	+	+	-	-	III				IV ^{r-1}	
E ₃ <i>Pinus sylvestris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	+2	+	II	I ^(b)	I ^(b)		I ^r
<i>Sorbus aria</i> x <i>S. aucuparia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I					
<i>Salix caprea</i>	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I					
E ₂ <i>Salix caprea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I					
E ₃ <i>Fagus sylvatica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I					
<i>Acer platanoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		III ^(b-vb)	V ^(b-vb)	V ^{r-5}	I ^r	
<i>Tilia platyphylloides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		I ^(b)				
E ₂ + E ₁ <i>Daphne mezereum</i>	+	+	+	+	-	+	-	-	+	+	+	+	+	+	+	+	+	V				I ^r	
E ₂ + E ₁ <i>Lonicera xylosteum</i>	+	+	+	+	-	-	-	+	+	+	+	+	+	+	+	+	+	III	V ^(c)	IV ^(r)	III ^{r-1}	III ^{r-1}	
E ₂ <i>Corylus avellana</i>	2-3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	IV	V	II ^{r-1}	IV ^{r-1}	
<i>Sambucus racemosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	III	I	I ^r	IV ^{r-1}	
<i>Rosa pendulina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I				III ^{r-1}	
<i>Lonicera nigra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		III	V	I ^r	III ^{r-1}	
<i>Cotoneaster integerrima</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		I	IV		III ^{r-1}	
<i>Viburnum opulus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		I				
<i>Ribes alpinum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		I				
E ₂ + E ₁ <i>Grossularia uva-crispa</i>	+	+	+	+1	-	-	-	-	+	-	+	-	-	-	-	-	-	III				II ^r	
E ₂ <i>Spirea media</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						

Species of the alliance <i>Piceion excelsae</i>															
<i>E₁ Picea abies</i>	+	1	+1	+	+	+	+	+	1-2	1-2	+	+1	IV	III ²	
Species of the alliance <i>Tilio - Acerion</i>															
<i>E₁ Acer pseudoplatanus</i>	+	+1	1	1	+	1	1	+	1	+	+	+	IV	II ¹	
<i>Grossularia uva - crispa</i>	+	+	+1	+	+	+	+	+	+	+	+	+	III	II ¹	
<i>Lamium maculatum</i>	+	+	2	+	+	+	+	+	1	+	+	+	III	·	
Species of the alliance <i>Carpinion betuli</i>															
<i>Galium schultesii</i>	1	+	+	+1	+	+	+	+	+	+	+	+	IV	III ¹	
<i>Pyrethrum clusii</i>	·	·	·	·	·	·	·	·	·	·	·	·	III	·	
<i>Campanula trachelium</i>	+1	+	·	·	·	·	·	·	·	·	·	·	I	IV ¹	
<i>Campanula persicifolia</i>	·	·	·	·	·	·	·	·	·	·	·	·	I	I ¹	
<i>Vincetoxicum hirundinaria</i>	1	·	·	·	·	·	·	·	·	·	·	+1	I	III ¹	
Species of the alliance <i>Abietion albae</i>															
<i>E₃ Pinus sylvestris</i>	1	1	1	2	2	·	1	4	4	5	·	·	II	·	
<i>E₁ Carex alba</i>	+	+	+	1	+	+	+1	·	·	1-2	+	+	V	V ²⁻⁴	
<i>Carex digitata</i>	1-2	+1	+1	+	+1	+	1-2	1	+	·	·	·	IV	V ¹⁻¹	
<i>Clematis alpina</i>	·	·	·	1	+	+	1-2	1	+	·	·	1	IV	III ¹	
<i>Melampyrum sylvaticum</i>	·	+	·	2	3	1	1	1	+	2	+	·	IV	II ²	
<i>Melica nutans</i>	1	1	+	·	2	+	1	1	·	+1	1	·	IV	V ¹⁻²	
<i>Rubus saxatilis</i>	+1	+	+	·	·	+	+1	+	1	·	+1	2	IV	II ²	
<i>Viola reichenbachiana</i>	·	+	+	+	·	·	·	+	+1	+	1	·	IV	III ¹	
<i>Vaccinium myrtillus</i>	·	+1	·	·	·	·	1	+	·	·	·	2	III	II ¹	
<i>Convallaria majalis</i>	+	·	·	1	·	·	·	·	·	·	·	1	III	·	
<i>Monotropa hypopitys</i>	·	·	·	·	·	·	·	·	·	+1	+	·	III	·	
<i>Aquilegia vulgaris</i>	·	·	·	+	+	·	·	·	·	·	·	·	II	·	
<i>Bellidiastrum michelii</i>	·	·	·	·	·	·	·	+	+1	·	·	·	II	·	
<i>Campanula persicifolia</i>	·	·	·	·	·	·	·	·	·	·	·	·	I	I ¹	
<i>Campanula trachelium</i>	+1	+	·	·	·	·	·	·	·	·	·	·	I	IV ¹	
<i>Ortilia secunda</i>	·	·	·	·	·	·	·	·	·	+1	·	·	I	·	
Differential species of the variant with <i>Pinus sylvestris</i>															
<i>E₃ Pinus sylvestris</i>	·	·	·	·	·	·	·	·	·	·	·	4	2	II	·
<i>Lasarpitium latifolium</i>	·	·	·	·	·	·	·	·	·	·	·	+	2	II	·
<i>Pimpinella major</i>	·	·	·	·	·	·	·	·	·	·	·	+	+	II	·
<i>Polygonatum odoratum</i>	·	·	·	·	·	·	·	·	·	·	·	·	+	I	·
<i>Pimpinella saxifraga</i>	·	·	·	·	·	·	·	·	·	·	·	·	·	I	·
Other species															
<i>E₁ Cirsium erisibales</i>	+	+	·	+	+	+	+	+	+	+	+	+	+	V	V ¹⁻¹
<i>Valeriana tripteris</i>	+	+	+	1	·	+	1	+	+1	+1	+	+1	·	V	V ¹⁻¹

Calamagrostis varia	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	V ⁽²⁻³⁾	V ⁽²⁻³⁾	IV ⁽²⁻²⁾	II ⁽⁻¹⁾
Fragaria vesca	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	V ⁽⁻⁵⁾	V ⁽⁻⁵⁾	III ⁽⁻¹⁾	V ⁽⁻⁵⁾
Hieracium bifidum	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	V ⁽⁻²⁾	V ⁽⁻²⁾	II ⁽⁻⁾	V ⁽⁻²⁾
Maianthemum bifolium	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	III ⁽⁻⁾	IV ⁽²⁻²⁾	II ⁽⁻⁾	V ⁽⁻²⁾
Oxalis acetosella	.	2	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV ⁽⁻²⁾	IV ⁽⁻²⁾	II ⁽⁻⁾	V ⁽⁻²⁾
Sesleria varia	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I ⁽⁻⁾	I ⁽⁻⁾	II ⁽⁻⁾	.
Asplenium viride	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV ⁽⁻⁾	IV ⁽⁻⁾	I ⁽⁻⁾	I ⁽⁻⁾
Digitalis grandiflora	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV ⁽⁻⁾	IV ⁽⁻⁾	I ⁽⁻⁾	I ⁽⁻⁾
Poa stiriaca	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	III	V ⁽⁻¹⁾	IV ⁽⁻⁾	I ⁽⁻⁾	III ⁽⁻²⁾
Astrantia major	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV ⁽⁻⁾	IV ⁽⁻⁾	I ⁽⁻⁾	.
Gymnocarpium robertiana	2-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I ⁽⁻⁾	I ⁽⁻⁾	.	III ⁽⁻²⁾
Athyrium filix - femina	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I ⁽⁻⁾	IV ⁽⁻²⁾	.	.
Carduus glaucinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I ⁽⁻⁾	I ⁽⁻⁾	III ⁽⁻⁾	.
Gentiana asclepiadea	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	V ⁽⁻¹⁾	V ⁽⁻³⁾	.	.
Rosa pendulina	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III(E ₂)	V(E ₂)	I ⁽⁻⁾	III ⁽⁻¹⁾
Rubus idaeus	.	+	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	V ⁽⁻⁵⁾
Eupatorium cannabinum	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II ⁽⁻²⁾	IV ⁽⁻²⁾	I ⁽⁻⁾	.
Petasites albus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I ⁽⁻⁾
Pyrola rotundifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III ⁽⁻⁾	III ⁽⁻⁾	IV ⁽⁻¹⁾	III ⁽⁻⁾
Solidago virgaurea	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III ⁽⁻⁾	III ⁽⁻⁾	.	.
Polygala amara ssp. amara	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.
Acinos alpinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.
Aruncus sylvestris	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II ⁽⁻⁾	III ⁽⁻⁾	.	.
Hieracium sphondylium	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV ⁽⁻⁾	IV ⁽⁻⁾	IV ⁽⁻¹⁾	I ⁽⁻⁾
Luzula luzulina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.
Luzula luzuloidea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I ⁽⁻⁾	I ⁽⁻⁾	.	II ⁽⁻¹⁾
Polypodium vulgare	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.

Sporadic species
Anemone ranunculoides (14), *Antifericum ramosum* (17), *Asplenium ruta-muraria* (13), *Briza media* (17), *Carex flacca* ssp. *claviformis* (8), *Chaerophyllum hirsutum* (2), *Coeloglossum viride* (8), *Corallorhiza trifida* (9),
Cotoneaster tomentosus (17), *Crepis jaquinii* (14), *Cyanus mollis* (15), *Dactylorhiza fuchsii* (15), *Dentaria glandulosa* (3), *Festuca tatrae* (17), *Galeobdolon montanum* (12), *Glechoma hederacea* (10), *Hieracium lachenalii* (16), *Homogyne alpina* (15), *Jovibarba hirta* ssp. *glabrescens* (14), *Kernera saxatilis* (14), *Libanotis pyrenaica* ssp. *bipinata* (17), *Listera ovata* (4), *Luzula sylvatica* (12), *Lycopodium annotinum* (8), *Melitis melissophyllum* (4), *Poa nemoralis* (1), *Polygala amara* ssp. *brachyptera* (14), *Polystichum aculeatum* (13), *Pulsatilla slavica* (14), *Ranunculus auricomus* agg. (3), *Ranunculus oreophilus* (14), *Ranunculus paniculata* (7), *Saxifraga hungarica* (10), *Swertia perennis* (5), *Thymus alpestris* (14), *Thymus pulegioides* (17), *Veronica officinalis* (8).

Table 1. Phytocenological table of new association and its comparison to the closed associations. C - categories of constancy; * constancy with the degrees of abundance in brackets, r - rare, h - abundant, dh - more abundant, vh - the most abundant

Localities of relevés

1. Nízke Tatry Mts., Malý Sokol, base of east slope, August 10, 1989.
2. Nízke Tatry Mts., Veľká Čierna dolinka, north slope, August 22, 1989.
3. Nízke Tatry Mts., Malý Sokol, base of east slope, July 21, 1989.
4. Nízke Tatry Mts., Malý Sokol, base of regularly, east oriented slope, July 21, 1989.
5. Nízke Tatry Mts., Malý Sokol, base of north-east slope, June 15., 1989.
6. Nízke Tatry Mts., Vyšný Blaník, base of east slope, July 8., 1988.
7. Nízke Tatry Mts., Demänovská hora, base of west slope, August 11, 1988.
8. Nízke Tatry Mts., Malý Sokol, base of north-east slope, June 15, 1989.
9. Nízke Tatry Mts., Demänovská jaskyňa Slobody, west slope to the south of the cave, May 31, 1989.
10. Nízke Tatry Mts., Demänovská hora, base of west slope, August 11, 1988.
11. Nízke Tatry Mts., Veľký Sokol, east slope, August 10, 1989
12. Nízke Tatry Mts., Repiská, base of east slope north-east to the Repiská, September 22, 1989.
13. Nízke Tatry Mts., the same location but 100 m to the south, September 22, 1989.
14. Nízke Tatry Mts., Demänovská jaskyňa Slobody, west slope below the range to the west of cave, May 31, 1989.
15. Nízke Tatry Mts., Veľká Čierna dolinka, north-west slope near the Demänovská ľadová jaskyňa (Ice Cave), June 21, 1989.
16. Nízke Tatry Mts., Veľký Sokol, base of east slope, June 21, 1989.
17. Nízke Tatry Mts., Malý Sokol, east slope, June 28, 1990.

Literature review

A distinction between our association and those of Sillinger (1933) is apparent. These results are shown clearly in Table 1.

The beech forest communities in the West Carpathians were comprehensively studied. A brief review has been made by Fajmonová (1972). She showed that calcareous Carpathian beech forests differ from the Central European beech forests (Carici - Fagetum Moor 1952) by the presence of geographically different species, for example *Hacquetia epipactis*, *Galium schultesii*, *Carduus glaucinus*, *Symphytum tuberosum* and *Glechome hederacea* ssp. *hirsuta*. Only the association in the Malé Karpaty Mts. (Jurko and Kontriš 1982) are found to be similar to the association mentioned in Central Europe - because both are thermophilous submontane communities with absence of montane elements.

Association Carici albae - Piceetum differs from the calcareous beech forests described by Fajmonová (1972) by the total absence of beech (*Fagus sylvatica*), dominance of spruce (*Picea abies*) and presence of characteristic differential species may be considered as representative to differentiate this association from Carici albae - Fagetum. It is important to mention that the number of characteristic species of the alliance Abietion albae is more than twice as high in this new association (Carici albae - Piceetum) than in the association Carici albae - Fagetum (Table 1).

Fir forests with *Carex alba* [Carici albae - Abietetum (Březina et Hadač 1969) Šomšák 1986] on calcareous soils of North-eastern Slovakia were described by Šomšák (1986). Fir forests predominantly occurred at the foot of slopes of canyons scattered all over the klippen zone of

the outer Carpathians. In comparison to other fir communities, *Melampyrum sylvaticum*, *Melampyrum nemorosum*, *Clematis alpina*, *Ribes petraeum* together with the conspicuous species *Carex alba* occur in the Carici albae - Abietetum. Ellenberg and Klötzli (1972) report a similar community under the same name. The similar association is also described by Zukrigl (1973) from the Alps, but this association differs from the Carpathian one by the presence of large number of species of the order Quercetalia pubescentis.

From an ecological and floristical point of view the association Carici albae - Piceetum is similar to the community described by Šomšák (1986), but the stands in the Demänovská valley differ through the occurrence of fir and maple. In our association, the frequency (I) and dominance (+) of the fir are fairly low. In the Demänovská valley maple is abundant, while in the northeast of Slovakia it is totally absent in the tree layer and in the other layers only occurs rarely. In the association Carici albae - Abietetum, a lower number of characteristic species of the classis Vaccinio - Piceetea and alliances Fagion and Abietion albae (Tab. 1) was found in the association described by Šomšák (1986).

However, Michalko and Berta (1972) mention about a subassociation Abieto - Fagetum caricetosum albae from the Nízke Tatry Mts., Slovak Paradise and Pieniny Mts., but we have not found any literature source from the Nízke Tatry, which would support their ideas, and their suggestions for the Nízke Tatry are probably only partially valid.

Although our new association is similar in some degree to the beech and fir communities with dominating *Carex alba* in the herb layer, we may conclude that the new association apparently differs from the mentioned communities. These differences were presented in this paper.

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