

Phytogeographical differentiation in the Dinaric fir-beech forest (*Omphalodo-Fagetum* s. lat.) of the western part of the Illyrian floral province

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A phytogeographical assessment of the west-Dinaric fir-beech association *Omphalodo-Fagetum* s. lat. (Treg. 1957 corr. Puncer 1980) Marinček et al. 1993 (= *Abieti-Fagetum dinaricum* Tregubov 1957 p.p.) in the western part of the Illyrian floral province is provided. The synoptic phytosociological table and the results of hierarchical classification and ordination showed a quite distinct floristic and phytogeographical pattern of differentiation in a northwest-southeast direction. The proportion of Southeast – European-Illyrian (Illyricoid) species decreases towards the northwest while Alpine species decrease in the opposite direction. Stands from the Trnovski gozd plateau form a geographical variant *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia*, further divided into two geographical sub-variants, western – subvar. geogr. *Anemone trifolia* and central-eastern – subvar. geogr. *Omphalodes verna*. All other stands belong to the geographical variant *Omphalodo-Fagetum* var. geogr. *Calamintha grandiflora*, also further divided into two geographical sub-variants, subvar. geogr. *Dentaria pentaphyllos* and subvar. geogr. *Dentaria polyphylla*. Although the distribution area of the association is well defined in its northwest part, the question of its south-eastern border is still open. The preliminary results of analyses indicate that the stands southeast of Velebit and Lička Plješivica should be treated as a different association, distinct from *Omphalodo-Fagetum*. Further phytosociological and phytogeographical research into the entire Illyrian floral province will therefore be needed to resolve the problem of the southern border of the distribution area of the association *Omphalodo-Fagetum* and the syntaxonomy of south-eastern Dinaric fir-beech stands.

Key words: phytogeography, vegetation, forest, *Omphalodo-Fagetum*, *Aremonio-Fagion*, Dinaric mountains, Slovenia, Croatia, Balkan.

Introduction

The west-Dinaric fir-beech forest *Omphalodo-Fagetum* (Treg. 1957 corr. Puncer 1980) Marinček et al. 1993 (= *Abieti-Fagetum dinaricum* Tregubov 1957 p.p., *Fagetum croaticum australe abietetosum* Horvat 1938 p.p.) is one of the most studied climatogenic associ-

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ations in the western part of the Illyrian floral province (HORVAT 1938; M. WRABER 1953, 1959; TREGUBOV 1957, 1960, 1962abc; TRINAJSTIĆ 1970, 1972; PUNCER et al. 1974; PELCER 1976; ACCETTO 1978, 1998; PUNCER 1979, 1980; VUKELIĆ 1985; DAKSKOBLER 1986, 2001; ZUPANČIĆ and PUNCER 1995; MARINČEK and KOŠIR 1998; DAKSKOBLER et al. 2000; SURINA 2001 and others). In the broadest sense (*Abieti-Fagetum dinaricum* s. lat.) it covers huge areas along the Dinaric mountains between 700–1300 m a.s.l. It is the high proportion of Southeast-European-Illyrian (Illyricoid) species, as much as their high cover values, that distinguishes these stands from Central European ones. However, the association *Omphalodo-Fagetum*, in contrast to the Central European beech communities, belongs to the Illyrian alliance *Aremonio-Fagion* (Horvat 1938) Borhidi in Török, Podani and Borhidi 1989. The association is optimally developed between the Snežnik plateau, the Kočevje region (Slovenia) and Gorski Kotar (Croatia). Floristic and phytogeographical differences occurring throughout its distribution area, which spreads from the Trnovski gozd plateau in the northwest to Velebit and Lička Plješivica in the southeast, indicate that the association is not homogenous. The reason for this is in the lower proportion of Southeast – European-Illyrian (Illyricoid) species towards the north-west, while the influence of Alpine species is greater from the north-west direction because of the close proximity of the Alps (M. WRABER 1953, 1959, PUNCER 1979, DAKSKOBLER et al. 2000, SURINA 2001). The aim of the paper is to highlight the phytogeographical characteristics of the *Omphalodo-Fagetum* association in the western part of the Illyrian floral province (i.e. Slovenia and Croatia, Fig. 1)

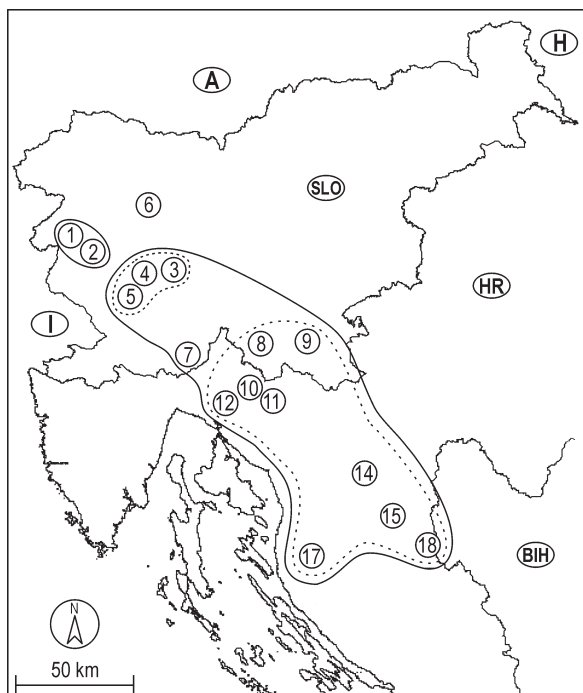


Fig. 1. Map of the studied area with phytogeographical differentiation of the association *Omphalodo-Fagetum* s. lat. (numbers correspond to columns in the synoptic phytosociological table – Tab. 1).

Materials and Methods

A total of 568 published relevés made according to the standard Central European methodology (BRAUN-BLANQUET 1964) from west Slovenia to southwest Croatia were taken into account (Fig. 1). We followed the principle of the multi-dimensional subdivision of vegetation units (MATUSZKIEWICZ and MATUSZKIEWICZ 1981). A synoptic phytosociological table was used for further classification of the columns with the aid of the computer programme SYN-TAX, using the methods of hierarchical classification (PODANI 1993). The measures of dissimilarity were the complement of the coefficient »similarity ratio« and a complement of the Jaccard coefficient. We used the Farthest neighbour – Complete linkage clustering method and the ordination method of Principal Coordinates Analysis (PCoA). In the first step, extensive comparison was made considering similar syntaxa from Central and South Eastern Europe and in the next step, only west-Dinaric fir-beech forests from the western part of the Illyrian floral province were taken into account.

The nomenclature source for ferns and flowering plants was the Register of the Flora of Slovenia (TRPIN and VREŠ 1995), in some cases we also took into account the most recent edition of Mala flora Slovenije (MARTINČIČ et al. 1999). With the names of mosses we followed the Moos flora of Germany and The Mosses of England and Ireland (FRAHM and FREY 1992, SMITH 1996), and with lichens the Catalogue of the lichenized and lichenicolous fungi of Slovenia (SUPPAN et al. 2000). Mosses and lichens were excluded in the use of methods of hierarchical classification and ordination since several authors have not included cryptogams into the phytosociological tables.

Results

In the first step (Fig. 2), the first well-distinguished group (A) forms stands from the Dinaric mountains ranging from Slovenia to Albania, including stands from Suva Planina (East Serbia) and according to subsistent syntaxonomy, in a broader sense group A corresponds well to the *Aremonio-Fagion* alliance. On the other hand, group C is fairly well differentiated from the other syntaxa. It includes predominantly Central European fir-beech stands on more acidophilic bedrock.

Pre-Alpine fir-beech forests from the syntaxa *Homogyno sylvestris-Fagetum* Marinček et al. 1993 var. geogr. *Sesleria autumnalis* Dakskobler 2001 and var. geogr. *Scopolia carniolica* Dakskobler 2001 (= *Abieti-Fagetum austroalpinum*) are gathered in group B, apart from group C which justifies the classification of pre-Alpine fir-beech forests from Slovenia to the *Aremonio-Fagion* alliance. Other analyses (DAKSKOBLER et al. 2000, DAKSKOBLER 2001, SURINA 2001) have also confirmed that fir-beech stands on the Trnovski gozd plateau are transitional between west-Dinaric – *Omphalodo-Fagetum* – and pre-Alpine – *Homogyno sylvestris-Fagetum* (No. 17, Fig. 2). Although the separation of group C from groups A and B is mainly linked with the characteristics of the bedrock (calcareous/non-calcareous-silicate), a distinct phytogeographical differentiation is already evident within the Dinaric fir-beech stands (group A).

In the next step, where only west-Dinaric fir-beech forests (group A – partly, Fig. 2) from the western part of the Illyrian floral province (i.e. Slovenian and Croatian stands) were taken into account (Fig. 3) dendrograms A and as B a show phytogeographical pattern in a northwest-southeast direction.

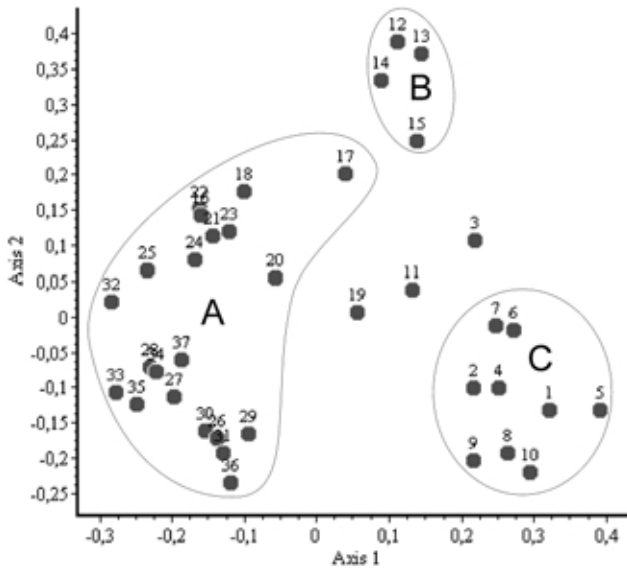


Fig. 2. Two-dimensional scatter-diagram of some fir-beech syntaxa of Central and South Eastern Europe; A – syntaxa from south-east Europe, B – pre-Alpine fir-beech forest (*Homogyno sylvestris-Fagetum* Marinček et al. 1993 var. geogr. *Sesleria autumnalis* Dakskobler 2001 and var. geogr. *Scopolia carniolica* Dakskobler 2001), C – Central European syntaxa (PCoA, similarity ratio).

Legend to Fig. 2. List of fir-beech syntaxa from Central- and South-eastern Europe.

1. Central part of the pre-Alpine phytogeographical region in Slovenia: *Luzulo-Abieti-Fagetum praealpinum typicum* (MARINČEK and DAKSKOBLER 1988)
2. Pohorje (Slovenia): *Luzulo-Abieti-Fagetum praealpinum galietosum rotundifolii* (MARINČEK and DAKSKOBLER 1988)
3. Baška grapa (Slovenia): *Luzulo-Abieti-Fagetum praealpinum lamietosum orvalae* (MARINČEK and DAKSKOBLER 1988)
4. Jelendol, the Karavanke Alps (Slovenia): *Abieti-Fagetum praealpinum luzuletosum* (ROBIČ 1965 mscr.)
5. Northern slopes of the Karavanke Alps and the Carnic Alps (Austria): *Luzulo-(Abieti)-Fagetum* var. *Anemone trifolia* (ZUKRIGL 1989)
6. Northern slopes of the Karavanke Alps and the Carnic Alps (Austria): *Lamiastro flavidi-(Abieti)-Fagetum* (ZUKRIGL 1989)
7. Eastern Alps (Avstrija): *Luzulo-(Abieti)-Fagetum typicum, festucetosum, dryopteridetosum, petasitetosum* (ZUKRIGL 1973)
8. Northern slopes of the Central Alps (Avstrija): *Abieti-Fagetum luzuletosum sylvaticae* (MAYER 1963)
9. Swiss Alps (Switzerland): *Abieti-Fagetum luzuletosum sylvaticae* (KUOCH 1954)
10. Schwarzwald (Germany): *Luzulo-Fagetum luzuletosum sylvaticae* (OBERDORFER 1957)
11. Jelendol, the Karavanke Alps (Slovenia): *Abieti-Fagetum praealpinum* (ROBIČ 1965 mscr.)
12. Kneža, Zadlaščica (Slovenia): *Homogyno sylvestris-Fagetum* var. geogr. *Sesleria autumnalis rhododendretosum hirsuti* (DAKSKOBLER 2000 mscr.)
13. Kneža, Zadlaščica (Slovenia): *Homogyno sylvestris-Fagetum* var. geogr. *Sesleria autumnalis typicum* (DAKSKOBLER 2000 mscr.)
14. Kneža, Zadlaščica (Slovenia): *Homogyno sylvestris-Fagetum* var. geogr. *Sesleria autumnalis athyrietosum* (DAKSKOBLER 2000 mscr.)
15. Porezen (Slovenia): *Homogyno sylvestris-Fagetum* var. geogr. *Scopolia carniolica* (DAKSKOBLER 2000 mscr.)

16. Blegoš (Slovenia): *Omphalodo-Fagetum ranunculetosum platanifolii* (MARINČEK and P. KOŠIR 1998)
17. Trnovski gozd (Slovenia): *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia* and var. geogr. *Calamintha grandiflora*, (SURINA 2001)
18. Nanos (Slovenia): *Abieti-Fagetum dinaricum* s. lat. (DAKSKOBLER 1986)
19. Pivka basin (Slovenia): *Abieti-Fagetum dinaricum equisetosum* (PUNCER and ZUPANČIČ 1975)
20. Snežnik (Slovenia): *Abieti-Fagetum dinaricum* s. lat. (TREGUBOV 1957)
21. Kočevsko region (Slovenia): *Abieti-Fagetum dinaricum* s. lat. (PUNCER 1980)
22. Krokari (Slovenia): *Abieti-Fagetum* var. geogr. *Omphalodes verna* (ZUPANČIČ and PUNCER 1995)
23. Strmec (Slovenia): *Abieti-Fagetum* var. geogr. *Omphalodes verna* (ZUPANČIČ and PUNCER 1995)
24. Rog (Slovenia): *Abieti-Fagetum dinaricum* s. lat. (PUNCER et al. 1974)
25. Delnice-Gorski Kotar (Croatia): *Fagetum silvaticae australe croaticum abietetosum* s. lat. (PELCER 1976)
26. Grmeč, Klelovača (Bosnia and Hercegovina): *Abieti-Fagetum dinaricum piceetosum*, (TREGUBOV 1941)
27. Igman (Bosnia and Hercegovina): *Abieti-Fagetum dinaricum* s. lat. (FUKAREK 1964)
28. Gostović (Bosnia and Hercegovina): »Cardamine-beech forest«, Krause and Ludw. 1957 (HORVAT et al. 1974)
29. Peručica (Bosnia and Hercegovina): *Abieti-Fagetum illyricum* (FUKAREK and STEFANOVIĆ 1958)
30. Čorkova uvala-Gorski Kotar (Croatia): *Fagetum silvaticae australe croaticum abietetosum* (TRINAJSTIĆ 1972)
31. Lička Plješivica (Croatia): *Fagetum silvaticae australe croaticum abietetosum* (HORVAT 1938)
32. Mala Kapela (Croatia): *Fagetum silvaticae australe croaticum abietetosum* (TRINAJSTIĆ 1972)
33. Velebit (Croatia): *Fagetum silvaticae australe croaticum abietetosum* (HORVAT 1938)
34. Southwest Croatia: *Fagetum silvaticae australe croaticum abietetosum* (HORVAT et al. 1974)
35. Piva valley (Yugoslavia): *Abieti-Fagetum montenegrinum* (BLEČIĆ 1958)
36. Albania; »beech forest« (MARKGRAF 1927)
37. Suva Planina (Yugoslavia): *Abieti-Fagetum serbicum* (JOVANOVIĆ 1955)

In dendrogram A (complete linkage clustering, similarity ratio) two large groups are formed. The first cluster combines stands from the Trnovski gozd plateau, Nanos, Ravnik-Logatec, Blegoš and Snežnik (Slovenia) while the second cluster includes stands from Hrušica, the Kočevsko region, Rog (Slovenia), Delnice, Delnice-Kupjak, Gorski Kotar, Risnjak, southwest Croatia, Velebit, Lička Plješivica, Mala Kapela and Čorkova uvala (Croatia). Dendrogram B (complete linkage clustering, Jaccard's index) is similar to dendrogram A except that Hrušica, the Kočevsko region and Rog are included in the Slovenian group and Blegoš in the Croatian group. Stands from the Trnovski gozd plateau form an even more distinct group in dendrogram B than in dendrogram A. Comparing the two dendrograms, similarities within certain branches are evident, i.e. pooling stands from Mala Kapela, Čorkova uvala, southwest Croatia, Velebit and Lička Plješivica on the one hand and the group of the Gorski Kotar area on the other.

On the basis of the synoptic table (Tab. 1) and analyses using the methods of hierarchical classification and ordination (Figs. 2 and 3, DAKSKOBLER et al. 2000, DAKSKOBLER 2001, SURINA 2001) we split the (macro) association *Omphalodo-Fagetum* s. lat. into two geographical variants: var. geogr. *Saxifraga cuneifolia* and var. geogr. *Calamintha grandiflora*. Within both geographical variants we also recognize two geographical sub-variants:

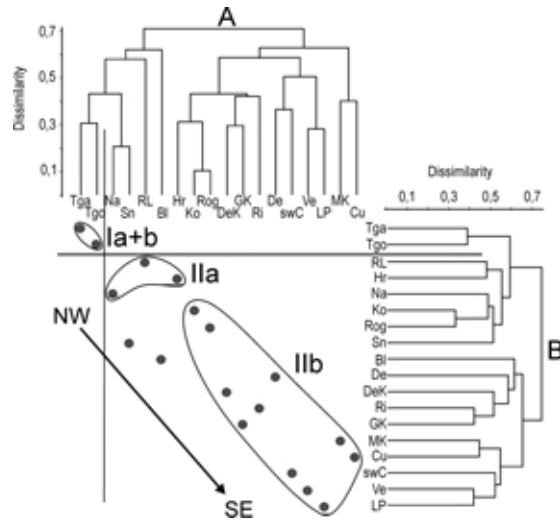


Fig. 3. Dendrogram of west-Dinaric fir-beech forests (*Omphalodo-Fagetum* s. lat.) from Slovenia (1–9) and Croatia (10–18); A = complete linkage clustering, similarity ratio; B = complete linkage clustering, Jaccard; I = var. geogr. *Saxifraga cuneifolia*, a = subvar. geogr. *Anemone trifolia*, b = subvar. geogr. *Omphalodes verna*; II = var. geogr. *Calamintha grandiflora*, a = subvar. geogr. *Dentaria pentaphyllos*, b = subvar. geogr. *Dentaria polyphylla*.

Legend to Fig. 3 and Tab. 1. List of west-Dinaric fir-beech syntaxa from the western part of the Illyrian floral province.

1. Tga: *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia* subvar. geogr. *Anemone trifolia* (SURINA 2001); W part of the Trnovski gozd plateau
2. Tgo: *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia* subvar. geogr. *Omphalodes verna* (SURINA 2001); E part of the Trnovski gozd plateau
3. RL: *Abieti-Fagetum dinaricum* s. lat. (TREGUBOV 1960, TREGUBOV 1962b); Ravnik-Logatec
4. Hr: *Abieti-Fagetum dinaricum* s. lat., (TREGUBOV 1962a); Hrušica
5. Na: *Abieti-Fagetum dinaricum* s. lat., M. Wraber 1970 mscr. (TREGUBOV 1962a, TREGUBOV 1962c, DAKSKOBLER 1986); Nanos
6. Bl: *Omphalodo-Fagetum ranunculetosum platanifolii* (MARINČEK and P. KOŠIR 1998); Blegoš
7. Sn: *Abieti-Fagetum dinaricum* s. lat. (TREGUBOV 1957); ; Snežnik
8. Ko: *Abieti-Fagetum dinaricum* s. lat., (PUNCER 1980), , *Abieti-Fagetum* var. geogr. *Omphalodes verna* (ZUPANČIČ and PUNCER 1995); Kočevsko, Strmec, Krokav
9. Ro: *Abieti-Fagetum dinaricum* s. lat., (PUNCER et al. 1974), (ACCETTO 1978), *Omphalodo-Fagetum festucetosum drymeiae* (ACCETTO 1998); Rog
10. De: *Fagetum silvaticae croaticum australe abietetosum* s. lat. (PELCER 1976); Delnice
11. DeK: *Abieti-Fagetum croaticum* s. lat. (RAUŠ et al. 1996); Delnice-Kupjak
12. Ri: *Abieti-Fagetum illyricum* s. lat. (VUKELIĆ 1985); 5 relevés, (RAUŠ et al. 1996); 5 relevés; Risnjak
13. GK: *Omphalodo-Fagetum* s. lat. (VUKELIĆ and BARIČEVIĆ 1996); Gorski Kotar
14. MK: *Fagetum silvaticae croaticum australe abietetosum* s. lat. (TRINAJSTIĆ 1970); Mala Kapela
15. CU: *Fagetum silvaticae croaticum australe abietetosum* s. lat. (TRINAJSTIĆ 1970); 3 relevés, (RAUŠ et al. 1996); 1 relevé; Čorkova uvala
16. swC: *Fagetum silvaticae croaticum australe abietetosum* s. lat. (HORVAT et al. 1974); SW Croatia
17. Ve: *Fagetum silvaticae croaticum australe abietetosum* s. lat. (HORVAT 1938); 8 relevés, (VUKELIĆ and BARIČEVIĆ 1996); 20 relevés, (RAUŠ et al. 1996); 5+3+3 relevés; Velebit
18. LP: *Fagetum silvaticae croaticum australe abietetosum* s. lat. (HORVAT 1938); 7 rel., (BERTOVIĆ et al. 1966) : 16 relevés; Lička Plješivica

Tab. 1. Synoptic table of the (macro) association *Omphalodo-Fagetum* s. lat. in the north-western part of the Illyrian floral province.

Successive number	CROATIA																		
	SLOVENIA									CROATIA									
	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	
	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23	
Character and differential species of the association <i>Omphalodo-Fagetum</i> (Tregubov 1957 corr. Puncer 1980) Marinček et al. 1993																			
VP	A	100	100	93	97	100	100	100	97	90	100	100	100	100	100	90	100	100	
	B	39	68	88	47	76	17	40	87	70	90	77	30	50	80	100	70	54	
	C	84	92	81	47	65	33	93	75	90	90	15	80	70	100	100	90	46	
AF	C	74	100	88	100	85	100	88	85	93	90	8	80	30	100	50	70	44	
AF	C	59	38	81	47	82	50	69	91	93	90	54	60	50	100	90	77	79	
AF	C	18	72	53	85	50	60	73	82	90	15	40	30	100	70	67	79	79	
AF	B	8	63	53	38	17	55	60	62	90	85	100	90	100	100	50	5	43	
AF	C	3	62	94	100	18	100	32	94	97	100	80	90	100	25	90	28	28	
Differential species for the geographical variant <i>Saxifraga cuneifolia</i>																			
VP	C	26	56																
	A	2																	
FS	B	1	2																
	C	4	2																
AT	C	4	40																
AT	C	7	22																
FS	C	26	6																
Edaphic differential species																			
VP	C	72	26				2			10						10			
VP	C	54	78																
Differential species of the geographical subvariant <i>Anemone trifolia</i>																			
	C	30																	
Differential species of the geographical subvariant <i>Omphalodes verna</i>																			
AF	C	3	62	94	100	18	100	32	94	97	100	30	90	100	25	90	28	28	
Differential species of the geographical variant <i>Calamintha grandiflora</i>																			
AF	C	18	72	53	50	50	60	73	82	90	15	40	30	100	70	67	67	67	
AF	C	3	62	94	100	18	100	32	94	97	100	80	90	100	25	90	28	28	

Tab. 1. – continued

Successive number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Region	Number of relevés	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	
		SLOVENIA										CROATIA								
Differential species of the geographical subvariant <i>Dentaria pentaphyllos</i>																				
FS	C	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23	
Differential species of the geographical subvariant <i>Dentaria polyphylla</i>																				
AF	C	12	8	59	100	18	.	.	.	.	.	.	.	.	.	.	.	.	.
AF	C	.	.	.	.	.	.	.	6	3	.	15	20	30	100	50	30	31	.
AF	C	.	.	.	.	.	.	.	3	11	30	.	.	30	100	50	30	31	38
<i>Aremonio-Fagion</i> (Horvat 1938) Borhidi in Torok, Podani et Borhidi 1989																				
AF	C	74	100	88	100	85	100	88	85	93	90	8	80	30	100	75	70	44	25	
	C	59	38	81	47	82	50	69	91	93	90	54	60	50	100	.	90	77	79	
	C	86	86	72	93	32	100	33	43	43	90	23	80	50	100	.	50	54	47	
	B	8	.	63	53	38	17	55	60	62	90	85	100	90	100	100	50	5	43	
	C	32	36	66	20	68	100	18	47	52	30	.	80	30	60	25	30	13	4	
	C	3	62	94	100	18	100	32	94	97	.	100	80	90	100	25	90	28	.	
	C	18	18	72	53	85	50	60	73	82	90	15	40	30	100	.	70	67	.	
	C	58	18	47	80	3	17	5	41	25	.	62	60	50	80	.	30	.	.	
	C	3	42	38	20	3	.	2	13	2	50	.	70	50	.	.	30	23	.	
	C	3	.	22	100	3	.	.	38	30	50	.	.	.	80	.	.	5	.	
	C	.	.	.	.	.	.	.	3	11	30	.	.	.	30	100	50	31	38
	C	2	47	13	.	83	5	16	16	.	50	.	50	30	20	.	.	.	7	
	C	16	47	.	.	100	2	8	10	10	.	.	70	.	.	25	10	.	.	
	C	3	.	6	.	33	5	9	3	3	.	.	.	.	.	25	10	3	.
	B	.	.	.	20	9	.	20	40	65	70	100	90	70	.	25	.	5	4	
	C	45	16	.	.	9	.	.	13	13	.	.	.	10	.	.	.	41	4	
	C	1	.	25	.	9	.	17	13	10	.	.	.	.	.	.	.	.	.
	C	1	.	1	93	9	.	.	.	.	.	.	.	.	.	.	.	.	.
	C	.	.	.	.	.	.	.	6	3	.	15	20	30	100	50	30	26	.
	C	.	.	.	.	.	.	.	.	.	.	.	40	10	40	25	10	5	13
	C	3	.	.	.	.	.	.	.	.	.	.	10	50	.	.	50	.	.
	C	30	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	C	.	.	.	.	.	.	.	.	2	.	.	.	.	20	.	.	.	.

Tab. 1. – continued

Region	SLOVENIA																		CROATIA									
	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	12	13	10	21	5	4	6	39	23	
	69	50	32	15	34	6	60	108	61																			
Number of relevés				7					11																			
<i>Festuca drymeia</i>	C																											
<i>Acer obtusatum</i>	A							2																				
<i>Polystichum setiferum</i>	B							8																				
<i>Knautia drymeia</i> subsp. <i>drymeia</i>	C	7																										
	C							2																				
FS																												
<i>Fagetalia sylvaticae</i> Pawłowski 1928																												
<i>Fagus sylvatica</i>	A	100	100	63	100	100	100	100	97	97	90	100	100	100	100	90	82	100										
<i>Fagus sylvatica</i>	B	81	94	81	93	88	67	90	94	90	90	100	100	100	100	90	77	79										
<i>Fagus sylvatica</i>	C	86	88	6		24	17	22	40	54	90				25	90	44	65										
<i>Daphne mezereum</i>	B	80	80	94	87	94	83	92	89	95	90	46	90	70	100	100	50	23	16									
<i>Mycelis muralis</i>	C	87	66	78	53	68	67	90	86	82	50	8	50	30	100	50	90	54	93									
<i>Sanicula europaea</i>	C	28	22	84	73	53	83	48	74	64	70	100	70	90	100	100	70	51	93									
<i>Galium odoratum</i>	C	75	32	10	93	59	50	17	57	93	90	69	90	70	100	100	50	74	93									
<i>Paris quadrifolia</i>	C	84	84	72	33	38	17	48	55	64	70	15	70	50	100	75	70	56	75									
<i>Viola reichenbachiana</i>	C	35	18	78	53	44	50	32	50	39	10	15	30	30	100	75	90	49	79									
<i>Carex sylvatica</i>	C	13	14	56	67	44	17	43	67	62	90	85	60	50	100	75	90	59	67									
<i>Polystichum aculeatum</i>	C	26	66	56	87	65		27	76	57	90		40	10	80	100	70	62	48									
<i>Euphorbia amygdaloides</i>	C		14	69	53	44	100	65	58	46	70	92	40	50	60	100	70	54	89									
<i>Prenanthes purpurea</i>	C	62	100	44	40	79	50	78	69	52	90		80	50	20	25	50	51	84									
<i>Mercurialis perennis</i>	C	51	50	97	67	79	100	85	64	57	90	85	90	90	80	25		28	11									
<i>Actaea spicata</i>	C	52	74	72	67	8	17	37	47	39	70	77	60	70	100	25	30	46	35									
<i>Lonicera alpigena</i>	B	30	60	81	53	68		62	26	42	10	62	70	70	60	25	50	38	62									
<i>Salvia glutinosa</i>	C	41	12	1	100	26	33	2	66	39	70	77		70	100	50	30	15	21									
<i>Sambucus nigra</i>	B	41	30	53	13	3	33	8	8	18	10				60	50		10	0									
<i>Polygonatum multiflorum</i>	C	28	1	56	7	32	33	30	24	36	50	62	80	50	40	25	10	15	30									
<i>Lathyrus vernus</i> subsp. <i>vernus</i>	C	52	6	38	13	24	100	8	2				20	10	40	50	10	5	43									
<i>Neottia nidus-avis</i>	C	29	20	38	7	6		22	15	23			40		40	25	10	8	9									
<i>Dentaria bulbifera</i>	C	38	10	5	53	32	33		38	25		38	30	30	80	25	70	51	39									
<i>Epilobium montanum</i>	C	39	52		7	35		18	34	41	10	8		100	50	70	23	49										

Tab. 1. – continued

Region	SLOVENIA																		CROATIA																	
	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23																		
Number of relevés																																				
<i>Scrophularia nodosa</i>	C	30	6	9	7	3	17	3	23	20	15	.	.	40	75	30	5	7																		
<i>Acer pseudoplatanus</i>	A	23	50	66	53	71	17	52	49	21	70	62	70	50	.	70	18	35																		
<i>Acer pseudoplatanus</i>	B	55	76	78	60	53	17	18	57	30	50	30	10	.	25	70	28	35																		
<i>Acer pseudoplatanus</i>	C	70	84	34	60	59	67	67	52	36	90	46	70	70	.	50	36	7																		
<i>Festuca altissima</i>	C	77	40	10	73	88	.	77	71	38	70	85	.	50	25	50	38	.																		
<i>Symphytum tuberosum</i>	C	10	8	19	53	.	67	.	13	11	.	.	60	30	40	25	70	49	34																	
<i>Lilium martagon</i>	C	12	44	.	.	.	67	3	1	.	10	46	60	50	40	25	50	13	4																	
<i>Brachypodium sylvaticum</i>	C	.	.	38	33	12	.	22	56	69	50	10	.	25	10	.	.	4																		
<i>Phyllitis scolopendrium</i>	C	17	6	47	.	12	.	3	16	20	.	15	30	.	80	100	.	5	21																	
<i>Asarum europaeum</i> subsp. <i>caucasicum</i>	C	1	2	88	27	6	.	.	19	25	.	.	.	.	80	10	.	.	.													
<i>Arium maculatum</i>	C	23	.	9	20	12	.	.	2	16	.	.	20	.	100	25	10	21	.																	
<i>Ulmus glabra</i>	A	3	2	28	40	18	.	35	32	8	30	8	40	10	.	.	3	7																		
<i>Ulmus glabra</i>	B	1	2	56	47	29	.	15	42	18	30	15	30	10	.	.	5	7																		
<i>Ulmus glabra</i>	C	.	2	.	47	3	.	35	23	3	90	15	.	.	.	10	3	.																		
<i>Galeobdolon luteum</i> agg.	C	71	.	.	53	38	.	67	65	66	.	92	90	.	60	75	.	10	.																	
<i>Ranunculus lanuginosus</i>	C	12	6	47	13	15	.	3	.	.	.	.	.	30	60	.	30	18	.												
<i>Phyteuma spicatum</i>	C	6	6	31	.	.	.	10	6	3	50	.	.	30	40	25	10	.	.																	
<i>Melica nutans</i>	C	3	2	56	7	6	.	7	3	.	.	.	.	.	.	10	13	.	.											
<i>Epipactis helleborine</i>	C	16	14	6	.	6	17	2	3	.	.	.	.	.	20	.	10	.	.												
<i>Pulmonaria officinalis</i>	C	.	2	97	53	24	33	.	19	.	.	77	30	50	100	.	15	7	.																	
<i>Rosa arvensis</i> (?)	B	.	.	63	.	3	.	.	2	3	90	.	.	.	.	30	8	4	.													
<i>Veronica montana</i>	C	3	.	.	.	.	.	.	1	18	.	.	.	.	80	25	10	10	4										
<i>Heracleum sphondylium</i> s. lat.	C	6	4	31	.	3	50	.	6	3	30	.	10																	
<i>Hordeolymus europaeus</i>	C	.	.	.	.	.	23	35	20	.	.	.	.	.	20	50	10	36	49										
<i>Campanula trachelium</i>	C	4	.	9	.	9	50	.	5	2	.	.	.	.	80														
<i>Adoxa moschatellina</i>	C	32	22	.	7	15	17	.	7	8																	
<i>Carex pilosa</i>	C	.	.	78	27	9	.	.	10	3	.	.	.	.	.	25	.	8	.												
<i>Acer platanoides</i>	A	1	.	3	.	.	.	.	.	.	10	.	.	.	100	25	10	3	22											
<i>Acer platanoides</i>	B	4	.	6	.	3	.	.	.	.	.	.	.	60	.	.	.	13	9										

Tab. 1. – continued

Region	SLOVENIA																		CROATIA																	
	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	1	.	.	.	3	.	.	.	.	.	.	.	.	.	.	10	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	38	22	16	.	6	50	.	.	2	30	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	17	2	.	.	.	.	.	15	15	15	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	.	.	.	.	3	100	.	6	3	90	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	.	.	16	.	.	.	.	27	33	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	.	.	.	.	12	.	18	6	15	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
A	3	6	13	13	.	.	.	6	3	15	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
B	10	2	28	.	.	.	.	4	5	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	1	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	71	58	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	42	14	.	.	6	.	.	12	15	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	26	4	.	7	6	.	.	9	2	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	12	8	59	100	18	.	.	.	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	.	.	.	.	.	.	7	.	3	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	16	4	.	7	.	.	.	4	.	15	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	1	40	.	7	6	.	3	.	.	.	20	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	4	.	.	7	6	.	.	6	2	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	4	.	.	7	6	.	.	.	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
A	1	6	9	.	.	.	.	.	.	.	20	10	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
B	3	8	31	.	6	.	.	.	.	.	.	10	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
A	.	.	6	.	6	.	.	.	.	70	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	.	.	.	.	3	.	.	.	.	70	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	20	4	.	.	3	.	3	.	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	1	4	.	.	.	17	.	1	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	1	4	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	4	8	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	4	8	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	6	3	.	.	.	.	.	1	.	.	10	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
C	1	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
A	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23

Tab. 1. – continued

Region	SLOVENIA																		CROATIA									
	Tga	Tgo	RL	3	4	5	6	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP								
	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23										
Number of relevés			25						3																			
<i>Allium ursinum</i>	B																			3								
<i>Corydalis cava</i>	C	1									10								30									
<i>Anemone ranunculoides</i>	C	6																10	8	4								
<i>Acer campestre</i>	C	1																10	5									
<i>Cornus sanguinea</i>	A		16						5	2																		
<i>Cardamine flexuosa</i>	B		6						4	2																		
<i>Carex pendula</i>	C	1			6																							
<i>Fragaria moschata</i>	C								6	20																		
<i>Ilex aquifolium</i>	C								2	10																		
<i>Cephalanthera longifolia</i>	B								2	7																		
<i>Laburnum alpinum</i>	C								6	2																		
<i>Laburnum alpinum</i>	A	1	2																									
<i>Laburnum alpinum</i>	B	4	2																									
<i>Laburnum alpinum</i>	C		2																									
<i>Tilia cordata</i>	A								1																			
<i>Tilia cordata</i>	B								1	2																		
<i>Lathyrus vernus</i> subsp. <i>flaccidus</i>	C	26	6																									
<i>Polystichum aculeatum</i> x <i>braunii</i>	C	4	10																									
<i>Poa nemoralis</i>	C	1	2																									
<i>Melandryum rubrum</i>	C								1	2																		
<i>Melica uniflora</i>	C														60													
<i>Phyteuma spicatum</i> x <i>ovatum</i>	C		30														25											
<i>Silene nemoralis</i>	C																											
<i>Cephalanthera rubra</i>	C																	10										
<i>Corydalis solida</i>	C	7																										
<i>Leucopogon vernum</i>	C									3																		
<i>Campanula latifolia</i>	C				3																							
<i>Festuca gigantea</i>	C				3										10													
<i>Myosotis scorpioides</i> (?)	C				3																							

Tab. 1. – continued

Region	Successive number																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP
	SLOVENIA									CROATIA								
Number of relevés	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23
<i>Peucedanum verticillare</i>	C	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cerastium sylvaticum</i>	C	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dryopteris villarii</i>	C	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Peucedanum austriacum</i>	C	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Chaerophyllum hirsutum</i>	C	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
<i>Taxus baccata</i>	A	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
<i>Scrophularia vernalis</i>	C	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Listera ovata</i>	C	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
QP <i>Quercetalia pubescentis</i> Klika 1933 s. lat.																		
<i>Sorbus aria</i>	A	6	22	.	12	.	.	2	.	10	.	.	.	.	.	.	.	.
<i>Sorbus aria</i>	B	26	52	25	26	.	18	11	7	10	15	60	.	.	.	.	.	.
<i>Sorbus aria</i>	C	20	32	.	.	.	.	.	2	10	.	.	.	.	.	.	.	.
<i>Euonymus verrucosa</i>	B	.	.	75	20	6	12	15	5	10	.	.	.	.	.	.	.	.
<i>Fraxinus ornus</i>	A	.	.	.	.	3	.	4	.	.	.	.	.	.	.	.	.	.
<i>Fraxinus ornus</i>	B	10	.	6	3	3	.	7	2	.	.	.	.	.	.	.	.	.
<i>Fraxinus ornus</i>	C	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
<i>Digitalis grandiflora</i>	C	1	.	9	.	50	.	6	.	.	.	.	.	.	.	.	.	.
<i>Carex flacca</i>	C	.	.	.	3	33	.	6	2	.	.	.	.	.	.	.	.	.
<i>Convallaria majalis</i>	C	7	14	.	3	.	.	1	.	.	.	.	.	.	.	.	.	.
<i>Tamus communis</i>	C	1	.	.	.	.	.	2	2	10	.	.	.	.	.	.	.	.
<i>Piptatherum virescens</i>	C	3	.	25	.	.	.	5	.	.	.	.	.	.	.	.	.	.
<i>Sesleria autumnalis</i>	C	28	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ostrya carpinifolia</i>	A	.	.	.	3	.	.	2	.	.	.	.	.	.	.	.	.	.
	B	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	C	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Arabis turrita</i>	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Vincetoxicum hirundinaria</i>	C	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tanacetum corymbosum</i>	C	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Melittis melissophyllum</i>	C	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.
<i>Campanula persicifolia</i>	C	.	2	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.

Tab. 1. – continued

Successive number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Region	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	
	SLOVENIA										CROATIA								
Number of relevés	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23	
QF <i>Quercus-Fageteta</i> Br.-Bl. et Vlieg. 1937 s. lat.																			
<i>Anemone nemorosa</i>	C	84	96	44	33	38	100	32	50	44	90	31	100	50	60	25	90	77	24
<i>Corylus avellana</i>	B	12	6	97	100	62	.	30	41	43	50	100	20	30	100	.	.	10	7
<i>Carex digitata</i>	B	39	32	78	33	32	33	37	60	33	30	.	.	.	.	.	.	.	.
<i>Lonicera xylosteum</i>	C	20	4	94	87	24	.	.	41	57	30	85	40	50	80	25	10	5	.
<i>Platanthera bifolia</i>	C	17	18	59	7	9	.	43	22	16	.	.	.	.	60	.	10	0	7
<i>Clematis vitalba</i>	B	1	10	10	7	3	17	3	22	12	10	.	.	.	.	.	.	15	.
<i>Euonymus latifolia</i>	B	1	.	6	7	6	.	.	3	8	.	.	20	10	80	.	10	26	.
<i>Hedera helix</i>	B	.	.	59	7	3	.	2	12	5	10	.	.	.	.	.	.	28	21
<i>Hepatica nobilis</i>	C	10	36	16	.	9	17	.	4	3	10	.	.	.	25	.	.	.	.
<i>Veronica officinalis</i>	C	.	.	6	.	.	.	15	6	.	.	.	.	.	20	.	30	8	.
<i>Crataegus monogyna</i>	B	.	.	31	.	3	.	3	6	3	.	.	.	.	40	.	.	.	.
<i>Pteridium aquilinum</i>	C	.	.	16	.	3	.	.	14	3	10	.	10	.	.	.	.	.	.
<i>Crucjata glabra</i>	C	.	4	13	.	3	.	2	6	.	.	.	.	.	.	.	.	.	.
<i>Staphylea pinnata</i>	B	.	.	19	13	.	.	.	.	.	.	.	.	.	40	.	.	.	.
<i>Berberis vulgaris</i>	B	.	.	53	.	.	.	2	6	.	.	.	.	.	.	.	.	.	.
<i>Ribes uva-crispa</i>	B	.	.	9	.	.	.	.	.	.	.	.	.	.	20	.	.	5	.
<i>Moeblingia trinervia</i>	C	6	.	.	.	3	.	.	.	.	.	.	.	.	.	.	30	.	.
<i>Viburnum lantana</i>	B	3	2	19	.	3	.	.	3	.	.	.	.	.	.	.	.	.	.
<i>Vinca minor</i>	C	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	10	.	.
<i>Aegopodium podagraria</i>	C	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lonicera caprifolium</i>	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Clinopodium vulgare</i>	C	.	.	38	.	.	.	.	2	.	.	.	.	.	.	.	.	.	13
<i>Ligustrum vulgare</i>	B	.	.	16	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
<i>Betonica officinalis</i>	C	.	.	.	.	.	17	.	2	.	.	.	.	.	.	.	.	.	.
<i>Anemone x pittonii</i>	C	10	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Gagea lutea</i>	C	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
<i>Galanthus nivalis</i>	C	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.
<i>Viburnum opulus</i>	B	.	.	9	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.

Tab. 1. – continued

Region	SLOVENIA																		CROATIA									
	Tga	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18									
Successive number	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP										
	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23										
Number of relevés																												
<i>Quercus petraea</i>	A	.	.	3	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
<i>Quercus petraea</i>	B	.	.	22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Frangula alnus</i>	B	1	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
<i>Prunus spinosa</i>	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	70	.	.	.
<i>Cornus mas</i>	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scilla bifolia</i>	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.
<i>Pyrus pyraeaster</i>	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Stellaria holostea</i>	C	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rhamnus catharticus</i>	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hypericum montanum</i>	C	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ranunculus auricomus</i> agg.	C	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Quercus robur</i>	B	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
VP																												
Vaccinio-Piceetea Br.-Bl. 1939 emend. Zupančić 1976 s. lat.																												
<i>Abies alba</i>	A	100	100	100	93	59	100	100	100	97	90	100	100	100	100	100	90	85	100									
<i>Abies alba</i>	B	39	68	88	47	48	17	40	87	70	90	92	30	50	80	100	70	54	89									
<i>Abies alba</i>	C	84	92	81	47	35	33	93	75	90	90	15	80	70	100	100	90	46	80									
<i>Oxalis acetosella</i>	C	87	90	97	93	82	33	88	88	97	90	38	60	30	100	100	90	77	93									
<i>Gentiana asclepiadea</i>	C	41	86	72	60	8	67	28	56	34	30	23	60	50	60	30	28	13										
<i>Picea abies</i>	A	23	68	5	9	41	50	60	43	28	.	.	20	10	60	75	10	28	70									
<i>Picea abies</i>	B	12	54	59	12	41	.	82	56	13	.	.	.	.	.	30	33	57					
<i>Picea abies</i>	C	38	58	25	.	18	.	27	22	21	.	.	.	.	25	10	15	21						
<i>Dryopteris dilatata</i>	C	23	54	5	27	32	.	35	33	23	.	.	.	100	100	10	26	22										
<i>Maianthemum bifolium</i>	C	80	86	69	13	56	.	55	26	16	.	60	10	40	25	.	13	20										
<i>Lonicera nigra</i>	B	30	90	16	47	70	.	80	28	8	.	.	10	.	.	30	26	.										
<i>Galium rotundifolium</i>	C	.	.	.	.	.	.	3	20	2	10	.	10	.	100	100	10	28	62			
<i>Solidago virgaurea</i>	C	30	62	75	7	29	.	15	50	36	10	.	.	.	25	.	.	.										
<i>Veronica urticifolia</i>	C	9	76	.	.	.	33	8	1	.	10	.	30	30	.	.	30	36	65									
<i>Aposervis foetida</i>	C	1	4	69	.	3	100	.	11	.	50	.	10	.	.	.	10	.	11									
<i>Vaccinium myrtillus</i>	C	7	68	.	.	44	.	42	24	3	.	.	.	.	.	.	30	21	4			

Tab. 1. – continued

Region	SLOVENIA																		CROATIA																	
	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP									
	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23	12	13	10	21	5	4	6	39	23									
	Number of relevés																																			
C	4	44	22	13	.	.	8	13	2	.	.	.	.	.	25	10	3	.	.	.	.	.	.	.	.	.	.	.
B	35	70	.	20	59	50	77	56	34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	9	66	.	.	15	.	37	24	3	10	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	16	20	6	.	12	.	48	14	.	10	.	.	.	.	.	.	5	4	.	.	.	.	.	.	.	.	.	.
C	4	12	.	7	9	.	8	20	.	.	.	.	.	25	10	.	17	.	.	.	.	.	.	.	.	.	.	.
C	19	68	.	.	26	33	20	2	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	.	.	.	.	24	17	.	34	30	.	40	.	100	100	.	5	.	.	.	.	.	.	.	.	.	.	.	.
C	70	74	.	.	6	83	.	9	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
C	16	60	.	.	9	.	28	19	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	1	.	19	7	3	.	23	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	3	2	.	.	6	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	72	26	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	9	54	.	.	3	.	20	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	17	34	6	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	14	30	.	.	3	.	12	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	.	2	.	7	.	.	3	2	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	10	44	.	7	.	.	.	.	10	.	15	10	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.
C	.	24	.	.	.	.	23	11	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	.	2	.	.	3	.	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	.	.	.	.	3	.	.	11	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	54	78	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21
C	26	56	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	.	.	.	.	.	.	.	1	18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	.	.	.	.	.	.	.	11	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	.	.	.	.	.	.	.	5	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
C	.	2	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B	.	16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Tab. 1. – continued

Successive number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Region	Number of relevés	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP	
		SLOVENIA										CROATIA								
C		69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23	
C	<i>Vaccinium vitis-idaea</i>	.	16
C	<i>Corallorhiza trifida</i>	.	2
C	<i>Moneses uniflora</i>	2
EP	<i>Erico-Pinetea</i> I. Horvat 1959 s. lat.																			
C	<i>Cirsium erisihales</i>	3	26	31	7	6	17	22	19	.	30	54	80	.	.	.	10	5	.	
C	<i>Carex alba</i>	1	2	66	.	6	17	43	10	.	.	.	.	.	.	.	.	.	.
C	<i>Calamagrostis varia</i>	1	8	.	.	3	83	2	1	.	.	.	.	.	.	.	.	.	.
C	<i>Rubus saxatilis</i>	1	46	.	.	.	.	2	.	.	.	.	10	.	.	.	.	.	.
B	<i>Ribes alpinum</i>	.	6	.	.	6	.	.	2	.	.	.	.	.	.	.	.	.	.
B	<i>Rhododendron hirsutum</i>	.	32	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	<i>Pyrola chlorantha</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.
C	<i>Juniperus communis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
C	<i>Sorbus chamaemespilus</i>	.	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	<i>Erica carnea</i>	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	<i>Laserpitium latifolium</i>	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
C	<i>Rhodothamnus chamaecistus</i>	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	<i>Polygala chamaebuxus</i>	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C	<i>Epipactis atrorubens</i>	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
AD	<i>Adenostyletalia</i> G. et J. Br.-Bl. 1931 s. lat.																			
C	<i>Athyrium filix-femina</i>	68	98	78	87	79	33	45	54	64	90	85	30	30	100	75	70	51	57	
C	<i>Senecio ovatus</i> (S. fuchsii)	91	56	10	73	85	83	30	67	74	90	100	100	90	80	75	30	56	70	
C	<i>Dryopteris filix-mas</i>	94	94	1	93	88	67	73	86	87	90	85	60	50	100	25	70	74	70	
C	<i>Geranium robertianum</i>	62	22	47	20	29	.	12	45	30	30	15	.	.	100	100	50	33	13	
C	<i>Polygonatum verticillatum</i>	57	92	.	7	50	100	12	19	8	.	23	50	10	20	50	30	49	17	
C	<i>Myosotis sylvatica</i>	19	4	.	.	3	.	5	12	3	10	.	.	.	60	100	10	8	9	
B	<i>Rubus idaeus</i>	70	80	88	67	82	17	73	73	66	70	23	20	.	.	.	50	33	35	
C	<i>Doronicum austriacum</i>	1	12	.	13	6	17	7	20	20	.	.	.	10	40	.	10	13	.	
C	<i>Veratrum album</i>	14	66	.	13	.	50	.	14	34	.	.	.	.	40	.	30	10	17
C	<i>Petasites albus</i>	.	2	16	47	9	.	3	14	18	.	.	30	.	.	.	.	15	.

Tab. 1. – continued

Region	SLOVENIA											CROATIA										
	Tga	Tgo	RL	Hr	Na	BI	Sn	Ko	Rog	De	DeK	Ri	GK	MK	CU	SWC	Ve	LP				
Number of releves	69	50	32	15	34	6	60	108	61	12	13	10	21	5	4	6	39	23				
<i>Milium effusum</i>	C	23	8	.	.	3	.	1	2	.	15	30	.	.	.	10	28	7				
<i>Saxifraga rotundifolia</i>	C	6	14	.	.	3	.	2	1	.	10	.	.	.	.	10	26	7
<i>Chrysosplenium alternifolium</i>	C	22	6	.	.	6	.	8	18	.	.	.	.	.	.	.	.	4
<i>Ranunculus platanifolius</i>	C	9	52	.	.	6	67	2	.	.	.	50	.	.	25	.	.	.				
<i>Cicerbita alpina</i>	C	.	.	.	.	.	17	2	.	.	.	.	.	.	.	10	18	76
<i>Thalictrum aquilegifolium</i>	C	4	16	.	.	3	33	1	.	.	.	.	.	.	.	.	.	.
<i>Aconitum lycoctonum</i> agg.	C	4	.	9	.	.	17	2	.	.	.	.	.	.	.	30	18	11
<i>Adenostyles alliariae</i>	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aconitum vulparia</i>	C	.	.	.	7	.	.	.	3	2	.	.	.	.	.	.	.	.
<i>Ribes</i> sp.	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21	26
<i>Salix appendiculata</i>	B	.	50	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dryopteris austriaca</i>	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.
<i>Veratrum album</i> subsp. <i>lobelianum</i>	C	4	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
<i>Deschampsia cespitosa</i>	C	1	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
<i>Viola biflora</i>	C	.	18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pleurospermum austriacum</i>	C	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Salix glabra</i>	B	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Centaurea montana</i>	C	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polystichum x luerssenii</i>	C	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ribes petraeum</i>	B	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
<i>Aquilegia nigricans</i>	C	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Myrrhis odorata</i>	C	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aconitum paniculatum</i>	C	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anthriscus nitida</i>	C	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Appendix to the table 1:

Agrostis capillaris (O) 5. 6; *Anthriscus fumarioides* (TR) 1. 6; *Arctium lappa* (O) 8. 1, 9. 2; *Asplenium adiantum-nigrum* (AT) 5. 3, 15. 25; *A. trichomanes* (AT) 1. 64, 2. 70, 3. 72, 4. 27, 5. 44, 7. 23, 8. 56, 9. 36, 10. 30, 14. 80, 15. 50, 17. 10, 18. 7; *A. viride* (AT) 1. 35, 2. 88, 3. 16, 4. 13, 5. 26, 7. 28, 8. 27, 9. 26; *A. ruta-muraria* (AT) 1. 20, 2. 48, 5. 6, 8. 12, 9. 2; *Aster bellidifolium* (SA) 2. 28, 7. 2; *Astragalus glycyphyllos* (O) 5. 3; *Atropa belladonna* (O) 1. 4, 2. 2, 3. 13, 5. 3, 7. 5, 8. 10, 9. 8; *Brachypodium pinnatum* (O) 7. 2; *Bromus ramosus* agg. (O) 8. 10, 9. 3; *Calamintha nepetoides* (O) 5. 3; *Cardamine chelidonia* (O) 15. 50; *Carex brachystachys* (AT) 2. 8; *C. ferruginea* (SA) 2. 18; *C. sempervirens* (SA) 18. 4; *C. tricolor* (O) 5. 3; *Cirsium eriophorum* (O) 5. 9; *Cymbalaria muralis* (AT) 1. 7, 5. 7; *Cystopteris fragilis* (AT) 1. 25, 2. 64, 7. 2, 8. 5, 9. 10; *C. montana* (TR) 1. 3; *C. regia* (AT) 2. 4; *Dactylorhiza maculata* (O) 1. 9, 2. 18, 8. 1; *Eupatorium cannabinum* (O) 1. 1, 2. 8, 3. 3, 5. 18, 7. 5, 8. 12, 9. 11, 10. 30, 16. 10, 18. 7; *Fragaria vesca* (O) 1. 25, 2. 18, 3. 84, 4. 40, 5. 25, 7. 80, 8. 53, 9. 38, 10. 50, 12. 50, 13. 30, 14. 80, 15. 25, 16. 50, 17. 18, 18. 57; *Galeopsis pubescens* (O) 5. 3; *G. speciosa* (O) 1. 10, 2. 4, 3. 13, 4. 7, 5. 6, 8. 6, 9. 2; *Galium mollugo* agg. (O) 3. 3, 7. 3; *Geranium phaeum* (O) 14. 40; *Geum urbanum* (O) 2. 2, 8. 6, 9. 2, 14. 20; *Glechoma hederacea* (O) 8. 2; *G. hirsuta* (O) 8. 2, 12. 21; *Gymnocarpium robertianum* (TR) 1. 3, 2. 32, 5. 9, 7. 5; *Hypericum hirsutum* (O) 2. 2; 8. 12; *H. maculatum* (O) 1. 1; *H. perforatum* (O) 1. 3, 5. 3, 8. 4, 9. 7; *Hieracium umbellatum* (O) 12. 10; *Laser trilobium* (O) 12. 50; *Leontodon hispidus* (O) 7. 2; *Malus sylvestris* (O) 8. 2; *Moehringia muscosa* (AT) 1. 42, 2. 24, 3. 56, 5. 18, 7. 12, 8. 24, 9. 21, 17. 5; *Orchis morio* (O) 17. 3; *Origanum vulgare* (O) 3. 22; *Paederota lutea* (AT) 1. 4, 2. 40; *Phyteuma scheuchzeri* subsp. *columnae* (AT) 1. 7, 2. 22; *Pinguicula alpina* (SA) 2. 4; *Polygala vulgaris* (O) 5. 3; *Polypodium vulgare* (AT) 1. 36, 2. 32, 3. 34, 4. 20, 5. 24, 7. 18, 8. 42, 9. 20, 10. 10, 14. 80, 15. 50, 17. 10, 18. 7; *Potentilla micrantha* (O) 16. 10; *Primula carniolica* (AT) 2. 10; *P. elatior* (O) 12. 10; *Prunella vulgaris* (O) 4. 7, 5. 6, 7. 3; *Rubus fruticosus* agg. (O) 2. 6, 3. 53, 4. 40, 5. 15, 7. 28, 8. 2; *Rubus* sp. (O) 10. 50_B, 13. 10_B, 16. 90_B, 17. 26_B; *Salix caprea* (O) 5. 3_A; *Sambucus racemosa* (O) 1. 9_B, 2. 8_B, 4. 27_B, 5. 29_B, 8. 16_B, 9. 11_B, 10. 30_B, 11. 15_B, 12. 40_B, 13. 10_B, 15. 25_B, 16. 10_B, 17. 26_B, 18. 35_B; *Sedum hispanicum* (AT) 1. 4, 5. 6; *Senecio rupestris* (TR) 2. 6, 16. 30; *Solanum dulcamara* (O) 1. 30, 2. 30, 3. 31, 5. 12, 7. 13, 8. 28, 9. 39, 14. 80, 15. 75, 18. 21; *Soldanella alpina* (SA) 18. 4; *Sorbus aucuparia* (O) 1. 6_A38_B 45_C, 2. 22_A66_B72_C, 3. 6_A8_B, 4. 73_B, 5. 3_A44_B 4_C, 7. 88_B, 8. 5_A31_B 3_C, 11. 31_C, 12. 40_B, 13. 10_A30_B, 14. 80_B, 17. 31_B, 18. 7_A7_B; *Spiraea chamaedryfolia* (O) 1. 4_B, 2. 2_B; *Stachys alpina* (SA) 17.3; *Tofieldia calyculata* (SA) 15. 50; *Valeriana officinalis* (O) 8. 1; *V. saxatilis* (AT) 2. 10; *Veronica chamaedrys* (O) 5. 3, 16. 10; *Viscum album* ssp. *abietis* (O) 3. 28, 8. 3;

AT – *Asplenietea trichomanis* Br.-Bl. in Meier et Br.-Bl. 1934 s. lat.; TR – *Thlaspietea rotundifolii* Br.-Bl. in Br.-Bl. et Jenny 1926 s. lat.; SA – *Seslerietea albicantis* Oberdorfer 1978 corr. Oberdorfer 1990 s. lat.; O – Other species

subvar. geogr. *Anemone trifolia* and subvar. geogr. *Omphalodes verna* within var. geogr. *Saxifraga cuneifolia* and subvar. geogr. *Dentaria pentaphyllos* and subvar. geogr. *Dentaria polyphylla* within var. geogr. *Calamintha grandiflora*.

Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia

The first person to point out the phytogeographical peculiarities of fir-beech stands on the Trnovski gozd plateau was M. WRABER (1953, 1959) in the 1950s. Some twenty years later PUNCER (1979, 1980) analysed these stands, applying the Braun-Blanquet method but his early death stopped him from publishing the results, supplemented with table material. He treated these stands as the (small) association *Abieti-Fagetum praealpino-dinaricum* Puncer 1979 mscr. He chose the species *Adenostyles glabra*, *Calamagrostis arundinacea*, *Polygonatum verticillatum*, *Saxifraga cuneifolia*, *Cardamine trifolia* and *Dentaria enneaphyllos* as differential to typical west-Dinaric fir-beech stands and thus tried to demonstrate the transitional position of these stands. Armed with the aforementioned understanding, ZUPANČIĆ et al. (1987) set apart the District of Trnovski gozd from the Snežnik-Risnjak District of the North-western Dinaric subsector of the western Dinaric

Sector of the Illyrian province. Recent studies on the syntaxonomy of fir-beech stands in the area have confirmed this point of view (DAKSKOBLER et al. 2000, DAKSKOBLER 2001, SURINA 2001). In the floristic composition of fir-beech stands from the western and middle-eastern part of the Trnovski gozd plateau, compared to other fir-beech stands in the Dinaric mountains of Slovenia and Croatia, there is a smaller proportion of Southeast – European-Illyrian species and their cover values are also much lower (Tab. 2). The same is true of characteristic species of the association, since only *Abies alba* (as edifier), *Cardamine trifolia* and *Aremonia agrimonoides* are more or less constant (columns 1 and 2, Tab. 1). Syntaxonomical analyses also showed a clear increase of species of the *Aremonio-Fagion* alliance towards the south-east (Tab. 3) and vice-versa a decrease of species belonging to the classes *Seslerietea albicantis*, *Thlaspietea rotundifolii*, *Asplenietea trichomanis* and *Vaccinio-Piceetea*.

We have therefore classified them into a new geographical variant *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia*. The stands of this new syntaxon are transitional to stands of the pre-Alpine fir-beech forests of the association *Homogyno sylvestris-Fagetum* Marinček et al. 1993 var. geogr. *Sesleria autumnalis* Dakskobler 2001. The differential species of the new geographical variant are species which are very rare in the other fir-beech stands of the Dinaric mountains in Slovenia and Croatia: *Saxifraga cuneifolia*, *Phyteuma scheuchzeri* subsp. *columnae*, *Paederota lutea*, *Lathyrus vernus* subsp. *flaccidus* and *Laburnum alpinum*. Distribution maps of differential species of the geographical variant are shown in Figs. 4–8.

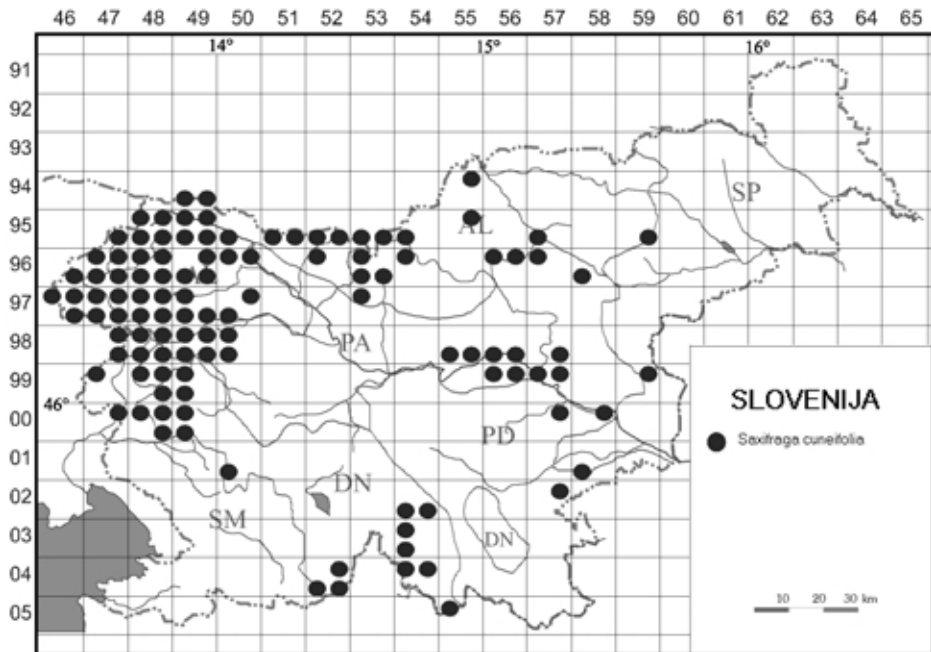


Fig. 4. Distribution map of *Saxifraga cuneifolia* in Slovenia (for the geobotanical remarks and the entire distribution area see also MEUSEL et al. 1965b: 344, 1965a: 200a).

Tab. 2. Chorological groups of the ferns and seed plants (according to POLDINI 1991).

Succesive number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Chorological groups (%)																		
SLOVENIA																		
CROATIA																		
European	19.6	16.9	25.5	24.3	20.1	24.4	20.7	21.4	19.0	23.5	26.7	26.4	27.0	24.5	25.9	22.4	26.2	22.7
Eurasitic	13.8	12.6	15.3	15.0	12.6	15.4	17.0	15.4	14.6	14.1	15.0	11.5	14.9	16.0	15.3	16.4	12.3	14.4
Mediterranean-montane	15.3	19.1	10.9	13.1	16.7	17.9	14.1	12.9	10.8	11.8	11.7	12.6	17.6	10.6	9.4	16.4	17.2	15.5
Boreal	15.9	18.6	10.2	15.0	14.9	8	17.0	15	17.7	7	13	13	4	10	13	9	12	12
Eurosiberian	5.8	6.0	5.8	4.7	6.3	6.4	5.2	6.0	3.8	4.7	3.3	5.7	5.4	5.3	4.7	6.0	4.9	5.2
Southeast-European	5.8	2.2	5.1	5.6	2.9	3.8	3.0	5.5	4.4	3.5	3.3	4.6	5.4	5.3	5.9	6.0	4.9	6.2
Cosmopolitan	4.2	4.4	3.6	3.7	4.6	2.6	4.4	4.0	5.1	5.9	5.0	3.4	2.7	3.2	3.5	3.4	2.5	3.1
N-illyrian	2.6	3.0	3.0	3.0	2.0	4.0	2.0	3.0	4.0	5.0	5.0	4.0	7.0	5.0	4.0	3.0	4.0	2.0
S-illyrian	1.6	1.1	2.2	0.9	0.6	2.6	2.2	1.5	1.9	2.4	1.7	3.4	2.7	1.1	3.5	3.4	1.6	1.0
Pontic	1.6	0.5	4.4	2.8	2.9	2.6	0.7	1.5	1.3	2.4	1.7	1.1	1.4	2.1	1.2	1.7	1.6	2.1
Paleotemperate	4.8	4.9	6.6	1.9	6.3	3.8	6.7	6.5	6.3	5.9	1.7	3.4		7.4	4.7	4.3	2.5	5.2
Mediterranean-atlantic			1.5	1.9	1.7		1.5	2.0	2.5	3.5	1.7	1.1	1.4	1.1	1.2	0.9	2.5	3.1
Alpine-Karpatic		1	1	1		1	1	1		1	1	1	1	1				1
Eurimediterranean	2.6	0.5		0.9	2.3			1.5	2.5	1.2		1.1				0.9		
Arctic-Alpine	2	2	1		1		1	1	1					1	1			
Endemic	0.5	1.1																
Alpine	1	2																
Total number of species	189	183	137	107	174	78	135	201	158	85	60	87	74	94	85	116	122	97

Tab.3. Fern and seed species arranged in syntaxonomic groups.

Successive number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Region	SLOVENIA																	
Syntaxonomical groups (%)	CROATIA																	
<i>Arenonio-Fagion</i>	8.5	6.6	10.9	13.1	7.5	15.4	9.6	10.0	12.0	15.3	15.0	17.2	21.6	14.9	11.8	12.9	13.1	10.3
<i>Fagetalia sylvaticae</i>	34.4	31.1	36.5	39.3	32.8	37.2	28.9	33.3	37.3	36.5	45.0	37.9	40.5	45.7	50.6	41.4	38.5	39.2
<i>Quercetalia pubescentis</i>	4.8	1.6	3.6	0.9	5.2	2.6	1.5	4.5	3.8	3.5	1.7	1.1	1.4					
<i>Quercus-Fagetalia</i>	8.5	6.0	17.5	9.3	8.6	6.4	7.4	10.9	7.6	9.4	5.0	5.7	5.4	9.6	3.5	9.5	9.0	5.2
<i>Vaccinio-Piceetalia</i>	15.3	19.1	9.5	13.1	13.8	12.8	20.7	15.9	16.5	12.9	6.7	12.6	10.8	8.5	11.8	12.9	12.3	15.5
<i>Erico-Pnietalia</i>	2.1	5.5	1.5	0.9	2.3	3.8	3.7	2.5		1.2	1.7	2.3				0.9	1.6	1.0
<i>Adenostyletalia</i>	10.6	10.9	5.8	9.3	9.8	14.1	11.1	7.5	8.2	8.2	11.7	9.2	6.8	8.5	8.2	11.2	13.1	14.4
<i>Asplenietea trichomanis</i>	5.3	6.6	2.9	2.8	4.6		3.7	3.0	3.8	2.4				1.1	2.4		1.6	1.0
<i>Seslerietea albicantis</i>		1.6					0.7											0.7
<i>Thlaspietalia rotundifolia</i>	1.6	1.1			0.6		0.7									0.9		
Other species	6.3	7.1	7.3	5.6	11.5		7.4	9.5	7.0	4.7	3.3	6.9	5.4	5.3	5.9	5.2	5.7	8.2
Total number of species	189	183	137	107	174	78	135	201	158	85	60	87	74	94	85	116	122	97

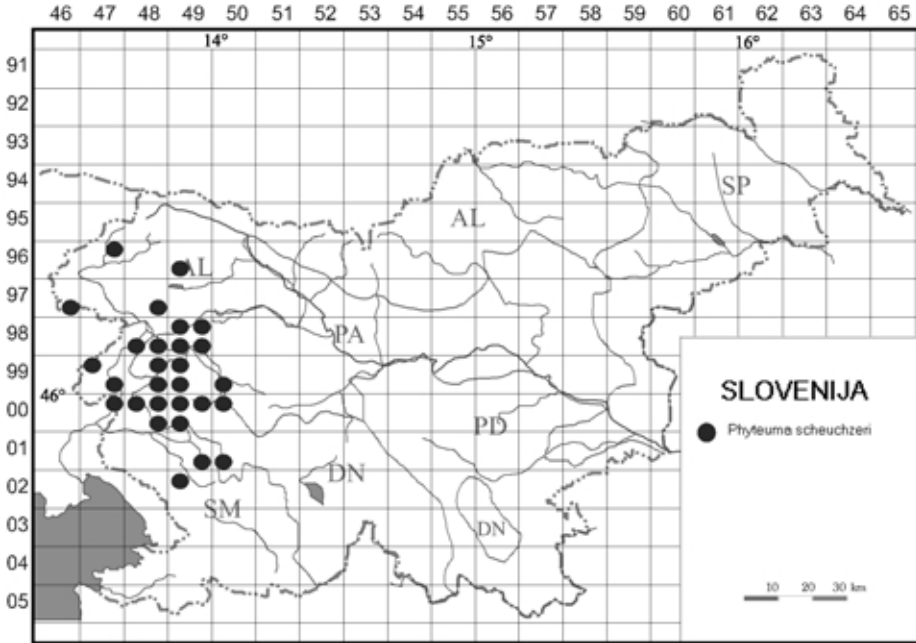


Fig. 5. Distribution map of *Phyteuma scheuchzeri* subsp. *columnae* in Slovenia (for the geobotanical remarks see also MEUSEL et al. 1978b: 172).

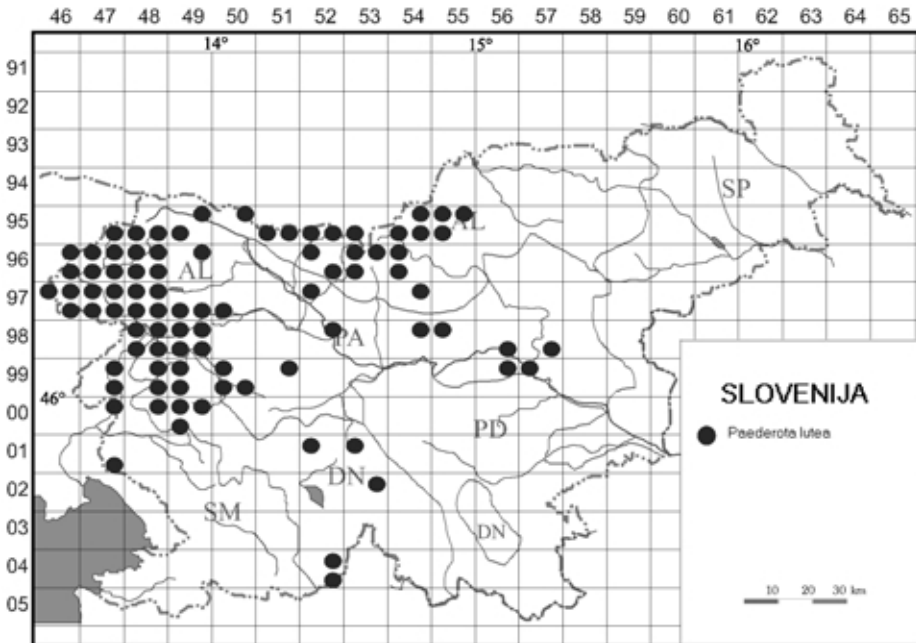


Fig. 6. Distribution map of *Paederota lutea* in Slovenia (for the geobotanical remarks and the entire distribution area see also MEUSEL et al. 1978b: 273, 1978a: 394c).

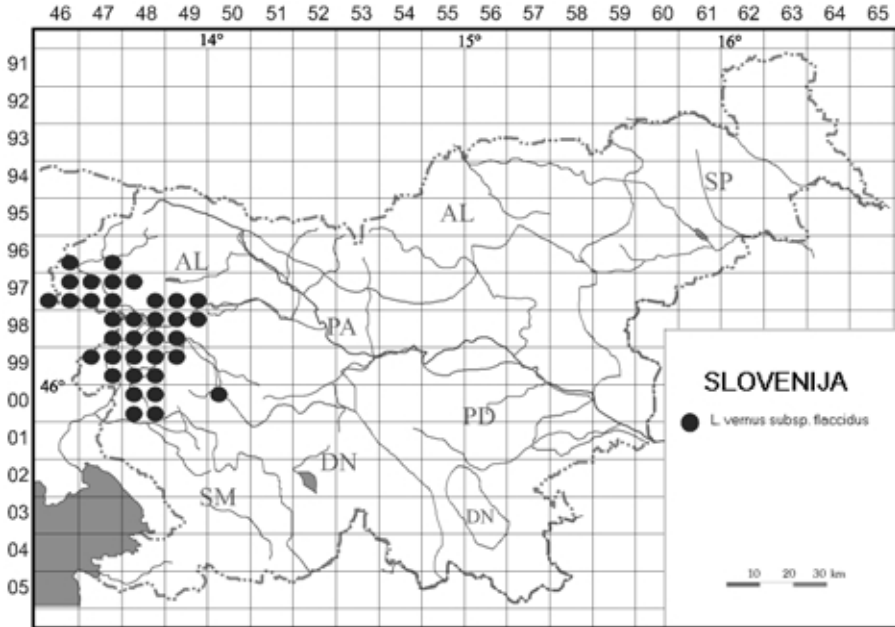


Fig. 7. Distribution map of *Lathyrus vernus* subsp. *flaccidus* in Slovenia (summarised and supplemented after DAKSKOBLER 1991); (for the geobotanical remarks see also DAKSKOBLER 1991, LAUBER and WAGNER 1998).

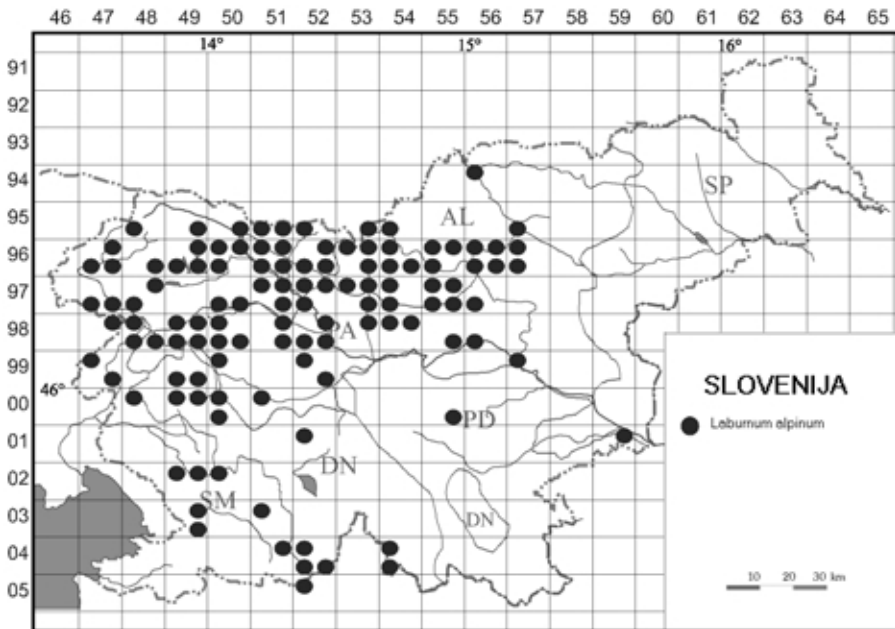


Fig. 8. Distribution map of *Laburnum alpinum* in Slovenia (for the geobotanical remarks and the entire distribution area see also MEUSEL et al. 1965b: 185, 365; FUKAREK 1978).

Calamagrostis arundinacea and *Luzula luzuloides* were listed as the edaphic differential species because their presence shows the acidity of the soil (chert) in that part but they also have a certain phytogeographical value since they are not as constant and as wide-spread in other fir-beech stands of the Dinaric mountains. The geographical variant *S. cuneifolia* is subdivided into two geographical sub-variants: western – *Anemone trifolia* and central-eastern – *Omphalodes verna*. We chose *Anemone trifolia* as differential species of the western sub-variant, which is the most impoverished of Southeast – European-Illyrian (illyricoid) species, and *Omphalodes verna* for the central-eastern sub-variant, which is transitional to the more or less typical west-Dinaric fir-beech stands (*Omphalodo-Fagetum* var. geogr. *Calamintha grandiflora* subvar. geogr. *Dentaria pentaphyllos*)

According to the synoptic table (Tab. 1) and analyses using the methods of hierarchical classification and ordination (Figs. 2 and 3, , DAKSKOBLER et al. 2000, DAKSKOBLER 2001, SURINA 2001) it is clear that the geographical variant *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia* forms the western border of the distribution area of west-Dinaric fir-beech stands (*Omphalodo-Fagetum* s. lat.).

Typification of geographical variants and sub-variants:

Omphalodo-Fagetum (Treg. 1957 corr. Puncer 1980) Marinček et al. 1993 var. geogr. *Saxifraga cuneifolia* var. geogr. nova subvar. geogr. *Anemone trifolia* subvar. geogr. nova.

Nomenclature type for the **geographical variant and sub-variant** (*holotypus*): Slovenia, Trnovski gozd (western part), Pri Studencu; altitude 1090 m, aspect SW, inclination 25°; cover: stoniness 50%, tree layer (A) 70%, shrub layer (B) 20%, herb layer (C) 70%, moss layer (D) 10%; date 30.6.2000, leg. B. Surina.

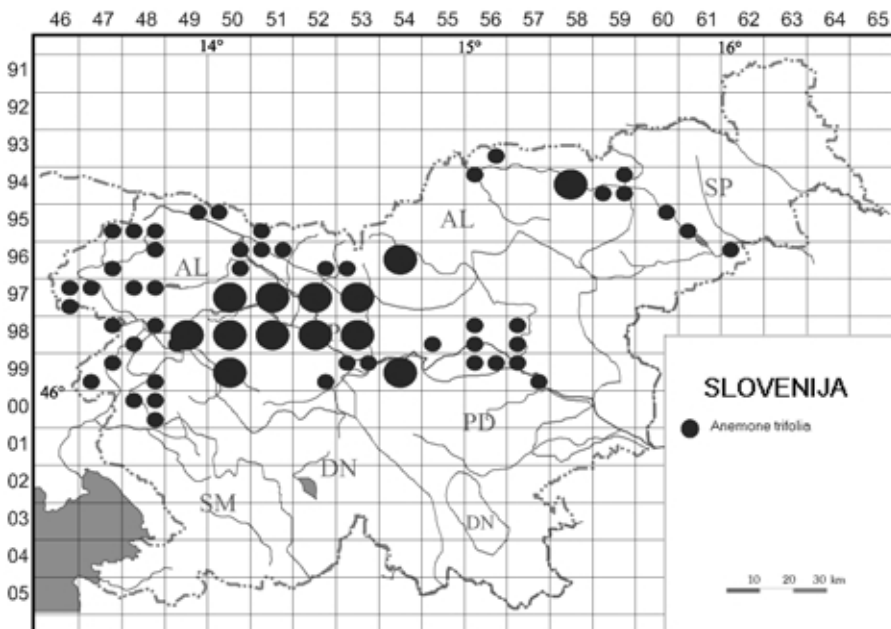


Fig. 9. Distribution map of *Anemone trifolia* in Slovenia (summarised and supplemented after MARINČEK et al. 1989); (for the geobotanical remarks and the entire distribution area see also MEUSEL et al. 1965b: 131, 159).

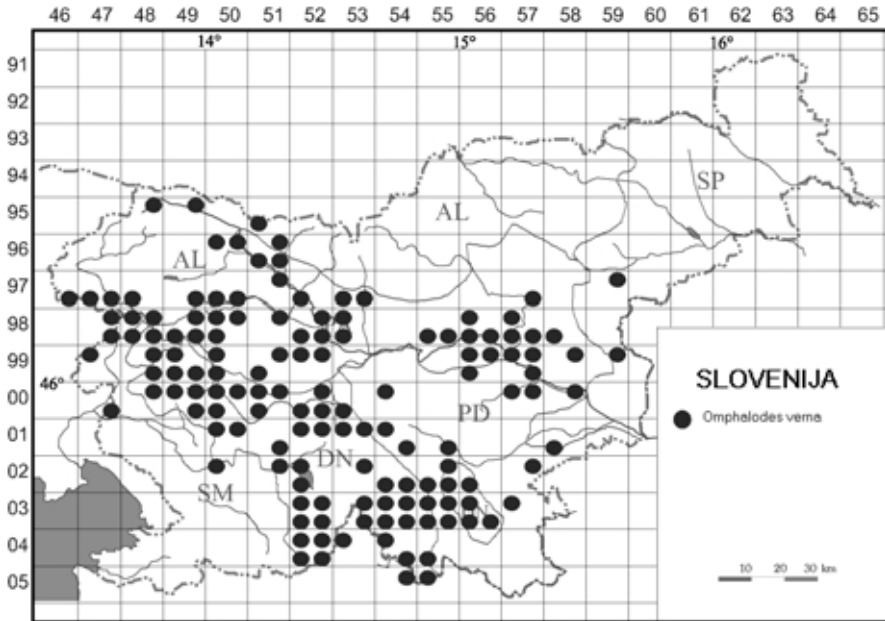


Fig. 10. Distribution map of *Omphalodes verna* in Slovenia (summarised and supplemented after PRAPROTNIK 1987); (for the geobotanical remarks and the entire distribution area see also GAŽI-BASKOVA 1963; FUKAREK 1978; MEUSEL et al. 1978b: 370, 1978a:366).

A1: *Fagus sylvatica* 3.1, *Abies alba* 1.2; A2: *Fagus sylvatica* 3.1, *Abies alba* +; B: *Fagus sylvatica* 1.2, *Daphne mezereum* 1.1, *Sorbus aria* 1.1, *Rosa pendulina* +.2, *Sambucus nigra* +, *Sorbus aucuparia* +; C: *Mercurialis perennis* 3.2, *Cyclamen purpurascens* 2.2, *Calamagrostis arundinacea* 2.2, *Geranium robertianum* 2.2, *Luzula luzuloides* 2.2, *Moehringia muscosa* 2.2, *Adenostyles glabra* 1.2, *Asplenium ruta-muraria* 1.2, *Cardamine trifolia* 1.2, *Dentaria enneaphyllos* 1.2, *Galium laevigatum* 1.2, *Mycelis muralis* 1.2, *Abies alba* 1.1, *Asplenium trichomanes* 1.1, *Fagus sylvatica* 1.1, *Hieracium sylvaticum* 1.1, *Prenanthes purpurea* 1.1, *Sorbus aria* 1.1, *S. aucuparia* 1.1, *Anemone trifolia* +.2, *A. nemorosa* +.2, *Anemone x pittonii* +.2, *Aremonia agrimonoides* +.2, *Dryopteris filix-mas* +.2, *Galeobdolon flavidum* +.2, *Festuca altissima* +.2, *Lathyrus vernus* subsp. *flaccidus* +.2, *L. vernus* subsp. *vernus* +.2, *Maianthemum bifolium* +.2, *Phyteuma scheuchzeri* subsp. *columnae* +.2, *Polygonatum multiflorum* +.2, *P. verticillatum* +.2, *Rubus idaeus* +.2, *Veratrum album* subsp. *lobelianum* +.2, *Saxifraga cuneifolia* +, *Carex digitata* +, *Daphne mezereum* +, *Hypericum perforatum* +, *Neotia nidus-avis* +, *Picea abies* +, *Sambucus nigra* +, *Senecio ovatus* +, *Vaccinium myrtillus* +, *Paris quadrifolia* r; D: *Ctenidium molluscum* 1.3, *Tortella tortuosa* 1.3, *Cladonia coniocraea* +, *C. pyxdata* +.

Omphalodo-Fagetum (Treg. 1957 corr. Puncer 1980) Marinček et al. 1993 **var. geogr. *Saxifraga cuneifolia*** var. geogr. nova subvar. geogr. ***Omphalodes verna*** subvar. geogr. nova.

Nomenclature type for the **geographical sub-variant (holotypus)**: Slovenia, Trnovski gozd (central-eastern part), Predmeja; altitude 1140 m, aspect SW, inclination 10°; cover: stoniness 40%, tree layer (A) 90%, shrub layer (B) 30%, herb layer (C) 40%, moss layer (D) 10%; date 7.7.2000, leg. B. Surina.

A1: *Abies alba* 4.1, *Picea abies* +; A2: *Fagus sylvatica* 2.1, *Abies alba* 1.1; B: *Abies alba* 2.1, *Fagus sylvatica* 2.1, *Lonicera alpigena* 1.2, *L. nigra* 1.1, *Picea abies* 1.1, *Sambucus racemosa* 1.1, *Acer pseudoplatanus* +.2, *Sorbus aucuparia* +.2, *Daphne mezereum* +, *Lonicera xylosteum* +, *Rosa pendulina* +; C: *Galium odoratum* 2.2, *Abies alba* 2.1, *Anemone nemorosa* 1.2, *Asplenium ruta-muraria* 1.2, *Athyrium filix-femina* 1.2, *Cardamine trifolia* 1.2, *Dentaria enneaphyllos* 1.2, *Dryopteris filix-mas* 1.2, *Galeobdolon flavidum* 1.2, *Lonicera alpigena* 1.2, *Oxalis acetosella* 1.2, *Maianthemum bifolium* 1.2, *Sanicula europaea* 1.2, *Mycelis muralis* 1.1, *Picea abies* 1.1, *Prenanthes purpurea* 1.1, *Sambucus racemosa* 1.1, *Solidago virgaurea* 1.1, *Sorbus aucuparia* 1.1, *Vaccinium myrtillus* +.3, *Adenostyles glabra* +.2, *Asarum europaeum* subsp. *caucasicum* +.2, *Asplenium trichomanes* +.2, *A. viride* +.2, *Calamintha grandiflora* +.2, *Carex sylvatica* +.2, *Cyclamen purpurascens* +.2, *Cystopteris fragilis* +.2, *Daphne mezereum* +.2, *Dryopteris dilatata* +.2, *Epilobium montanum* +.2, *Euphorbia amygdaloides* +.2, *Geranium robertianum* +.2, *Heracleum sphondylium* +.2, *Lamium orvala* +.2, *Paris quadrifolia* +.2, *Ranunculus platanifolius* +.2, *Rosa pendulina* +.2, *Rubus idaeus* +.2, *Scrophularia nodosa* +.2, *Solanum dulcamara* +.2, *Symphytum tuberosum* +.2, *Urtica dioica* +.2, *Valeriana tripteris* +.2, *Aremonia agrimonoides* +, *Dentaria bulbifera* +, *Fagus sylvatica* +, *Omphalodes verna* +, *Polypodium vulgare* +, *Pulmonaria officinalis* +, *Senecio ovatus* +, *Veratrum album* subsp. *lobelianum*, *Peucedanum austriacum* r, *Saxifraga cuneifolia* r; D: *Ctenidium molluscum* 2.3, *Neckera crispa* 2.3, *Dicranum scoparium* 1.3, *Grimmia pulvinata* 1.3, *Cladonia pyxidata* +, *Radula complanata* +.

Omphalodo-Fagetum* var. geogr. *Calamintha grandiflora

Stands with a high proportion and cover value of Southeast – European-Illyrian species (mostly characteristic species of the *Aremonio-Fagion* alliance) and complete association characteristic species composition are termed typical and are located between Snežnik, the Kočevsko region, Rog (Slovenia) and Gorski Kotar (Croatia). We therefore classified them together with other stands from Slovenia and Croatia into a new geographical variant *Omphalodo-Fagetum* var. geogr. *Calamintha grandiflora* (columns 3–18, Tab. 1). We chose *Calamintha grandiflora* and *Omphalodes verna* as a differential species for the geographical variant. The distribution area of *C. grandiflora* and *O. verna* in Slovenia is shown in Figures 11 and 10.

Both from the synoptic phytosociological table (Tab. 1) and analyses using the methods of hierarchical classification and ordination (Figs. 2 and 3) it is clear that further floristic and therefore phytogeographic differences occur within the geographical variant *Calamintha grandiflora*. We thus subdivided the geographical variant *Calamintha grandiflora* into two geographical sub-variants: subvar. geogr. *Dentaria pentaphyllos* (north-western, columns 3–5 in Tab. 1) which includes stands from Nanos, Hrušica and Ravnik-Logatec (Slovenia) and subvar. geogr. *Dentaria polyphylla* (south-eastern, columns 8–18 in Tab. 1), which includes stands from the Kočevsko region, Rog (Slovenia) and all other stands from Croatia. As differential species for the subvar. geogr. *Dentaria pentaphyllos* we chose *D. pentaphyllos* (for the distribution see also MEUSEL et al. 1978b: 335, 1978a: 186a) and *D. polyphylla* (for the distribution see also GAŽI-BASKOVA 1963, FUKAREK 1978, MEUSEL et al. 1978b: 335, 1978a: 186a, PRAPROTNIK 1987) and *D. trifolia* (for the geobotanical remarks and the entire distribution area see also MEUSEL et al. 1978a: 335, 1978b: 186b, PRAPROTNIK 1987) for the subvar. geogr. *Dentaria polyphylla*. Fir-beech forest from the Snežnik plateau tends to be an intermediate between the two geographical sub-variants. However, it was not subject to further classification. Stands from Blegoš (close proximity of the Julian Alps) act as a disjunct of the var. geogr. *Calamintha grandiflora* (most probably

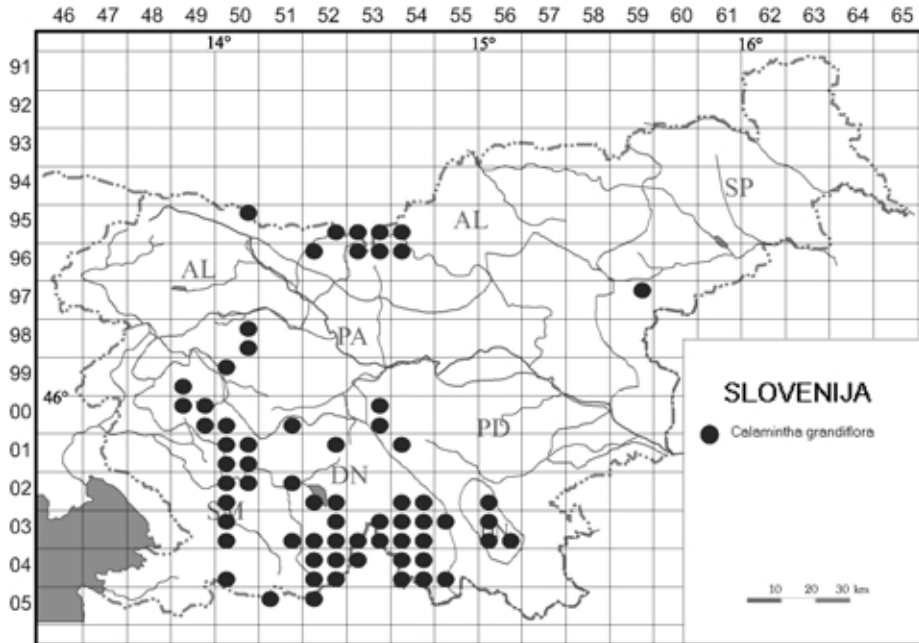


Fig. 11. Distribution map of *Calamintha grandiflora* in Slovenia (for the geobotanical remarks and the entire distribution area see also MEUSEL et al. 1978b: 382, 1978a: 381d).

subvar. geogr. *Dentaria pentaphyllos*) since, according to the phytogeographical division of Slovenia, it belongs to the pre-Alpine region (M. WRABER 1969) or Kranj district of the pre-Alpine subsector of the Illyrian floral province (ZUPANČIČ et al. 1987). It was Beck who was the first to point out the floristical and phytogeographical peculiarities of the foothills of Begunjščica (Karavanke), part of Upper Sava Valley and Završnica river valley, and much later also Zupančič and Žagar (BECK 1908, ZUPANČIČ and ŽAGAR 1998), but unfortunately fir-beech stands from the area have not been treated in this paper since no available table material exists. These stands also host a high proportion and cover value of Southeast – European-Illyrian species. Nevertheless, according to analyses performed by I. Daksobler (verbal communication) they belong to the pre-Alpine fir-beech association *Homo-gyno-Fagetum*.

Typification of geographical variants and sub-variants:

Omphalodo-Fagetum (Treg. 1957 corr. Puncer 1980) Marinček et al. 1993 var. geogr. *Calamintha grandiflora* var. geogr. nova hoc loco.

Nomenclature type for the **geographical variant** (*lectotypus*): TREGUBOV 1957: Tab. 5, Relevé No. 11, *lectotypus* hoc loco.

Omphalodo-Fagetum (Treg. 1957 corr. Puncer 1980) Marinček et al. 1993 var. geogr. *Calamintha grandiflora* var. geogr. nova hoc loco subvar. geogr. *Dentaria polyphylla* M. Zupančič and Puncer 1995 ex Surina 2002.

Nomenclature type for the **geographical sub-variant** (*lectotypus*): TRINAJSTIĆ 1970: Tab. 1, Relevé No. 19, *lectotypus* hoc loco.

Omphalodo-Fagetum (Treg. 1957 corr. Puncer 1980) Marinček et al. 1993 var. geogr. ***Calamintha grandiflora*** var. geogr. nova hoc loco subvar. geogr. ***Dentaria pentaphyllos*** subvar. geogr. nova.

Nomenclature type for the **geographical sub-variant** (*lectotypus*): Slovenia, eastern part of Trnovski gozd plateau, Tisovec; altitude 840 m, aspect NNE, inclination 20°; cover: stoniness 60%, tree layer (A) 80%, shrub layer (B), herb layer (C) 80%, moss layer (D) 10%; date 19.7.2000, leg. B. Surina.

A1: *Abies alba* 3.1, *Picea abies* 1.1; A2: *Fagus sylvatica* 4.1, *Abies alba* 1.1, *Sorbus aria* +, B: *Fagus sylvatica* 3.1, *Acer pseudoplatanus* 2.2, *Daphne mezereum* 1.2, *Rubus idaeus* 1.2, *Corylus avellana* +.2, *Tilia platyphyllos* +, *Lonicera nigra* +, *Salix appendiculata* +, *Sorbus aucuparia* +; C: *Omphalodes verna* 3.2, *Athyrium filix-femina* 2.2, *Mercurialis perennis* 2.2, *Maianthemum bifolium* 2.2, *Oxalis acetosella* 2.2, *Abies alba* 2.1, *Senecio ovatus* 2.1, *Acer pseudoplatanus* 1.2, *Calamintha grandiflora* 1.2, *Cardamine trifolia* 1.2, *Cyclamen purpurascens* 1.2, *Dentaria enneaphyllos* 1.2, *Euphorbia carniolica* 1.2, *Galeobdolon flavidum* 1.2, *Rubus idaeus* 1.2, *Picea abies* 1.1, *Prenanthes purpurea* 1.1, *Solidago virgaurea* 1.1, *Actaea spicata* +.2, *Anemone nemorosa* +.2, *Blechnum spicant* +.2, *Calamagrostis varia* +.2, *Carex salvatika* +.2, *Cystopteris fragilis* +.2, *Dentaria pentaphyllos* +.2, *Dryopteris filix-mas* +.2, *Epilobium montanum* +.2, *Eupatorium cannabinum* +.2, *Festuca altissima* +.2, *Gentiana asclepiadea* +.2, *Laburnum alpinum* +.2, *Mycelis muralis* +.2, *Neottia nidus-avis* +.2, *Paris quadrifolia* +.2, *Platanthera bifolia* +.2, *Polygonatum verticillatum* +.2, *Polystichum aculeatum* +.2, *Salvia glutinosa* +.2, *Sanicula europaea* +.2, *Solanum dulcamara* +.2, *Veronica urticifolia* +.2, *Aremonia agrimonoides* +, *Asplenium trichomanes* +, *A. viride* +, *Atropa belladonna* +, *Carex digitata* +, *Clematis vitalba* +, *Corylus avellana* +, *Daphne mezereum* +, *Epipactis helleborine* +, *Fagus sylvatica* +, *Huperzia selago* +, *Hypericum hirsutum* +, *Lamium orvala* +, *Lonicera nigra* +, *Monotropa hypopitys* +, *Sambucus nigra* +, *Scrophularia nodosa* +, *Sorbus aucuparia* +, *Viola reichenbachiana* +; D: *Ctenidium molluscum* 2.3, *Atrichum undulatum* 1.3, *Polytrichum formosum* 1.3, *Grimmia pulvinata* +.3, *Neckera crispa* +.3, *Plagiochilla asplenoides* +.3, *Tortella tortuosa* +.3, *Cladonia coniocraea* +, *C. furcata* +.

Discussion

The results of present (Tab. 1, Figs. 2 and 3) and past analyses (DAKSKOBLER et al. 2000, DAKSKOBLER 2001, SURINA 2001) quite plainly show the appurtenance of the west-Dinaric fir-beech forest *Omphalodo-Fagetum* to the Illyrian alliance *Aremonio-Fagion* and thus to the Illyrian floral province. Describing the association *Abieti-Fagetum dinaricum* (= *Fagetum croaticum australe abietetosum* Horvat 1938) on the Snežnik plateau (southwest Slovenia) TREGUBOV (1957) had in mind all the fir-beech stands from the Dinaric mountains ranging from Slovenia to Albania which is fully evident from his own selection of character species of the association. On the other hand, FUKAREK (1978) took a different view of the chorology of this (macro) association, stating that treatment of the climatogenic association should be more limited to the frames of phytogeographical borders. Following Fukarek's concept, PUNCER (1980) dealt with west-Dinaric fir-beech stands in the Kočevsko region and amended Tregubov's choice of association character species and thus at the same time narrowed the distribution area of the association. We find the phytogeographical principle for assessment and syntaxonomical treatment of climatogenic fir-beech stands accurate. On the other hand, following the floristic principle strictly, a description of sev-

eral new (micro) associations is unavoidable. We are very aware that the sample of analysed relevés using the methods of hierarchical classification is far from complete. There are also biases due to the varied number of relevés over the researched area and differences in methodological approach, since a strict floristic principle has today totally prevailed over the typological one from the past. Nevertheless, the results correspond well with our expectations. Thus stands from the Trnovski gozd plateau (west Slovenia) represent the north-eastern border of the distribution area of the association *Omphalodo-Fagetum*, and their classification into a new geographical variant *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia* is not in dispute. On the other hand, the question of the south-eastern border of the distribution area of the association *Omphalodo-Fagetum* is still open. Preliminary results suggest that central- and east -Dinaric fir-beech stands, east of the Una river, i.e. stands from Grmeč, Igman, Peručica (Bosnia and Hercegovina) and the Piva valley (Montenegro), should be treated as a new Dinaric fir-beech association. Even the problem of ranking these stands into higher syntaxonomical units arises, since recent syntaxonomical studies from the adjacent area (DZWONKO et al. 1999, DZWONKO and LOSTER 2000) interpret fir-beech stands, i. e. stands from the Suva Planina (east Serbia) and Macedonia, in the frame of the suballiance *Doronico columnae-Fagenion* Dzwonko et al. 1999. In order to resolve the problem of the south-eastern border of the distribution area of the association *Omphalodo-Fagetum* s. lat., and the syntaxonomical status of central- and east -Dinaric fir-beech stands, further phytosociological and phytogeographical research of the entire Illyrian floral province will be needed.

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