THE NARDO-GNAPHALIETUM SUPINI PLANT ASSOCIATION IN THE WESTERN CARPATHIANS (THE TATRA MTS AND THE BABIA GÓRA MASSIF)

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ABSTRACT

This article is the first published information on the occurrence of the snow-beds of Nardo-Gnaphalietum supini in the Western Carpathians. So far, localities of Nardo-Gnaphalietum supini phytocoenoses have been known exclusively from the Alps, the Black Forest, and the Eastern Carpathians. During this study, carried out in the Polish Carpathians, phytocoenoses of Nardo-Gnaphalietum were recorded in the two highest massifs – the Tatra Mountains and the Babia Góra Massif. They were closely related to anthropogenically-influenced sites with exposed and lumped ground located near tourist routes. Habitat characterization and spatial complexes of the patches of Nardo-Gnaphalietum in the investigated area are given herein.

Critical revision of phytosociological data from the Alps and the Eastern Carpathians revealed that the discussed phytocoenoses have been described within the communities of Luzuletum alpino-pilosae, Salicetum herbaceae or Nardetum strictae. In this study, all phytosociological data concerning the association were collected and the floristic distinction of the phytocoenoses of particular mountain massifs is discussed. A new subassociation Nardo-Gnaphalietum oligotrichetosum hercynici was distinguished on the basis of local habitat variability. Although Nardo-Gnaphalietum supini does not have characteristic species, it is a well-distinguished typological unit in the class Salicetea herbaceae Br.-Bl. 1948, and is a central association of the alliance Nardo-Salicion herbaceae Englisch 1999.

KEY WORDS: Nardo-Gnaphalietum supini, Salicetea hebraceae, snow-bed vegetation, Tatra Mts, Babia Góra Massif, Western Carpathians.

INTRODUCTION

Phytocoenoses of Nardo-Gnaphalietum supini have not been, as yet, known from the Western Carpathians. All available information on their occurrence refers to the Alps, the Black Forest and the Eastern Carpathians. This syntaxon has been first documented over sixty years ago (Bartsch J. and Bartsch M. 1940) with a single phytosociological relevé and described as 'Nardus-Gnaphalium supinum–Gesellschaft' from the Black Forest Mountains. That patch overgrowed a hollow within the dense Vaccinietum myrtilli community in the subalpine zone of the Feldberg Massif. However another relevé made in the same area, was regarded as representing 'Nardus stricta-Gnaphalium supinum-Association' (Müller 1948). Oberdorfer (1950), although not questioning the distinctiveness of the Nardus-Gnaphalium community, considered it as merely a variant (with *Nardus stricta*) of the association Luzuletum alpino-pilosae Br.-Bl. in Br.-Bl. et Jenny 1926 (see Table 16, rel. 1 in the cited paper). Materials by Thimm (1953, included in the table of Salicetum herbaceae Br.-Bl. 1913, variant with *Mutellina purpurea* cf. Table 25, col. 3, 4 and 5) may also be listed as belonging to Nardo-Gnaphalietum. The mentioned variant of the association distinguishes itself negatively by the lack of *Salix herbacea*. Other data may be found in studies by Bolleter (1921), under the name of Nardetum with *Plantago alpina*, and by Eggensberger (1994). Another documentation from the Eastern Carpathians consists of 8 relevés from the Rodney Mountains (Coldea 1990) and other 8 records from the Retezat (Resmerita 1975; the relevés included in tables of Nardetum strictae alpinum and N. s. a. poetosum mediae).

As may be derived from the above review, the documentation referring to Nardo-Gnaphalietum supini is still insufficient and scattered in various phytosociological tables under different names. The aim of this study was to provide a scientific description of the Western Carpathians' phytocoenoses of Nardo-Gnaphalietum supini and to di-

scuss the relations of their floristic composition to the published material from the whole distribution area of the association.

MATERIALS AND METHODS

The original material consisted of 16 phytosociological relevés made by using the classic Braun-Blanquet's (1951) method (cf. Dierschke 1994). The modified quantitative scale (2a, 2b, 2m) of Barkman et al. (1964) was implemented for assessment of the species' cover. The constancy values and cover coefficients were computed according to the procedure proposed by Pawłowski (1966). The names of vascular plants are in accordance with the list of Mirek et al. (1995), Ochyra et al. (1992) for mosses, and Grolle (1983) for liverworts. Altogether, 27 published phytosociological relevés were taken into consideration in comparative tables.

The investigations were carried out in 1995-1999 in all massifs of high mountain character in the Polish part of the Carpathians. The patches of Nardo-Gnaphalietum supini were recorded from the Tatra Mountains and the Babia Góra Massif. The first one is the highest mountain range in the whole Carpathians (with Gerlach elevated at 2663 m a.s.l.). It is a borderline mountain chain situated between Poland and Slovakia, with the greater part belonging to the latter country. The Babia Góra (Diablak, 1725 m a.s.l.) is the second highest mountain range in Poland. It is the culmination of the Beskid Wysoki in the Western Carpathians.

RESULTS

Patches of Nardo-Gnaphalietum supini were recorded in non-calcareous parts of the Tatra Mountains and in the Babia Góra Massif (Table 1). They have established in both forest belts and the subalpine belt, and were observed along tourist routes parallel to contour lines (on the upper side of the slope above the route) and on non-marked footpaths within the subalpine communities of bilberry and mat grass communities.

Phytocoenoses of Nardo-Gnaphalietum supini occupy distinctly marked places in the mountain vegetation landscape. In areas potentially covered by montane spruce forests they occur in a spatial complex with: Plagiothecio-Piceetum (Szaf., Pawł. et Kulcz. 1932) Br.-Bl., Vlieg. et Siss. 1939 em. J. Mat. 1978 (P-P), Hieracio-Nardetum Kornaś 1955 (H-N), and Vaccinietum myrtilli Szaf., Pawł. et Kulcz. 1923 (Vm). The mentioned vegetation appear in following linear patterns (Fig. 1):

forest edge (P-P) → Vm → H-N → Nardo-Gnaphalietum → [tourist route] → forest edge (P-P)
or
forest edge (P-P) → H-N → Nardo-Gnaphalietum → [tourist route] → forest edge (P-P).

Patches of the association developed at higher mountain elevations were observed in extensive complexes of bilberries, and subalpine mat grass communities. Within the mentioned vegetation, the phytocoenoses of Pogonato-Oligotrichetum (Herzog 1943) Balcerk. 1984 have usually been observed directly on the routes.

It is tourism that plays an important role in the origin and persistence of the Nardo-Gnaphalietum phytocoenoses. Most often, it triggers substratum destabilisation on one hand, and treading on the other. The former limits density of the herb layer and generates small eroded places with bare soil. A geobotanical consequence of that is natural seeding and germination of *Gnaphalium supinum* and the occurrence of orthotropous mosses connected with the freshly eroded areas; i.e. *Oligotrichum hercynicum*, *Pogona-*

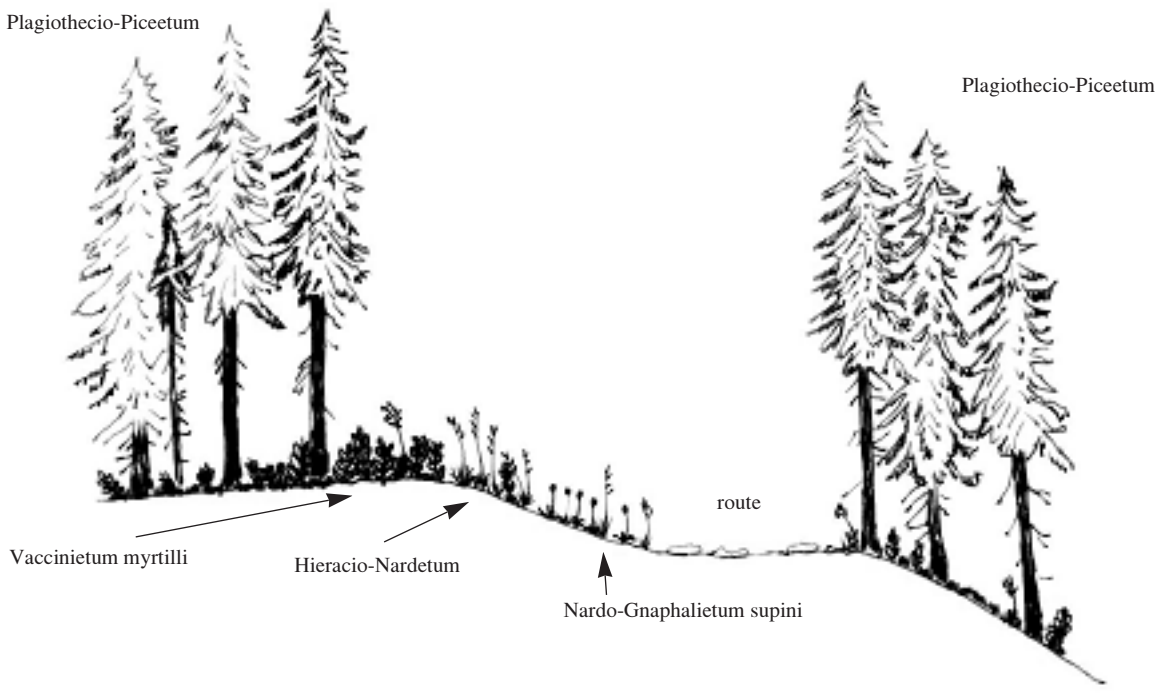


Fig. 1. Spatial pattern of vegetation accompanying the route to Trzydniowiański Wierch (the Western Tatra Mountains).

TABLE 1. **Nardo-Gnaphalietum supini** Bartsch et Bartsch ex Müller 1948 from the Tatra Mts. and the Babia Góra Massif.

Succesive number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Number of relevé in the field	39	58	619	49	9519	9520	511	507	506	509	59	508	549	396	551	512		
day	3	3	4	8	10	10	7	7	7	7	4	7	10	13	10	7		
Date month	7	8	7	7	8	8	8	8	8	8	8	8	8	9	8	8		C
year	99	99	97	94	95	95	96	96	96	96	99	96	96	97	96	96	C	O
Herb layer cover [%]	45	50	60	20	35	35	55	15	40	15	40	30	45	50	35	15	O	V
Moss layer cover [%]	80	20	35	20	25	5	10	15	10	30	90	40	85	25	30	60	N	E
Stone cover [%]	5	35	10	30	5	10	10	10	5	15	5	25	5	zn	20	20	S	R
Altitude in [m]	1490	1770	1380	1150	1085	1085	1475	1315	1315	1400	1455	1400	1355	1410	1610	1490	T	
Exposure	NW	–	NEE	?	–	–	?	W	W	NNW	NW	NNW	NE	NNE	SW	NW	A	C
Inclination [°]	3	–	5	20	–	–	5	10	5	5	5	5	5	3	30	20	N	O
Size of a patch [cm]	100×	200×	–	87×	70×	65×	–	70×	125×	–	350×	70×	120×	–	–	–	C	E
	25	150		70	35	60		40	40		115	40	30				Y	F
Area of relevé [m^2]	0.3	3	1.5	0.6	0.2	0.4	0.3	0.3	0.5	0.5	4	0.3	0.3	1	0.5	0.5		F.
Number of species	18	14	16	14	16	17	12	12	15	14	18	15	16	13	12	16		
Mountain range	T	T	T	T	T	T	T	T	T	T	T	T	T	BG	T	T		
I. Ch. **Salicetea herbaceae**																		
Gnaphalium supinum	2b.2	2b.1	3.2	+.2	1.2	1.2	2b.3	1.2	2a.2	2a.2	2b.2	2a.2	2a.2	3.2	2a.2	2a.2	V	1441
Nardia scalaris D	.	.	+	.	+	+	.	.	.	+	.	+	2.2	2.2	1.2	2b.3	III	391
Pohlia drummondii	.	.	.	.	.	.	.	.	.	.	.	r	2.2	.	.	.	I	110
Kiaeria starkei	1.2	.	.	r	.	.	.	.	.	.	.	.	1.1	.	.	1.1	II	94
Sedum alpestre	.	r	.	.	.	.	.	.	.	.	.	.	.	.	1.1	1.2	I	63
Cerastium cerastoides	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	+.2	I	9
II. Ch. **Nardo-Callunetea**																		
Nardus stricta	+	.	2a.1	+.2	+.2	1.2	2a.2	+.2	2a.2	1.2	+	1.2	2a.2	2b.1	r	.	V	485
Potentilla aurea	.	2a.1	.	+.2	+	2a.2	r	r	.	.	+	.	r	.	.	+	III	139
Carex leporina	.	.	.	+	(+.2)	+	.	.	.	.	.	.	.	.	.	.	I	38
Luzula multiflora	.	.	+	r	.	.	.	.	.	.	.	.	.	.	.	.	I	4
Carex pilulifera	.	.	+	.	.	.	.	.	r	.	.	.	.	.	.	.	I	4
Potentilla erecta	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I	3
Gnaphalium norvegicum	.	.	.	.	.	.	.	.	.	.	1.2	.	.	.	.	.	I	31
III. Ch. **Pogonato-Dicranelletea**																.		
Oligotrichum hercynicum	+	1.2	2.3	2.3	2a.3	+	+	+	+	+	3.2	+.2	+	1.2	1.2		V	634
Ditrichum heteromallum	.	.	.	.	1.1	+	+	1.3	+	.	2b.2	.	.	.	1.2	.	III	228
Pogonatum urnigerum	+	.	.	1.1	.	+	.	.	r	1.2	2.2	+.2	+	r	.	+	IV	189
Dicranella heteromalla	.	1.2	+	.	.	.	.	.	1.2	.	.	r	.	+	.	.	II	69
IV. Others																		
Deschampsia flexuosa	r	.	1.2	.	+.2	.	1.2	1.2	1.2	+	1.1	1.2	1.2	+	1.2	r	V	261
Picea abies juv.	.	.	r	+	r	+	.	r	r	.	r	.	.	.	.	.	III	9
Anthoxanthum alpinum	+	.	+.2	.	.	.	1.2	.	.	+.2	.	+	+	.	+	1.2	III	81
Vaccinium myrtillus	+	.	+	.	.	.	r	r	.	r	+	.	.	.	r	.	III	12
Mutellina purpurea	+	+	.	.	.	.	.	.	.	.	.	.	r	.	.	r	II	8
Agrostis rupestris	1.3	2b.1	1.1	.	.	.	r	.	.	.	.	.	.	.	+	.	II	191
Agrostis capillaris	.	.	.	2.2	2b.3	+	.	.	+	.	.	.	.	.	.	.	II	241
Deschampsia caespitosa	r	+	.	.	2a.2	2a.2	.	.	.	.	+	.	.	.	.	r	II	133
Polytrichastrum pallidisetum	.	.	.	.	1.2	1.2	2a.2	.	.	.	.	.	.	.	.	.	I	125
Lophozia sudetica	.	.	+	.	.	.	+	.	.	.	2b.2	+	.	.	1.2	+	II	169
Cephalozia bicuspidata	.	.	.	.	.	.	.	.	.	.	3.2	r	2.2	.	.	.	I	344
Homogyne alpina	.	.	.	.	.	.	.	.	.	+	.	+.2	2a.3	.	.	.	I	69
Pleurozium schreberi	.	.	.	.	.	.	.	.	.	r	.	+	r	.	.	.	I	4
Rumex acetosella	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	1.2	I	38
Luzula luzuloides	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	r	I	7
Rubus idaeus	.	.	.	.	.	.	.	r	+.2	.	.	.	.	r	.	.	I	4
Jungermannia sphaerocarpa	4.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	391
Campanula polymorpha	2.3	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	I	113

Sporadic species: I. *Luzula alpino-pilosa* 3(+); *Marsupella brevissima* 10(+); *Sibbaldia procumbens* 2(+). **II.** *Geum montanum* 2(r). **III.** *Alchemilla* sp. 5(r); *Anastrophyllum minutum* 12(r); *Bryum* cfr. *bicolor* 2 (2.2); *Calamagrostis villosa* 14(+); *Festuca airoides* 1(r); *Gnaphalium sylvaticum* 6(r); *Hieracium alpinum* 13(r); *H. atratum* 8(r), 9(r); *H. murorum* 11 (1.1); *Leontodon autumnalis* 4(r); *Lophozia* cfr. *sudetica* 10(+); *L. wenzelii* 10(+); *Luzula sylvatica* 11(r); *Oxalis acetosella* 6(r); *Phleum commutatum* 2(+), 11(r); *Poa alpina* 2(+); *Pohlia nutans* 7(r); *P. obtusifolia* 4(r); *Polytrichastrum alpinum* 8(+), 9(r); *P. formosum* 1(+), 14 (+.2); *Polytrichum piliferum* 3 (2.1); *Racomitrium elongatum* 12 (2a.2), 16 (1.2); *R. ericoides* 1(+), 10 (1.2); *Rhytidiadelphus squarrosus* 1(+), 4(r); *Salix silesiaca* 14(+); *Sanionia uncinata* 1(+); *Scapania curta* 5(+), 9(r); *Senecio nemorensis* 11(r); *S. subalpinus* 11(r); *Soldanella carpatica* 16 (+.2); *Taraxacum* sp. 2(r), 5(r), 6(r); *Vaccinium vitis-idaea* 14(+).

Key: BG – the Babia Góra Massif, T – the Tatra Mountains.

TABLE 2. Differentiation of the floristic composition of **Nardo-Gnaphalietum supini** Bartsch et Bartsch ex Müller 1948 in Europe.

Number of column	1	2	3	4	*5*	*6*	*7*	8	9	10
Number of relevés	16	8	8	5						
Total number of species in the table (relevé)	72	42	47	59	(11)	(10)	(12)	(14)	(11)	(15)
Average number of species in relevé	12	15	17	20						
Minimal number of species in relevé	12	11	11	13						
Maximal number of species in relevé	18	18	32	27						
Altitude in [m]	1085-1770	1660-1820	1920-2020	1790-2030		1980		1900	1420	
Mountain range	Carpathians			Alps				Black Forest		
Snow-bed species										
Gnaphalium supinum	V 1441	V 3875	V 50	IV 130	*2.4*	*3.4*	*2.3*	2.3	+	+
Luzula alpino-pilosa	I 32	II 131			*1.2*	*1.1*		+.2		
Veronica alpina		I 6	I 6	II 20	+	+		+		
Kiaeria starkei	II 94	I 219		III 860			*1.2*			1
Sedum alpestre	I 63	IV 31	I 6							
Cerastium cerastoides	I 9	I 63					+			
Nardia scalaris	III 391									1
Ranunculus crenatus		IV 144								
Soldanella hungarica		IV 31								
Anthelia juratzkana		III 250								
Plantago gentianoides			II 19							
Ranunculus pseudomontanus			II 19							
Tanacetum alpinum			II 13							
Plantago atrata			II 19	I 100		*1.2*	+			
Soldanella pusilla			II 225	V 570	*3.3*	*1.2*	*1.2*	+.2		
Plantago alpina				IV 2600				+.2		
Salix herbacea				III 30						
Sagina saginoides				II 20					+	
Mat grassland species										
Nardus stricta	V 485	V 1725	V 3563	V 2860	+	*1.2*	+	4.4	4	4
Potentilla aurea	III 139	V 100	V 856	I 10	+		*1.2*	2.2	3	
Geum montanum	I 1	V 313	V 100							
Carex leporina	II 38	I 6								
Carex pilulifera	I 4									
Potentilla erecta	I 3									
Festuca rubra			II 13							
Leucorchis albida			IV 31							
Species attesting to great dynamics of substrate										
Oligotrichum hercynicum	V 634			I 10						2
Ditrichum heteromallum	III 228									
Pogonatum urnigerum	III 189									
Lophozia sudetica	III 169									+
Dicranella heteromalla	II 69									
Others										
Mutellina purpurea	II 8	IV 981	V 525	V 320	*2.2*	*2.3*	*3.3*	+.2	4	4
Polytrichastrum alpinum	I 4	V 794			*1.2*	*1.2*	+			1
Agrostis rupestris	II 191	II 125	II 69							
Anthoxanthum alpinum	III 81	IV 263	I 63	II 20						
Deschampsia caespitosa	II 133	IV 38	II 13	I 10						
Homogyne alpina	I 69	II 13	III 238	IV 40						
Poa alpina	I 3	II 13	II 13	II 110		+	+			
Deschampsia flexuosa	V 261	I 6	I 6	II 20				1.2		
Festuca airoides	I 1	II 69	I 6							
Campanula abietina		I 6	IV 31							
Campanula alpina		II 13	II 13							
Taraxacum alpinum		II 13	II 13							
Cetraria islandica		I 63	II 13	I 10						
Vaccinium myrtillus	III 12	II 13								
Picea abies	III 9									
Agrostis capillaris	II 241			I 10						
Poa media			V 3569							
Avenula versicolor			V 256	I 10				+		
Poa annua			III 25	I 10						
Phleum commutatum	I 4		III 25							
Phyteuma nanum			III 25							
Rhododendron myrtifolium		IV 38								
Leontodon helveticus				III 210	*1.2*		*2.2*	+.2	+	1
Racomitrium canescens					*2.3*		*1.2*			

tum urnigerum, *Dicranella heteromalla* and *Ditrichum heteromallum*. All these taxa are the components of *Pogonato-Oligotrichetum*, a common association in this area. It seems that the presence of snow-bed plants in patches of Nardo-Gnaphalietum is determined more by treading of the soil by tourists rather, than by longer coverage of snow. The latter may be of higher importance in the montane zones.

Identification of Nardo-Gnaphalietum phytocoenoses in the field does not provide any substantial problems. *Gnaphalium supinum* and *Nardus stricta* are structural dominants in the communities' coverage. The floristic composition of the association includes additionally an admixture of the species characteristic of the classes: Nardo-Callunetea Prsg. 1949 (most often *Potentilla aurea*, which is linked to trodden places in anthropogenic habitats), Salicetea herbaceae Br.-Bl. 1948 (mainly mosses), and Pogonato-Dicranelletea v. Hübschmann 1975 (components of Pogonato-Oligotrichetum). Forms of the community known from the higher elevations are characterised by a share of taxa typical to alpine grasslands of Caricetea curvulae Br.-Bl. 1948, such as *Agrostis rupestris*, which prefers places with unstable substratum.

In the Tatra Mountains, Nardo-Gnaphalietum supini is a common plant community due to its anthropo-auksochoric character. Patches of the association were also found on the Babia Góra Massif; from where they were documented with one relevé (Table 1, rel. 14). The secondary character of the patches of Nardo-Gnaphalietum supini has been previously postulated by Oberdorfer (1957).

DISTRIBUTION OF THE STUDIED PATCHES

The Babia Góra Massif: Izdepczyska (Table 1, rel. 14). The Tatra Mts: At the route to Trzydniowiański Wierch Mt. (from Dolina Jarząbcza Valley) near Wielki Przysłop (Table 1, rel. 1); Przełęcz Wyżnia Kondracka Pass near a tourist trail (2); Dolina Wyżnia Chochołowska Valley, near a tourist trail (3, 4); above the crossroads of the routes to Przełęcz Iwaniacka and to Dolina Staroroboclańska (5, 6); Dolina Jarząbcza, at the route to Trzydniowiański Wierch above the stream flowing down from Szeroki Żleb (7, 16); Dolina Jarząbcza, at the route to Trzydniowiański Wierch above Potok Jarząbczy (8, 9); Dolina Jarząbcza, at the route to Trzydniowiański Wierch above Jarząbcze Szałasiska (10, 12); slightly below Przełęcz Iwaniacka on the side of Dolina Chochołowska (11); Dolina Staroroboclańska, above Staroroboclańska Rówień near a tourist trail (13); Dolina Staroroboclańska, near the tourist trail (15).

Elevations above sea level of the studied patches are given in the head of Table 1.

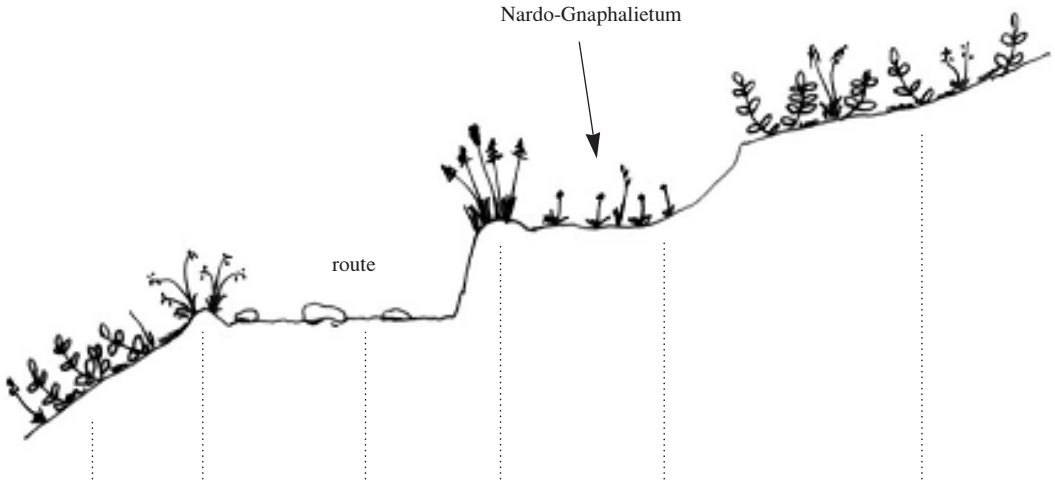
DISCUSSION

A synthetic comparison of the floristic composition of Nardo-Gnaphalietum supini from the Alps, the Black Forest, and both Western and Eastern Carpathians (Table 2), shows that this syntaxon has a unique floristic combination among all snow-beds communities. It is distinguished by a representation of the species of the class Nardo-Callunetea. It is not possible, however, to point out characteristic taxa for the association. Phytocoenoses known from the Carpathians are floristically richer than those described from the Alps and the Black Forest. The highest number of taxa were recorded in patches of the association from the Tatra Mountains and the Babia Góra Massif. This is the consequence of two facts: Firstly, the documentation from the Western Carpathians comprises the highest number of relevés; secondly, they encompass the highest difference of altitude, i.e. 1085 to 1770 m. All the other compared phy-

Sporadic species: *Agrostis agrostiflora* 4 (I 750); *A. alpina* 3 (I 6), 4 (I 10); *Alchemilla decumbens* 4 (I 100); *A. monticola* 4 (I 10); *A. obtusa* 2 (I 6); *A.* sp. 1 (I 1); *A. vulgaris* 3 (I 6); *Anastrophyllum minutum* 1 (I 1); *Androsace chamaejasme* 4 (I 10); *Antennaria dioica* 3 (I 6); *Arabis alpina* 2 (I 6); *Barbilophozia floerkei* 10(+); *B. lycopodioides* 4 (I 10); *Bartsia alpina* 4 (I 10); *Bryum* cfr. *bicolor* 1 (I 109); *B.* sp. 4 (II 760); *Calamagrostis villosa* 1 (I 3); *Campanula polymorpha* 1 (I 113); *C. scheuchzeri* 4 (I 10); *Cardaminopsis arenosa* ssp. *borbasii* 2 (I 6); *Carex atrata* 3 (I 6); *C. capillaris* 4 (I 10); *C. nigra* 4 (I 10); *Cephalozia bicuspidata* 1 (I 344); *Cerastium alpinum* 3 (II 19); *C. caespitosum* 3 (I 6); *Cladonia* sp. 4 (II 20); *Cratoneuron filicinum* 4 (I 1250); *Distichum capillaceum* 4 (II 20); *Euphrasia minima* 4 (II 20); *Festuca nigrescens* 2 (I 6); *F. picta* 3 (II 13); *F. rupicaprina* 4 (II 20); *Galium anisophyllon* 4 (I 10); *Gentiana bavarica* 4 (II 20); *G. kochiana* 8(r); *G. nivalis* 4 (I 10); *G. punctata* 4 (I 10), 8(+); *G. verna* 2 (I 6); *Gnaphalium norvegicum* 1 (I 31), 2 (I 6); *G. sylvaticum* 1 (I 1); *Hieracium alpinum* 1 (I 1); *H. atratum* 1 (I 1), 3 (II 13); *H. lachenalii* 1 (I 1); *H. murorum* 1 (I 31); *Huperzia selago* 2 (I 6); *Hypericum grisebachii* 2 (I 6); *Juncus trifidus* 2 (II 13); *Jungermannia gracillima* 10(+); *J. sphaerocarpa* 1 (I 391); *Leontodon autumnalis* 1 (I 1); *L. hispidus* 4 (I 10); *Lophozia wenzelii* 1 (I 3), 9(+); *Luzula campestris* 4 (I 10); *L. luzuloides* 1 (I 7); *L. multiflora* 1 (I 4), 8(+); *L. spicata* 3 (II 13); *L. sylvatica* 1 (I 1); *Marsupella brevissima* 1 (I 3); *Meum athamanticum* 9(+), 10 (1); *Nardia geoscyphus* 4 (I 10); *Oxalis acetosella* 1 (I 1); *Phleum raeticum* 4 (II 20); *Pleurozium schreberi* 1 (I 4); *Poa minor* 4 (I 10); *P. supina* 2 (I 6); *Pohlia drummondii* 1 (I 110), 10 (1); *P. nutans* 1 (I 1); *P. obtusifolia* 1 (I 1); *Polygonum viviparum* 4 (I 10), 5 (1.1), 6(+); *Polytrichastrum formosum* 1 (I 6), 4 (II 110); *P. pallidisetum* 1 (I 125); *P. sexangulare* 4 (I 10); *Polytrichum juniperinum* 4 (II 450); *P. piliferum* 1 (I 109); *P.* sp. 9(r); *Potentilla brauniana* 4 (I 100); *Primula minima* 2 (I 6), 3 (I 6); *Racomitrium elongatum* 1 (I 94); *R. ericoides* 1 (I 34); *R. lanuginosum* 2 (I 6); *R.* sp. 7(r), 8(+); *Ranunculus alpestris* 4 (I 10); *Rhododendron kotschyi* 3 (I 6); *Rhytidiadelphus squarrosus* 1 (I 4); *Rubus idaeus* 1 (I 4); *Rumex acetosella* 1 (I 38), 8(r); *Salix retusa* 4 (I 10); *S. silesiaca* 1 (I 3); *Sanionia uncinata* 1 (I 3), 4 (II 110); *Scapania curta* 1 (I 4); *Senecio nemorensis* 1 (I 1); *S. subalpinus* 1 (I 1); *Selaginella selaginoides* 4 (I 10); *Sesleria albicans* 4 (I 10); *Sibbaldia procumbens* 1 (I 3), 4 (I 100); *Soldanella carpatica* 1 (I 3); *Taraxacum* sp. 1 (I 2); *Thymus alpestris* 2 (I 6); *T. montanus* 3 (II 13); *Trifolium repens* 3 (II 13), 4 (I 10); *Vaccinium gaultherioides* 3 (I 6); *V. vitis-idaea* 1 (I 3), 3 (I 6); *Veratrum album* 2 (I 6); *Veronica bellidioides* 3 (I 6); *V. officinalis* 3 (II 13).

Explanations of data included in the columns: 1 – GÓRSKI (orig.), the Western Carpathians; 2 – COLDEA (1990, Table 23), the Eastern Carpathians, the Rodney Mountains; 3 – RESMERITA (1975, Table 2, rel. 1,2 and Table 3, rel. 1, 2, 5, 6, 8, 9), the Eastern Carpathians, Retezat; 4 – EGGENSBERGER (1994, Table 15, rel. 39-43), the Eastern Alps, the Ammergauer Alpen; 5, 6, 7 – THIMM (1953, synthetic table 25, columns 4, 5, 6), the Tyrol Alps, Rofan; 8 – OBERDORFER (1950, Table 16, rel. 1), the Alps, Allgaeu; 9 – BARTSCH J., BARTSCH M. (1940, page 113), first ever made relevé of Nardo-Gnaphalietum, the Black Forest, Feldberg; 10 – MÜLLER K. (1948, page 314-315), second ever made relevé of Nardo-Gnaphalietum, the Black Forest, Feldberg.

Measurements of species share presented in columns: 1, 2, 3, 4 – cover coefficient and phytosociological constancy in classes; 5, 6, 7, 8 – species' quantity and sociability; 9, 10 – species' quantity.



Running number	1	2	3	4	5	6
Herb layer cover [%]	100	100	10	95	45	90
Moss layer cover [%[	10	0	5	0	80	5
Stone cover [%]	0	0	70	0	5	0
Exposure	NW	-	-	NW	NW	NW
Inclination [°]	10	-	-	5-90	3	40
Area of relevé [m^2]	1	0,3	2,2	0,3	0,3	1,5
Number of species	11	5	10	10	18	
Size of a patch [cm]	100× 100	100× 25	150× 145	100× 30	100× 25	150× 100
Kiaeria starkei	.	.	.	.	1.2	.
Jungermannia sphaerocarpa	.	.	.	.	4.3	.
Gnaphalium supinum	.	.	.	+.2	**2b.2**	.
Campanula polymorpha	.	.	.	+	2.3	.
Oligotrichum hercynicum	.	.	1.2	.	+	.
Pogonatum urnigerum	.	.	+	.	+	.
Tussilago farfara	.	.	2a.1	.	.	.
Cardaminopsis ssp. *borbasii*	.	.	r	.	.	.
Deschampsia flexuosa	.	**3.4**	.	.	r	3.2
Vaccinium myrtillus	5.5	2a.2	.	+.2	+	2.3
Agrostis rupestris	.	**3.4**	.	+	1.3	+
Anthoxanthum alpinum	+	.	+	2.2	+	1.2
Deschampsia caespitosa	.	.	+	5.4	r	.
Nardus stricta	.	.	.	.	+	2.2
Mutellina purpurea	+	+	r	+	+	2.2
Rhytidiadelphus squarrosus	1.2	.	.	.	+	1.2
Homogyne alpina	1.2	.	.	.	.	+
Plagiothecium curvifolium	1.2	.	.	.	.	.
Polytrichastrum formosum	.	.	.	.	+	1.2

Aconitum firmum 4(r); *Epilobium alsinifolium* 3(+); *Festuca airoides* 4(+), 5(r); *Festuca picta* 2(+), 6(+); *Geum montanum* 1(+); *Hieracium* sp. 3(r); *Hylocomium splendens* 1(+); *Oxalis acetosella* 6(r); *Pleurozium schreberi* 1(+); *Potentilla aurea* 1(+), 6(+); *Racomitrium ericoides* 5(+); *Sanionia uncinata* 5(+); *Soldanella carpatica* 1(+), 4 (+.2), 6(+); *Taraxacum* sp. 3(r).

Fig. 2. Phytocoenoses of Nardo-Gnaphalietum supini in a complex with the subalpine bilberry (*Vaccinium myrtillus*) community developing on additional footpath above the tourist route in the Tatra Mountains [at the route to Trzydniowiański Wierch (from Dolina Jarząbcza) near Wielki Przysłop, 1490 m a.s.l.]. rel. 1 – Vaccinietum myrtilli; 2 – a community with *Agrostis rupestris* developing on the lower (descending) side of a slope; 3 – fragmentally developed Pogonato-Oligotrichetum and a natural seeding of *Tussilago farfara* observed between the stabilised rocky slabs of a mountain route; 4 – a community with *Deschampsia caespitosa*; 5 – Nardo-Gnaphalietum supini above the main tourist track, on additional, rarely used footpath; 6 – alpine grassland Hieracio alpini-Nardetum being overgrown by bilberry and wavy hair-grass.

tosociological data refer exclusively to the high mountain zones.

Englisch (1993) has postulated a need of revision of snow-bed communities with *Nardus stricta*. Moreover, he formulated a hypothesis that mat-grass communities from the Alps and average mountains of Germany could be forms of two different associations. The presented synthetic material (Table 2) was still insufficient to distinguish two separate units. However, the compared data were quantitatively poor. Therefore, it is possible that enriching of the documentation by additional relevés would allow to show clear floristic differences between the analysed snow-bed vegetation. However, it may be difficult because of the lack of characteristic species of Nardo-Gnaphalietum supini. In this context, the discussed unit remains the central association (according to Dierschke 1981, 1994) within the alliance Nardo-Salicion herbaceae distinguished by Englisch (1999).

A constant share of the group of moss species growing on the freshly eroded soil manifests the distinctiveness of the patches recorded from the Western Carpathians. Such phytocoenoses have a specific floristic composition and are easily distinguishable in relation to local habitats' variability. This enables to give them the status of a separate subassociation, namely Nardo-Gnaphalietum supini oligotrichetosum hercynici subass. nova [Typus: Table 1, rel. 3]. The relevé made by Müller (1948) in the Black Forest should also be regarded as representing the described unit (cf. Table 2, col. 10 in this article).

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