

Dedicated to Prof. dr. LJUDEVIT LJJANIČ on the occasion of his 70th birthday.

Some syntaxonomic problems of the class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939

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The proposed characteristic and differential species of the class *Vaccinio-Piceetea* are completed. The nomenclatural problem of the order *Vaccinio-Piceetalia* (= *Piceetalia excelsae*) and the alliance *Vaccinio-Piceion* (= *Piceion excelsae*) is discussed.

Key words: Plant communities, syntaxonomy, Braun-Blanquet, alpine, dinaric, forest, Europe.

Introduction

I have already written about the characteristic and differential species of class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939 emended Zupančič 1976 in my dissertation (ZUPANČIČ 1976 + supplements), followed by treatises of great extent (ZUPANČIČ 1980: 28–30, 1999: 159–164). These publications were edited in Slovene with foreign language abstracts. Here I aim to present and complete my views on the syntaxonomic problems of the class *Vaccinio-Piceetea* and its syntaxonomic lower units.

Results and Discussion

Class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl., Sissingh et Vliieger 1939 emended Zupančič 1976

When research is done into the spruce woods in frost Dinaric of Slovenia ravine (ZUPANČIČ 1976, 1980) the question arises which plant species of the class *Vaccinio-Piceetea* are characteristic and which differential. Slovenia is rather rich in secondary spruce woods but not in primary. Primary spruce woods di-

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vided into different associations on various bedrocks are mostly distributed upon small to medium-large areas. Diagnostic species of the class *Vaccinio-Piceetea* fairly widely distributed have great significance just because of area's smallness, diversity(biodiversity) of associations, and the considerable distribution of secondary spruce associations influenced by other phytocenoses, especially beech communities. BRAUN-BLANQUET (1939, 1950, 1954) did not define the characteristic and differential species of the class *Vaccinio-Piceetea* during his research. When defining the class *Vaccinio-Piceetea*, BRAUN-BLANQUET (1939) only drew attention to the width of the class that should embrace the Euro-Siberian-North-American region, however much it differs with respect to the distribution of specific plant species, especially the spruce. Thus he divided and compared the region according to spruce species: in Europe *Picea abies*, in northern Siberia *Picea obovata*, in eastern Asia *Picea jezoënsis*, in Alaska *Picea sitchensis*, in Canada *Picea canadensis* and *Picea mariana* with *Abies balsamea* as vicariant representative in the tree layer of climatogenous communities. Nowadays, BRAUN-BLANQUET (1950, 1954, 1964) and other European authors (OBERDORFER 1957; HORVAT 1962; FUKAREK 1967, 1968; HORVAT et al. 1974; and others) assign the class primarily to the European part of the Euro-Siberian region, where *Picea abies* (partly *Picea obovata*) dominates. According to investigations of the mentioned authors and to both synthetic tables embracing spruce forests of the wider environment of the Eastern-Alpine-Dinaric region, we wanted to define more clearly the characteristics of the class in Slovenia. Species that define a class are, according to their synsystematic value, extensive and are associated with moderately acid to acid soils from lowlands to higher altitudes, and attain their optimal development in spruce associations and acidophilous phytocenoses of fir and beech forests. They inhabit greater surfaces and also develop well in acid variants of beech, fir-beech, and oak associations, which are frequently taken as forms intermediate to acidophilous phytocenoses. The characteristics of the class *Vaccinio-Piceetea* relate it to the species of the moderately acidic forests of the class *Quercetea robori-petraeae* Br.-Bl. et R. Tx. 1943 [or *Quercetalia roboris-petraeae* R. Tx. (1931) 1938 that Oberdorfer joined to the class *Quercu-Fagetea* Br.-Bl. et Vlieger 1937] on one side and on the other with species of the acidophilous communities of the *Luzulo-Fagion* alliance Lohm. et R. Tx. 1954 from the *Fagion medio-europaeum* alliance Soó (1960) 1962 and the class *Quercu-Fagetea* Br. Bl. et Vlieg. 1937.

The comparison tables indicate that the chosen characteristics are represented homogeneously with a great constancy and mean coverage value not only in Slovenia but everywhere in spruce woods of the montane and subalpine belt in Europe. Therefore they could be taken as being characteristic of a wider area and accordingly may coincide with the distribution of the species *Picea abies* and with the two vicariant tree species *Pinus sylvestris* and *Abies alba* as ecotypes constructing phytocenoses on noncarbonate geologic-lithologic bedrock. It seems to be obvious to complete the choice of the until now established characteristics or any of them shall be dropped out.

The determination of the characteristics of the class *Vaccinio-Piceetea* claimed to define more clearly the separate islands of spruce woods growing out of the area of the spruce of the Alpine, Carpathian, and northern European sub-

regions that lack the most important characteristics of association and class but – as we know – cannot be ranged elsewhere. Most plant species proposed as characteristic of the class *Vaccinio-Piceetea* are generally widespread in spruce associations of the whole Euro-Siberian region, thus confirming the choice. Many authors have written about this problem in the Slovene Dinaric area, above all: I. Horvat, M. Wraber, and P. Fukarek who also made, on the base of the distribution of the class *Vaccinio-Piceetea*, a map of the distribution of *Picea abies* for Yugoslavia and Europe (ZUPANČIČ 1980, 1999).

According to their experience and my own conclusions, I proposed the characteristic species for the class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939 emended Zupančič (ZUPANČIČ 1976, 1980: 29–30). With further research into the spruce woods of Slovenia, I have supplemented the knowledge about the characteristic and differential species of the class *Vaccinio-Piceetea*. The then choice of the characteristic species of the class *Vaccinio-Piceetea* was based upon two synthetic tables that comprehend European spruce communities of montane and subalpine belt (ZUPANČIČ 1976). The two enclosed tables (ZUPANČIČ 1976, 1999) clearly show the occurrence of the chosen characteristic and differential species of the class *Vaccinio-Piceetea* in Europe and Slovenia extending from the Western through the Central to Eastern Alps, Carpathians, Dinaric mountains, and Stara Planina. The synthetic manuscript tables of the Balkan Peninsula spruce communities used may be looked over.

The characteristic and differential species of the class *Vaccinio-Piceetea* have not been distinguished so far. Their choice is explained at the beginning of the chapter, and the division of characteristic and differential species mainly results from the chorological structure, presence or degree of presence in spruce associations and generic connections with other syntaxonomic units such the order *Quercetalia roboris-petraeae* R. Tx. 1932, the *Lonicero-Fagenion* suballiance Lohm. et R. Tx. 1954, and partly the class *Erico-Pineteta* Ht. 1959, analytically shown by phytocenological tables (ZUPANČIČ 1976, 1999) and in this paper (Tab. 1).

The chosen characteristic species of the class *Vaccinio-Piceetea* are above all distributed in Europe spruce communities mostly with a high degree of presence and frequently of considerable coverage value, having some generic connections, because of ecological conditions and transition from one syntaxon to another, with other acidophilous syntaxa:

Calamagrostis arundinacea (L.) Roth
Dicranum scoparium (L.) Hedw.
Gentiana asclepiadea L.
Hylocomium splendens (Hedw.) Br. eur.
Luzula albida (Hoffm.) DC.
Luzula pilosa (L.) Willd.
Maianthemum bifolium (L.) F.W. Schmidt
Oxalis acetosella L.
Pleurozium schreberi (Willd.) Mitt.
Polytrichum commune L. ap. Hedw.
Rhytidiadelphus triquetrus (L. ap. Hedw.) Warnst.

Rubus hirtus W. et K.

Solidago virgaurea L. subsp. *alpestris* (W. K.) Rchb.

Solidago virgaurea L. subsp. *virgaurea* (L.)

Differential species of the class *Vaccinio-Piceetea* have a mostly chorological character being more or less limited to some region. A distinctly limited phytogeographical distribution is possessed by a few of them (*Lonicera borbasiana*, *Campanula trichocalycinum*, *Aposeris foetida*). These species are usually rare, sometimes having no high degree of presence:

Aposeris foetida (L.) Less.

Campanula trichocalycinum Ten.

Calypogeia trichomanis (L.) Corda

Carex pallescens L.

Equisetum sylvaticum L.

Peltigera leucophlebia Gyelnik

Hookeria lucens (L. ap. Hedw.) Sm. (conditionally)

Hypericum umbellatum Kern.

Hypnum cupressiforme L. ap. Hedw.

Isoetecium myosuroides (L.) Brid. (conditionally)

Leucobryum glaucum (L. ap. Hedw.) Aschimper

Lonicera borbasiana Deg.

Lophocolea heterophylla (Schrader) Dum.

Mnium hornum L. ap. Hedw.

Plagiothecium ruthei Limpricht

Scapania nemorosa Dum.

Taxiphyllum depressum (Bruch) Reimers

Thuidium delicatulum (L. ap. Hedw.) Mitten.

Thuidium tamariscinum (Hedw.) Br. eur.

Order *Vaccinio-Piceetalia* Br.-Bl. in Br.-Bl., Sissingh et Vlieger 1939 emended K.-Lund 1967 and alliance *Vaccinio-Piceion* Br.-Bl. in Br.-Bl., Sissingh et Vlieger (1938) 1939

(*Piceetalia excelsae* Pawl. in Pawl., Sokolovski et Wallisch 1928 and *Piceion excelsae* Pawl. in Pawl., Sokolovski et Wallisch 1928)

The recent literature (MUCINA et al. 1993) attributes the first authorship of the order and alliance of spruce phytocenoses to the Polish botanist PAWLOWSKI (1928). Until the new Code of Phytosociological Nomenclature (BARKMAN et al. 1986), authorship was attributed to BRAUN-BLANQUET (1939) as he was able to carry out the synthesis properly and determine the characteristic and differential species of the order *Vaccinio-Piceetalia* (BRAUN-BLANQUET et al. 1939: 4–9), based on the then known and published spruce associations. In the same way he determined the characteristic and differential species for the *Vaccinio-Piceion* alliance (BRAUN-BLANQUET et al. 1939: 10–13). Before him, Pawlowski proposed provisionally for spruce woods the order *Piceetalia excelsae* and the *Piceion excelsae* alliance. The author himself says: »Die Einreihung dieser Verbandes

zur Ordnung der *Piceetalia* ist bloß provisorisch«, i.e. »The classification of this association into the order *Piceetalia* is nothing but provisional« (PAWLOWSKI et al. 1928: 255). He puts the *Piceion* alliance into an *ad hoc* grouping. In the analytical table of the *Piceetum normale* association according to 4 phytocenological relevés, in the syntaxonomic column for characteristics of the alliance and order he mentions the following plant species: »*Athyrium alpestre*, *A. filix-femina*, *Dryopteris dilatata*, *D. linneana*, *Gentiana asclepiadea*, *Luzula sylvatica*, *Pirola secunda*, *Polygonatum verticillatum*.« (PAWLOWSKI et al. 1928: Table 12). This proves that Braun-Blanquet carried out a correct choice of characteristic and differential species for the order and alliance of spruce phytocenoses based on the then published material in Europe. This broadness gives reliability of uniting of spruce phytocenoses into the *Vaccinio-Piceion* alliance and the order *Vaccinio-Piceetalia*. Provisional disposition of the order according to 4 phytocenological relevés from a single area in Europe (Morskie Oko, Tatre) is unreliable, inexact, and inadequately documented. The code intrudes confusion regarding articles 2, 22, and 23. Articles 22 and 23 are contradictory concerning article 2. To mention the two syntaxons in the following manner: *Piceion excelsae* Pawlowski ex Br.-Bl. 1939 in Br.-Bl. et al. 1939, *Piceetalia excelsae* Pawlowski ex Br.-Bl. 1939 in Br.-Bl. et al. 1939 is another possible solution. This would be a compromise between the authors, and is difficult to decide about. Mucina et al., gives priority to Pawlowski regarding article 29 of the code (MUCINA et al. 1993: 283, 286–288). In our opinion, article 29 of the code is not sufficiently exact and clear. It is not important to give a better name to the syntaxon, rather to choose correct and documented characteristic and differential species of the alliance and order, which Pawlowski did not do.

Another novelty of importance has been HADAČ'S (1969) nomenclature for spruce phytocenoses on a calcareous bedrock. The Slovak phytocologist Hadač strove to separate spruce and fir phytocenoses on *rendzina* and »grey forest soil«, where the soil is poor acid, subneutral to alkaline with intensive nitrification and rich of hemicryptophytes (HADAČ et al. 1969: 265) from the order *Vaccinio-Piceetalia*. He proposed a new order, *Athyrieto-Piceetalia* 1962, with the characteristics: *Prenanthes purpurea*, *Mycelis muralis*, *Soldanella hungarica* subsp. *major*, *Moneses uniflora*, *Orthilia secunda*, and *Pyrola minor* (HADAČ 1962: 53). Later on he updated the name of the order to *Athyrio alpestris-Piceetalia* Hadač 1962 and confirmed the same characteristics (HADAČ et al. 1969: 265). The first two characteristics *Prenanthes purpurea* and *Mycelis muralis* belong to the order *Fagetalia sylvaticae*, the third one *Soldanella hungarica* subsp. *major* is a Balkan-Carpathian species with a confined area the centre of which is in the Carpathian Mountains. The last three characteristics, *Moneses uniflora*, *Orthilia secunda*, and *Pyrola minor*, belong to the order and alliance of spruce woods. All characteristics, except the species *Soldanella hungarica* subsp. *major* are generally distributed in spruce phytocenoses on carbonate and non-carbonate stones. Thus they do not have any true diagnostic value for the spruce wood order *Athyrio-Piceetalia*. Within the order *Athyrio-Piceetalia* he picked out the alliance *Chrysanthemo rotundifolii-Piceion* (Krajina 1933) Břzina et Hadač in Hadač 1962, which unites »lowland« spruce woods (Flurnwälder), where spruce dominates on granite foremost on quartzite and

Tab. 1. Sub-alpine and montane spruce forests of Eastern-Alpine-Dinaric and neighbouring regions.

SUB-ALPINE SPRUCE FORESTS - Synthetic table of class <i>Vaccinio-Piceetea Br.-Bl. 1939 emend. Zupančić</i>		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Dicranum scoparium</i>	IV	V	I	I		825 V	V	68 IV	IV-V	V	1382 V	923 V	752 V	255 V	2	182 V	217 V
<i>Hylocomium splendens</i> (H. proliferum)		V	IV	III	V	4150 V	V	1531 V	V	V	3195 V	3443 V	2625 V	3855 V	3	2164 V	147 IV
<i>Oxalis acetosella</i>	III	V	V	III	V	1276 V		I	II-IV	IV	167 IV	1797 V	206 IV	555 V	3	224 IV	
<i>Pleurozium schreberi</i>	IV	V	V	V		150 V	V	II	I-III	II	1087 V	229 III	1298 V	1041 V	3	431 IV	464 IV
<i>Rhytidolepis triquetus</i>		V	III	V	V	750 V		344 II	II	IV	644 V	1228 V	11	2697 V	3	2149 V	287 IV
<i>Mniamthernum bifolium</i>	III	III	I	II	104 IV			II	II	V	11	151 III	563 IV	55 II	1	33 III	
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>				II	56 V		II	1120 III	II-IV	III	220 IV	640 V	4 III	736 V			
<i>Polytrichum commune</i>	IV							I	I		250 II	24 II				2 II	
<i>Hypnum cupressiforme</i>								I	I	I	-						
<i>Leucobryum glaucum</i>								I	I		177 III		379 IV				
<i>Equisetum sylvaticum</i>	III							I	I								
<i>Lophocolea heterophylla</i> (L. profunda)	IV							I	I								
<i>Luzula albida</i> (L. luzuloides)	III							I	I								
<i>Luzula pilosa</i>																	
<i>Thuidium tamariscinum</i>	IV												11	4 III		122 IV	503 V
<i>Gentiana asclepiadea</i>	III										23 II	399 IV	441 V	27 II		3 II	
<i>Carex pallescens</i>											- II	24 III					
<i>Solidago virgaurea</i> subsp. <i>alpestris</i>													31 I				
<i>Colmagrostis arandiacaea</i>	IV													28 II	1	65 IV	
<i>Mnium hornum</i>																	
<i>Grimmia leucophlebia</i>																	
<i>Taxiphyllum depressum</i>																	
<i>Lonicera barbastiana</i>																	
<i>Asyneuma trichocalycinum</i> (Complanula t.)	III																
<i>Hypnium umbellatum</i>																	

Tab. 1. – continued

	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
<i>Dicranum scoparium</i>	500 V	V	II-V	V	V	V	V	V		1	II	I-IV	3		II-IV	22 II
<i>Hylocomium splendens</i> (<i>H. proliferum</i>)	3350 V	V	IV-V	V	V	V	V	I-III		1	I	I-IV	3		I-III	267 III
<i>Oxalis acetosella</i>		IV-V	V	V	IV-V	IV	V	III-IV		3	V	II-V	3	170 IV	IV-V	100 V
<i>Plenazium schreberi</i>	3350 V	V	I-IV	V	V	IV	IV	IV-V	2		I	I	1		II-IV	251 II
<i>Rhytidadelphus triquetus</i>	2950 V	V	V	V	V	IV	V	IV-V			I-II	I-IV	3		I-V	410 III
<i>Miathemum bifolium</i>	104 IV	II-III	III-V	V	I-II	III	IV	II-IV		1	I	I		3 II	I	
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>		I-II	III-V	V	II-V	IV	IV-V	IV-V	2	3	IV-V	III-V	3	7 IV	II-III	
<i>Polytrichum commune</i>				V	II-IV	IV									I-II	
<i>Hypnum cupressiforme</i>				II	III-V										I	1 II
<i>Leucobryum glaucum</i>																
<i>Equisetum sylvaticum</i>							III	I-II								
<i>Lophocolea heterophylla</i> (<i>L. profunda</i>)																
<i>Luzula albida</i> (<i>L. luzuloides</i>)										1	I	II-IV			IV-V	327 IV
<i>Luzula pilosa</i>		II-V	I-III		II-IV										I-II	208 IV
<i>Thuidium tomentosum</i>		III-IV	II-III		I										I	
<i>Gentiana asclepiadea</i>				IV	I-II										II-III	61 IV
<i>Carex pallescens</i>			I-III	IV	II-III					1	II	I-III				
<i>Solidago virgaurea</i> subsp. <i>alpestris</i>				IV	II-III											176 IV
<i>Calamagrostis arundinacea</i>															II-IV	986 III
<i>Minium hornum</i>																
<i>Girardinia leucophlebria</i>																
<i>Toxiphyllum depressum</i>																
<i>Lonicera borbasiana</i>																
<i>Asyneuma trichocalycinum</i> (<i>Campanula</i> t.)																
<i>Hypericum umbellatum</i>	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
<i>Dicranum scoparium</i>		105 IV	85 II	1	II	148 II	300 V	728 V	6 III	3	39 I		1000 V	504 IV	I-V	IV
<i>Hylocomium splendens</i> (<i>H. proliferum</i>)	54 II	1502 V	1502 IV	1	II	34 III	478 V	3 II	(130 IV)	1	2000 III		(2250 V)	409 IV	IV-V	V

Tab. 1. – continued

<i>Oxalis acetosella</i>	III	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
<i>Pleurozium schreberi</i>	IV	1153 V	463 V	1	II	343 V	1289 V	52 II	66 III			3200 V	1173 IV	1310 IV		V	V
<i>Rhytidadelphus triquetris</i>	III	53 III	2783 V	1	II	141	54 II	5 III	(130 IV)		2	1500 III	1098 III	(2250 V)	344 III	II-V	III
<i>Maianthemum bifolium</i>	III	3976 V			II	675 IV	1145 V	853 V								II	IV
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>	IV	318 V	55 IV			133 IV	737 V								125 II		
<i>Polytrichum commune</i>		202 IV	I	1		16 II		309 II					(39 I)	1219 V			
<i>Hypnum appressiforme</i>		1343 IV		1		309 II	30 II										
<i>Leucobryum glaucum</i>	III	54 II				4 II	11										
<i>Equisetum sylvaticum</i>	IV	583 V				11	11										
<i>Lophocolea heterophylla</i> (L. <i>profunda</i>)	III	241 V	57 V	1		3 II	53 I										
<i>Luzula albida</i> (L. <i>luzuloides</i>)	IV		3 II	1		136 V	138 V	353 V	6 III	2	10 V	119 IV	254 V		126 II	I-III	IV
<i>Carex pallescens</i>	III					2372 V	29 II		11							I-III	
<i>Solidago virgaurea</i> subsp. <i>alpestris</i>	IV					13 I	1293 V								405 IV	I-V	
<i>Calamagrostis arundinacea</i>	III					21											
<i>Minium hornum</i>						- I		175 IV	129 III								
<i>Grimmia leucophaea</i>																	
<i>Taxiphyllum depressum</i>																	
<i>Lonicera bobostiana</i>																	
<i>Asyneuma trichocalycinum</i> (Campanula t.)																	
<i>Hypericum umbellatum</i>																	
MONTANE SPRUCE FORESTS - Synthetic table of class <i>Vaccinio-Piceetea</i> Br.-Bl. 1939 emend. Zupančić																	
	III	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Oxalis acetosella</i>	V	1442 V	586 V	4	185 IV	V	4	2628 V	IV-V	V	V	V	III-IV	V	V	III	2 I
<i>Maianthemum bifolium</i>	IV	34 III	235 V	2	952 V	4 III	3	4 III	I-II	IV	I	I	II-III	II	III-IV	III	2 I
<i>Dicranum scoparium</i>	I	195 IV	129 IV	4	167 V	IV	IV	6 IV	I-III	I	I	I	V	II-V	III-IV	V	

Tab. 1. – continued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Hylocomium splendens</i> (H. proliferum)	I	2676 V	4062 V	4	2614 V	V	4	2626 V	I-V	I	V	V	IV-V	V	V	291 I
<i>Rhytidelaphus triquetrus</i>	I	1105 V	2699 V	4	2023 V		2	65 II	I-III		I	V	III-IV	V	IV	85 II
<i>Luzula pilosa</i>	III	34 III	45 III			II	1		II	III	III	II-III	II-III	II-III	I	
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>	IV	5 III	26 III	3	96 V				II-V	II	IV	II-IV	V	IV	II	2 I
<i>Pleurozium schreberi</i>	IV	236 II	356 IV		138 II				IV-V		IV	V	II-IV	II-IV	V	87 III
<i>Luzula albida</i> (L. luzuloides)	III	104 II	75 II			V		130 IV	IV-V		I	V	V	III		
<i>Hypnum cupressiforme</i>	IV	2 II										II-IV	III-V	I-II	I	
<i>Polytrichum commune</i>								219 I		I			I		III	1502 V
<i>Thuidium tamariscinum</i>	III							63 I	III-V		I	I	I	I	II	
<i>Calamagrostis arundinacea</i>																
<i>Gentiana asclepiadea</i>																
<i>Carex pallescens</i>																
<i>Equisetum sylvaticum</i>																
<i>Leucobryum glaucum</i>	IV									I	II	I		I-II		
<i>Grimmia pulvinata</i>										I	II	I			I	378 IV
<i>Lonicera borbasiana</i>	II															
<i>Oxalis acetosella</i>	III	473 V	1408 V	4	1214 V	1679 V	85 II	407 V	978 V	2202 V	27	106 V	55 IV	220 V	31	32
<i>Maianthemum bifolium</i>		190 III	345 V	3	643 IV	680 IV	2 I					6 IV	5 III	8 IV		
<i>Dicranum scoparium</i>	IV	1 I		3	147 IV	115 V	666 IV	454 V	304 V	104 IV	146 IV	206 V	7 IV	218 V	8 V	
<i>Hylocomium splendens</i> (H. proliferum)		1 I	226 II	2	216 IV	271 IV	918 III		1228 V	108 V	360 V	(478 V)	304 V	3050 V		
<i>Rhytidelaphus triquetrus</i>		470 II	6 III	4	964 II	555 III	628 III	1701 V	429 V	108 V		977 V	428 V	304 V		
<i>Luzula pilosa</i>	III	1 I	162 IV	1		3 II					1 II	(6 IV)	27 II		2550 V	1
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>	IV	1 I	1 I	2												
<i>Pleurozium schreberi</i>	IV				253 III	127 II	625 I					5 III	57 V	30 III		
<i>Luzula albida</i> (L. luzuloides)	III	908 V	113 V	3 II		4 III					4 III	(IV)	(6 IV)	5 III		
<i>Hypnum cupressiforme</i>	IV		5 III	3	1 II	1 I		5 III	56 IV		77 IV	281 V	281 V	155 V		
<i>Polytrichum commune</i>			1 I					353 III			(217 IV)	206 V	106 V	79 III		

Tab. 1. – continued

<i>Thuidium tamariscinum</i>		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	37
<i>Calamagrostis arundinacea</i>	III		8487 V	4368 V			126 II	293 II							3 II		
<i>Gentiana asclepiadoidea</i>		4 II	295 V	293 V	4	73 III	287 III		255 V	652 V	1000 V	80 V	4 III	4 III	30 III	652 V	3
<i>Carex pallescens</i>														2 II	53 II		
<i>Equisetum sylvaticum</i>	IV																
<i>Leucobryum glaucum</i>		4 II		3 II									8 V	5 III			
<i>Grimmia pulvinata</i>						1 II	5 I										
<i>Lonicera bobasiana</i>	II	33	34														
<i>Oxalis acetosella</i>	III	1039 V	448 IV														
<i>Maianthemum bifolium</i>																	
<i>Dicranum scoparium</i>	IV	116 II	168 III														
<i>Hylacomium splendens (H. proliferum)</i>			(528 II)														
<i>Rhytidolepthus triquetrus</i>		808 I	(528 II)														
<i>Luzula pilosa</i>	III																
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>			1 I														
<i>Pleurozium schreberi</i>	IV																
<i>Luzula albida (L. luzuloides)</i>	III		336 V														
<i>Hypnum cupressiforme</i>	IV																
<i>Polytrichum commune</i>		(251 III)	418 IV														
<i>Thuidium tamariscinum</i>																	
<i>Calamagrostis arundinacea</i>	III	385 III	334 V														
<i>Gentiana asclepiadoidea</i>																	
<i>Carex pallescens</i>																	
<i>Equisetum sylvaticum</i>			57 II														
<i>Leucobryum glaucum</i>	IV																
<i>Grimmia pulvinata</i>																	
<i>Lonicera bobasiana</i>	II																

Legend to Tab. 1. List of sub-alpin syntaxa

- 1 *Piceetum subalpinum* Br.-Bl. 1938
- 2 *Piceetum subalpinum myrtilletosum* Br.-Bl. 1969 (Tregubov 1959)
- 3 *Rubo-Piceetum* Tregubov 1959
- 4 *Listera cordata- Hylocomium umbratum* (Aubert et Luquet 1930) Br.-Bl. et Vlieger 1939 (*Asplenio-Piceetum*)
- 5 *Asplenio-Piceetum* (R. Kuoch 1953) M. Moor 1954
- 6 *Mastygobryeto-Piceetum* (Schmid et Gaisberg 1936) Br.-Bl. et Siss. 1939
- 7 *Mastygobryeto-Piceetum* (Schmid et Gaisberg 1936) Br.-Bl. et Siss. 1939 (J. et M. Bartsch 1940)
- 8 *Bazzanio-Piceetum* Br.-Bl. et Siss. 1939 (Oberd. 1957)
- 9 *Piceetum boreoalpinum* Oberd. 1950 (*Bazzanio-Piceetum boreoalpinum* Oberd. 1950)
- 10 *Piceetum subalpinum* Br.-Bl. 1938 (R. Kuoch 1953)
- 11 *Asplenio-Piceetum* (Br.-Bl. et Vlieger 1939) R. Kuoch 1954
- 12 *Sphagno-Piceetum* R. Kuoch 1953
- 13 *Piceetum subalpinum* Br.-Bl. 1938 (R. Kuoch 1953) *myrtilletosum* Br.-Bl. 1954
- 14 *Piceetum subalpinum* Br.-Bl. 1938 (R. Kuoch 1953) *sphagnetosum* Br.-Bl. 1954
- 15 *Piceetum subalpinum* Br.-Bl. 1938 (R. Kuoch 1953) *vaccinietosum* Br.-Bl. 1954
- 16 *Piceetum subalpinum* Br.-Bl. 1938 (R. Kuoch 1953) *pinetosum* Br.-Bl. 1954
- 17 *Piceetum subalpinum* Br.-Bl. 1938 (R. Kuoch 1953) *blechnetosum* Br.-Bl. 1954
- 18 *Listero-Piceetum subalpinum* H. Mayer 1969
- 19 *Adenostylo glabrae-Piceetum subalpinum* H. Mayer 1969
- 20 *Asplenio-Piceetum* R. Kuoch 1954 (H. Mayer 1962)
- 21 *Piceetum subalpinum myrtilletosum* H. Mayer 1963
- 22 *Lophozio-Piceetum* Volk (Prodromus 1939)
- 23 *Soldanello-Piceetum* Volk 1939 (Prodromus 1939)
- 24 *Soldanello-Piceetum* Volk 1939 (E. Oberdorfer 1957)
- 25 *Piceetum hercynicum* R. Tx. 1939 (apud. Br.-Bl. 1939) (E. Oberdorfer 1957)
- 26 *Vaccinium myrtillus-Oxalis- Calamagrostis varia* Zukrigl 1963
- 27 *Adenostylo alliariae-Piceetum subalpinum* Zukrigl 1973
- 28 *Adenostylo glabrae-Piceetum subalpinum* Zukrigl 1973
- 29 *Vaccinium myrtillus-Hylocomium* Zukrigl 1963 (*Asplenio-Piceetum*)
- 30 *Luzula sylvatica-Calamagrostis varia* Zukrigl 1963
- 31 *Homogyno-Piceetum subalpinum* Zukrigl 1973
- 32 *Luzulo sylvaticae-Piceetum* M. Wraber 1963
- 33 *Bazzanio-Piceetum* (Schmid et Geisberg 1938) Br.-Bl. et Siss. 1939 (Per-soglio 1957)
- 34 *Piceetum excelsae* E. Aichinger 1933
- 35 *Piceetum croaticum subalpinum* I. Horvat (1950, 1962) 1967 (Tregubov 1957)

- 36 *Piceetum subalpinum* Br.-Bl. 1938 *dinaricum* M. Wraber (1960) 1969 n. nud.
 37 *Asplenio-Piceetum* R. Kuoch 1953 (Accetto 1972)
 38 *Piceetum subalpinum* Br.-Bl. 1938 *dinaricum* (M. Wraber 1960, 1969 n. nud.) Zupančić 1976
 39 *Piceetum croaticum subalpinum* I. Horvat (1950, 1962) 1967
 40 *Sorbo-Piceetum* Fukarek 1964 mscr.
 41 *Aceri visianii-Piceetum subalpinum* Stefanović 1970
 42 *Piceetum excelsae* E. Aichinger 1933 *illyricum* Fukarek et Stefanović 1958 prov.
 43 *Piceetum croaticum subalpinum* I. Horvat (1950, 1962) 1967 (V. Blečić 1958)
 44 *Piceetum excelsae bertiscum subalpinum* V. Blečić 1964
 45 *Piceetum excelsae serbicum* Greb. (1950) *subalpinum* V. Blečić et B. Tatić 1962
 46 *Piceetum excelsae serbicum* Greb. (1950) *arctostaphylletosum* B. Jovanović 1955
 47 *Picea excelsa-Hieracium rotundatum* (Zlatnik 1935) Pawl. et Br.-Bl. 1939?
 48 *Piceetum tataricum* (Szafer, Pawlovski et Kulczynski 1923) Br.-Bl., Vliieger et Sissingh 1939

Legend to Tab. 1. List of montan syntaxa

- 1 *Piceetum montanum* Br.-Bl. (1938) 1939
 2 *Piceetum montanum galietosum* Br.-Bl. 1954
 3 *Piceetum montanum melicetosum* Br.-Bl. 1954
 4 *Piceetum transalpinum* Br.-Bl. 1939
 5 *Piceetum transalpinum* Br.-Bl. (1939) 1954
 6 *Picea excelsa-Luzula nemorosa* (Schmid et Geisberg 1936) Br.-Bl. et Siss. 1939
 7 *Picea excelsa-Galium rotundifolium* Bartsch 1940
 8 *Picea excelsa-Luzula nemorosa* Bartsch 1940
 9 *Galio-Piceetum* (Bartsch 1940) Oberdorfer 1957
 10 *Piceetum montanum* Br.-Bl. 1939 *boreoalpinum* Oberdorfer 1957
 11 Bavarian forest with *Picea* Oberdorfer 1957
 12 *Luzulo-Piceetum montanum* H. Mayer (1969) 1973
 13 *Oxali-Piceetum montanum* H. Mayer (1969) 1973
 14 *Adenostylo glabrae-Piceetum montanum* H. Mayer (1969) 1973
 15 *Piceetum montanum* H. Mayer 1969
 16 *Sphagno-Piceetum* Zukrigl 1973
 17 *Adenostylo glabrae-Piceetum* (Zupančić et Puncer 1963 mscr.) M. Wraber 1966 prov.
 18 *Luzulo-Piceetum* Zupančić 1976
 19 *Piceetum montanum dinaricum* Zupančić 1976
 20 *Abieti-Piceetum* (M. Wraber 1964 prov.) *dinaricum* M. Zupančić (mscr.)
 21 *Piceetum croaticum montanum* Ht. (1938, 1950) 1962 (Ht. 1938)
 22 *Piceetum croaticum montanum* Ht. (1938, 1950) 1962 (Cestar 1967)
 23 *Piceetum dolomiticum* Ht. 1958 (prov.)

- 24 *Pyrolo-Piceetum* Fukarek 1964 (mscr.) 1
 25 *Pyrolo-Piceetum* Fukarek 1964 (mscr.) 2
 26 *Pyrolo-Piceetum* Fukarek 1964 (mscr.) 3
 27 *Piceetum montanum silicicum* Stefanović 1964
 28 *Lycopodio-Piceetum montanum* Stefanović 1964
 29 *Sphagno-Piceetum montanum* Stefanović 1964
 30 *Abieti-Piceetum silicicum* Stefanović 1964
 31 *Piceetum omoricae* Tregubov 1941
 32 *Piceetum croaticum montanum* Ht. (1938, 1950) emend. V. Blečić 1958
 33 *Piceetum excelsae bertiscum montanum* V. Blečić 1964
 34 *Piceetum excelsae serbicum* Greb. (1950) *montanum* V. Blečić et B. Tatić 1962

limestone debris with a light humid soil (HADAČ et. al. 1969: 275). For differential species he took the following: *Ranunculus platanifolius*, *Cicerbita alpina*, *Doroncium austriacum*, *Milium effusum*, *Petasites albus*, *Adenostyles alliariae*, *Minium punctatum*, and *Drepanocladus uncinatus* (HADAČ et. al. 1969: 275–276). Differential species of vascular flora belong to the *Adenostylion* alliance and the order *Adenostyletalia*, except the species *Petasites albus*, which we assign to the order *Fagetalia*. The two moss species are ranged in the *Vaccinio-Piceion* alliance. All the mentioned species are distributed in spruce phytocenoses on noncarbonate and carbonate bedrock. Species have no diagnostic value for any of the alliances of spruce forests (for example: the *Chrysanthemo-Piceion* alliance) except of being hydrophilous.

Susanne Wallnöfer (MUCINA et al. 1993: 311) defined differential species for the order *Athyrio-Piceetalia* 29. Most species (25) are generally widespread on carbonate and noncarbonate bedrock. Only three are of diagnostic value: *Rosa pendulina*, *Astrantia major*, and *Silene alpestris*. Probably, differential species are also the following: *Aster bellidiastrum*, *Dentaria enneaphyllos*, *Erica carnea*, *Helleborus niger* subsp. *niger*, *Hepatica nobilis*, *Lamiastrum flavidum*, *L. montanum*, *Lilium margaton*, *Mercurialis perennis*, and *Polygala chamaebuxus*. Unfortunately the order *Athyrio-Piceetalia* does not have any characteristics of its own. The choice of such a great number of relative differential species with a wide distribution on carbonate (neutral, moderate acid) bedrock, limestone, dolomite, schist, gypsum, and others, rich in nutrition and bases, mostly mid-deep to deep brown soil or rendzina, or brown soil with basic to moderate acid reaction are rather a product of computer choice than of deliberate ecological and floristic studies. Some ubiquitous differential species cannot be omitted, for example: *Calamagrostis varia*, *Ctenidium molluscum*, *Fragaria vesca*, *Knautia maxima*, *Mnium marginatum*, *Ranunculus nemorosus*, *Tortella tortuosa*, *Valeriana montana*, and some others. Susanne Wallnöfer (MUCINA et al. 1993: 311–312) mentions 17 differential species for the *Chrysanthemo rotundifolii-Piceion* alliance. Among them, 8 species: *Centaurea montana*, *Chaerophyllum villarsii*, *Heracleum austriacum* s. lat., *Homogyne discolor*, *Hypericum maculatum*, *Potentilla aurea*, *Senecio subalpinus*, and *Streptopus amplexifolius* are absent from our forests, but they

grow on subalpine pastures and in *Pinus mugo* stands. One of them, *Streptopus amplexifolius*, is a very rare species distributed in Slovenia. Species such as *Gentiana pannonica*, *Geranium sylvaticum*, *Poa alpina* s. lat., *Ranunculus platanifolius*, *Saxifraga rotundifolia*, and *Veratrum album* s. lat. are distributed on carbonate and noncarbonate bedrock.

Only two differential species are reliable: *Aconitum lycoctonum* subsp. *vulparia* and *Soldanella alpina*. The alliance has no characteristics. Coniferous phytocenoses are ranged into the alliance on sites with relatively good water and nutrition supply in the subalpine and altimontane belts. Habitats may be on carbonate or noncarbonate bedrock.

What reason is there to divide the class *Vaccinio-Piceetea* into two orders, *Vaccinio-Piceetalia* and *Athyrio-Piceetalia*? In the floristic composition of spruce phytocenoses there is no reason for this separation into two orders, for there are no reliable diagnostic species for the order *Athyrio-Piceetalia*. The ecological view is linked to the floristic principle that agrees with the standard Central European method. Ecological conditions are expressive mostly in lower synsystematic units – association, subassociation, variant, facies, and suchlike. For the moment there is no better solution than that proposed by Braun-Blanquet with certain additions by Oberdorfer, R. Tüxen, Matuszkiewicz, K. Lund, and others.

It is the same with the *Chrysanthemo rotundifolii-Piceion* alliance. A certain confusion has occurred; for example, ranging the *Asplenio-Piceetum* association into *Abieti-Piceion* is not convenient. The association has many elements of subalpine spruce forests that range it among subalpine but not montane spruce forests.

So such a division of the class *Vaccinio-Piceetea* might entitle us to separate special suballiances, an alliance, or even order for the Illyrian floral province. So would *Cardamino trifoliae-Piceetalia* with the *Homogyno sylvestris-Piceion* alliance and *Anemone trifoliae-Piceion* and *Betonico alopecuri-Piceion* suballiances divide subalpine and montane spruce phytocenoses on carbonate bedrock. The question of the division of alliances for phytocenoses of dwarf pine stands on carbonate and noncarbonate ground thus arises.

As long as we do not have enough material throughout Europe, any new syntaxonomic division seems to be premature, not to mention risky.

In Slovenia we take into consideration the syntaxonomic approach of Oberdorfer and Matuszkiewicz who are introducing new syntaxonomic categories: geographical variants and subvariants, and forms. These syntaxonomic categories are essential for countries with diversified orography and relief, rich with carbonate stones, varied soil and local climate, rich flora, and numerous endemites. This is very largely valid for Slovenia.

An unverified division of higher syntaxonomic units could cause some embarrassment when placing the geographical variants into higher syntaxonomic units. So, different geographical variants of one association ought to be ranged into a different alliance or order. For example, the *Adenostylo-Piceetum* s. lat. association is placed, with all geographical variants, into the uniform *Vaccinio-Piceion* alliance; the *Adenostylo-Piceetum* association is ranged, according

to Hadač, into the order *Athyrio-Piceetalia* and *Chrysanthemo rotundifolii-Piceion* alliance. The geographical variant *Adenostylo-Piceetum* var. geogr. *Cardamine trifolia*, distributed in Slovenia and partly in Austria, cannot be placed within this order. The species *Cardamine trifolia* has 13 south-eastern European-Illyrian geographical variants, some of them having a more confined distribution. More examples of these are found in communities of deciduous woods on carbonate ground.

The alliances and especially suballiances were based on floristic principle and altitude belt, both reflecting ecological conditions. This is what the alliances and suballiances according to BRAUN-BLANQUET (1939), completed by OBERDORFER (1957, 1993), already assure.

Conclusion

The paper deals with the arrangement of the class *Vaccinio-Piceetea* s. lat. The primary form presented and elaborated with rather rich material by BRAUN-BLANQUET (1939, 1950, 1954) ought to be adhered to. His syntaxonomic arrangement of class *Vaccinio-Piceetea*, order *Vaccinio-Piceetalia*, *Vaccinio-Piceion* alliance, and *Abieti-Piceenion* and *Vaccinio-Piceenion* suballiances (Oberdorfer's completion) is clear and integral. The two suballiances that unite above all the phytocenoses of spruce and acidophilous fir woods are mentioned deliberately. There is no need to set up special syntaxonomic units like *Athyrio-Piceetalia*, *Chrysanthemo-Piceion* distributed over a small area and floristically slightly different only because of some particular local floristic specialities that do not occur in a larger area of the appearance of spruce phytocenoses. The fact that the bedrock does not influence plant or vegetation growth and differentiation between new higher syntaxa (order, alliance, suballiance), cannot be confirmed. The acidophilous soil makes the influence of calcareous bedrock questionable, however it makes possible the growth of acidophilous plants. The two OBERDORFER's (1957, 1979, 1992) nomenclatures with geographical variants or MATUSZKIEWICZ's (1981) forms may be taken into consideration for the solution of the appearance of specific, chorologically very limited species that may be phyto-geographically differential species.

It is unacceptable to set up higher syntaxonomic units (class, order, alliance, suballiance) without such evidence as synthetic, comparative, phytocenological tables of wide appearance area of lower order generic syntaxa (association, subassociation) or even if corroborated by computer-aided methods.

Some illogicalities of the code, not in interest of the phytocenological science, might be a beginning for a discussion of a different classification and nomenclatural problems based on arguments of wide aspect.

The proposed nomenclature of the class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939 emended Zupančič 1976, order *Vaccinio-Piceetalia* Br.-Bl. in Br.-Bl. et al. 1939 emended K.-Lund 1967, *Vaccinio-Piceion* alliance Br.-Bl. in Br.-Bl. et al. (1938) 1939, and *Abieti-Piceenion* suballiance 1939 Br.-Bl. in Br.-Bl. et al. 1939 and *Vaccinio-Piceenion* Oberd. 1957 is one possibility. For some workers in the field, it may look conservative but in my opinion it is the most clear and

simple. Some other interpretations pointing to a better nomenclature for the class *Vaccinio-Piceetea* s. lat. and its lower synsystematic units may be possible.

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Povzetek

Nekateri sintaksonomski problemi razreda *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939

BRAUN-BLANQUET et al. (1939) je postavil razred *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939, vendar brez nazorne navedbe njegovih značilnic in razlikovalnic. ZUPANČIČ (1976, 1980) je na osnovi primerjav smrekovih fitocenoz Evrope predlagal diagnostične vrste za razred *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939 emend. Zupančič 1976 in jih kasneje še dopolnil (ZUPANČIČ 1999). Sedaj je razčlenil te diagnostične vrste med značilnice in razlikovalnice razreda *Vaccinio-Piceetea*.

Značilnice razreda *Vaccinio-Piceetea* so predvsem razširjene v smrekovih gozdovih Evrope, večinoma imajo visoko stopnjo navzočnosti, velikokrat precejšnjo srednjo pokrovno vrednost ter sorodstvene vezi z drugimi acidofilnimi sintaksoni zaradi ekoloških razmer in razvojnih tendenc prehajanja iz enega v drug sintakson; te so: *Calamagrostis arundinacea*, *Dicranum scoparium*, *Gentiana asclepiadea*

Hylocomium splendens, *Luzula albida*, *Luzula pilosa*, *Maianthemum bifolium*, *Oxalis acetosella*, *Pleurozium schreberi*, *Polytrichum commune*, *Rhytidadelphus triquetrus*, *Rubus hirtus*, *Solidago virgaurea* subsp. *alpestris*, *Solidago virgaurea* subsp. *virgaurea*

Razlikovalnice razreda *Vaccinio-Piceetea* imajo predvsem horološki karakter in so bolj ali manj omejene na določeno območje. Izrazito omejeno fitogeografsko razširjenost ima le malo razlikovalnic. Navadno so te vrste redkeje zastopane oziroma, včasih nimajo visoke stopnje navzočnosti.

Glede reda *Vaccinio-Piceetalia* Br.-Bl. in Br.-Bl. et al. 1939 emend. K.-Lund 1967 (= *Piceetalia excelsae* Pawl. in Pawl. et al. 1928), zveze *Vaccinio-Piceion* Br.-Bl. in Br.-Bl. et al. (1938) 1939 (= *Piceion excelsae*. Pawl. in Pawl. et al. 1928) in podzveze *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939 menimo, da jih je ustrezno dokumentiral BRAUN-BLANQUET et al. (1939) na osnovi bogatega gradiva evropskih smrekovih, kislih jelovih in drugih podobnih fitocenoz. K tej nomenklaturi ureditvi uvrščamo še podzvezo *Vaccinio-Piceenion* Oberdorfer 1957. PAWŁOWSKI et al. (1928) je le začasno postavil red *Piceetalia* in zvezo *Piceion* na osnovi štirih popisov le iz območja Morskie Oko, zato vztrajamo pri nomenklaturni ureditvi BRAUN-BLANQUET et al. 1939.

Nadalje smo mnenja, da ni potrebno deliti smrekove fitocenoze na karbonatu v nov red *Athyrio-Piceetalia* Hadač 1962 in zvezo *Chrysanthemo rotundifolii-Piceion* (Krajina 1933) Bzina et Hadač in Hadač 1962. Acidofilne talne razmere, ne glede na karbonatno podlago, pospešujejo rast acidofilnih vrst smrekovih gozdov (*Vaccinio-Piceetea*, *Vaccinio-Piceetalia*, *Vaccinio-Piceion*), zato te smrekove fitocenoze zlahka uvrstimo v že obstoječo Braun-Blanquetovo nomenklaturno ureditev. BRAUN-BLANQUETOVA et al. (1939) nomenklaturna ureditev je pregledna in celostna oziroma zaokrožena. Prepričani smo, da ni potrebe ustvarjati posebnih sintaksonomskih enot (*Athyrio-Piceetalia*, *Chrysanthemo-Piceion*), ki zajemajo pravzaprav majhna območja, floristično malo različna,

različna le zaradi nekaterih posameznih lokalnih florističnih posebnosti, ki jih ni v širšem območju pojavljanja smrekovih fitocenoz. Za reševanje takih problemov, kjer se pojavljajo specifične, horološko zelo omejene vrste, ki so lahko fitogeografske razlikovalnice, prideta v poštev nomenklaturni rešitvi OBERDORFERJA (1957, 1979, 1992) z geografskimi variantami ali z MATUSZKIEWICZEVIMI (1981) formami.