THE ASSOCIATION *HACQUETIO-FAGETUM* KOŠIR 1962 (*AREMONIO-FAGION*) IN CROATIA

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Abstract
The ass. *Hacquetio-Fagetum* has been analyzed floristically at several localities in north-western Croatia (Velika Kapela, Samoborsko gorje, Cesargradska gora, Brezovica, Strahinjščica, Ivanščica) just in the area where the highest concentration of the relict Illyricoid elements has been registered. On the occasion, the data on the floristic composition of the ass. *Hacquetio-Fagetum* based on our own researches are shown in the analytical table (Tab. 1), consisting of 9 relevés. By the analysis of the floristic composition it was found that the ass. *Hacquetio-Fagetum* comprises 119 species. The number of species by relevé is between 42 and 73, or 60 (59.8) on the average. In all relevés 4 species have been registered, and in more than 50% of relevés 37 species or 25.3 % of the total floristic composition were registered. In only one relevé 53 species or 36.3 % of the total floristic composition were registered. In Table 2, a comparative presentation is given in synthetic form of a total of 63 relevés. On this basis of the data presented, a total of 202 species have been registered in the floristic composition of the ass. *Hacquetio-Fagetum.*

Izvleček
Na več lokalitetah v severozahodni Hrvaški (Velika Kapela, Samoborsko gorje, Cesargradska gora, Brezovica, Strahinjščica, Ivanščica) smo analizirali floristično sestavo asociacije *Hacquetio-Fagetum.* Na tem območju je zabeležena največja pogostost reliktnih, ilirikoidnih rastlinskih vrst. Ob tej priliki je prikazana tabela, narejena na osnovi 9 lastnih popisov (tabela 1). Z analizo floristične sestave smo ugotovili, da se v sestojih asociacije *Hacquetio-Fagetum* pojavlja 116 vrst. V posameznih popisih se pojavlja od 42 do 73 vrst oziroma 60 (59,8) povprečno. V vseh popisih se pojavljajo 4 vrste, v več kot polovici 37 vrst oziroma 25,3 % celotne floristične sestave. V samo enem popisu je 53 vrst ali 36,3 % celotne floristične sestave. V tabeli 2 je primerjalno prikazanih 63 popisov. Na osnovi teh podatkov obsega floristični sestav asociacije *Hacquetio-Fagetum* 202 vrsti.

Key words: *Hacquetio-Fagetum,* Vegetation, Croatia
Ključne besede: *Hacquetio-Fagetum,* vegetacija, Hrvaška

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1. INTRODUCTION

It has long been known that the first systematic phytosociological and syntaxonomic research of forest vegetation in Croatia was made by the botanist Ivo Horvat, who published the results of his research in that classical work "Phytosociological Research on the Forests of Croatia" (cf. Horvat 1938). As it is also known, I. Horvat made the phytosociological analysis of the pedunculate oak, sessile oak-hornbeam, beech, beech-fir and spruce forests, and he also gave a brief review of the sweet chestnut, black alder and black pine forests.

Since on this occasion, our attention will be focused on the beech forests, it is interesting to note that Horvat comprised all Croatian beech forests by a unique association "*Fagetum 'silvaticae' croaticum*", and that within this association he distinguished two main complexes – "*Fagetum 'silvaticae' croaticum boreale*" and *Fagetum 'silvaticae' croaticum australe*". In the first complex the same author distinguishes several subassociations – "*Fagetum croati-*

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cum subass. *montanum – lathyretosum* and *corydaletosum*". In the second complex, according to the orographic principle, he distinguishes the pure beech forests – "*Fagetum croaticum (australe) montanum* and *subalpinum*" and the mixed beech-fir forests – "*Fagetum croaticum (australe*) subass. *abietetosum*". The mixed beech-fir forests thus happened to be within two complexes (partly "*boreale*", partly "*australe*"). Horvat generally no longer changed this first concept of the Croatian beech forests phytosociological division, he just completed it slightly (cf. Horvat 1950) by separating a special subassociation of "littoral beech forests" – "*Fagetum croaticum seslerietosum*". Finally, it is to be noted that Horvat's name for the beech forests "*Fagetum sylvaticae croaticum*" has been changed quite illegitimately into "*Fagetum illyricum*" (cf. Horvat et al. 1974).

As in the course of time – namely in the first half and especially in the second half of the 20th century – considerable attention was being paid to the phytocoenological research of pure beech forests and the mixed beech-fir forests, it became evident that the Horvat's "classical" concept would not be able to survive.

The biggest syntaxonomic changes happened to the pure beech forests designated by Horvat (1938) as "*Fagetum silvaticae croaticum boreale*". The first attempt at revision was made by Košir (1962) who, from a relatively small Gorjanci area in the border part between Slovenia and Croatia, named several new associations of the pure beech forests. Similarly, using Horvat's data, Borhidi (1963, 1965) reported also several new associations (ass. *Lamio orvalae-Fagetum, Vicio oroboidi-Fagetum*) of the pure beech forests.

Of several associations (*Querco-Fagetum, Hacquetio-Fagetum, Isopyro-Fagetum, 'Enneaphyllo'-Fagetum, 'Savensi'-Fagetum, Arunco-Fagetum*), special attention has been attracted by the ass. *Hacquetio-Fagetum*, reported for Croatia under this name for the first time by Trinajstić (1995a), and discussed more in detail recently by Vukelić & Baričević (2002). These authors, using the relevés of Horvat (1938) and Lj. Regula-Bevilacqua (1978), present the floristic composition of this association in the synthetic table only (columns 3 and 4). Vukelić & Baričević (2002) took over all the data indicated by Horvat (1938) as "*Fagetum silvaticae croaticum montanum-lathyretosum*" and by Regula-Bevilacqua (1978) as "*Fagetum illyricum montanum* subass. *lathyretosum*", a total of 31 relevés. By a more detailed analysis it could be established that only 13 relevés published by Horvat (1938: Table 3) and 7 relevés published by Regula-Bevilacqua (1978: Table 40) correspond to the optimally developed *Hacquetio-Fagetum*. For this reason, it was necessary to present the floristic composition of the ass. *Hacquetio-Fagetum* from Croatia also in the form of an analytical table.

2. METHODS

The research was carried out using the standard central European method (Braun-Blanquet 1964). The nomeclature of plant species is according to Ehrendorfer (1973), except for the species *Lamium galeobdolon* (L.) Nath.

3. RESULTS

3.1. Analytical presentation of the floristic composition of ass. *Hacquetio-Fagetum* in Croatia

The ass. *Hacquetio-Fagetum* from Croatia has been analyzed floristically on several sites (mountains) in northwestern Croatia (Velika Kapela, Samoborsko gorje, Cesargradska gora, Brezovica, Strahinjščica, Ivanščica), in the very area where the highest concentration of relict Illyricoid elements was recorded (cf. Trinajstić 1992, 1995b). Its floristic composition is given in Table 1, made on the basis of 9 relevés. The relevés originate from the following sites (areras): 1st relevé: Cesargradska gora; 2nd relevé: Velika Kapela-Jasenak (Vrelo); 3rd relevé: Ivanščica – Oštrc over Lobor; 4th relevé: Reka draga at the foot of Japetić; 5th relevé: Samoborsako gorje – Palačnik (Hajdovčak); 6th relevé: Samobor, at the foot of the hiking trail to Palačnik; 7th relevé: Hrvatsko zagorje: Brezovica; 8th relevé: Hrvatsko zagorje: Brezovica; 9th relevé: Hrvatsko zagorje: Strahinjščica.

By the analysis of the floristic composition in Table 1, it was found out that the ass. *Hacquetio-Fagetum* from Croatia comprises 119 species. The number of species by relevé is between 42 and 73 or 60 (59.8) on the average. In all relevés 4 species have been registered, and in more than 50 % of relevés 37 species or 25.3 % of the total floristic composition were registered. In only one relevé, 53 or 36.3 % of the total floristic composition were registered. The dominant and characteristic species of the association is *Hacquetia epipactis*, a relict and endemic Illyriciod species of the monotypic genus *Hacquetia*. The very range of *H. epipactis* is at the same time the range of the ass. *Hacquetio-Fagetum*.

As regionally characteristic species of association, *Ruscus hypoglossum* and *Ilex aquifolium* can be mentioned, and *Epimedium alpinum* is understood as a regionally differential species of the association.

As a characteristic species of the alliance *Aremonio-Fagion*, 22 species have been registered; as charcteristic species of the order *Fagetalia* and the class *Querco-Fagetea* a total of 91 species have been registered and as companions 21 species have ben registered.

In Table 2, a comparative presentation is given in the synthetic form of own data (9 relevés), Horvat's data from 1938 (13 relevés), Regula-Bevilacqua's data from 1978 (7 relevés), Marinček & Zupančič's data from 1977 (10 relevés) and Košir's data from 1979 (24 relevés), i. e. a total of 63 relevés. On the basis of the presented data, a total of 202 species have been registered in the floristic composition of the ass. *Hacquetio-Fagetum.*

4. DISCUSSION

Since the time when the concept according to which all beech forests to the south-east from the Alps – those in Croatia in the first place – would belong to a unique association "*Fagetum silvaticae croaticum*", as supported by Horvat (1938), has been abandoned, the number of beech forest associations (as mentioned above in the introduction), began to increase rapidly. The principle of splitting the unique association of beech forests was to give to the newly described association – in addition to the obligatory "*Fagetum*" as a part of the combination – also another name after a species considered by individual authors to define in the most accurate manner the content of such a new nomenclatural combination. It is interesting to note that the authors of such combinations have chosen mostly the very species that formerly (cf. Trinajstić 1992, 1995b, 1997) had been designated as Illyricoidal. Such are, for instance, *Vicia oroboides* and *Lamium orvala* – *Vicio oroboidi-Fagetum, Lamio orvalae-Fagetum* (Borhidi 1965), *Hacquetia epipactis, Aruncus dioicus, Isopyrum thalictroides* and *Dentaria trifolia* (= "*Cardamine savensis*") – *Hacquetio-Fagetum, Arunco-Fagetum, Isopyro-Fagetum, Savensi-Fagetum* (Košir 1962, 1979), then *Omphalodes verna* – *Omphalodo-Fagetum* (Marinček et al. 1993). After all, the very name of Horvat's alliance "*Fagion illlyricum*" has been renamed after the Illyricoidal species *Aremonia agrimonoides* into *Aremonio-Fagion* (Török et al. 1989)

The number of Illyricoidal species, as we understood them (cf. Trinajstić 1992, 1995b, 1997) being still larger, the number of associations of neutrophile beech forests in the alliance *Aremonio-Fagion* might nominally continue to increase, which could result in an "inflation" of syntaxa with association status, similarly as Pignatti (1968) pointed out earlier for the "inflation" of higher syntaxa nominations.

If we understand nomenclaturally that, in the floristic composition of an association, the species after which this association was named must be represented in practically ± 100 % of relevés, then the species such as, for instance, *Lamium orvala, Vicia oroboides, Hacquetia epipactis, Aruncus dioicus, Isopyrum thalictroides, Omphalodes verna* etc. in each particular case must be represented at least in 100 % of relevés. There remains a problem, and a doubt, in the case when two or more of the said species occur in one and the same relevé, such as *Lamium orvala* and *Hacquetia epipactis* (e.g. relevés 2, 3, 4, 8, 9 in Table 1), or *Vicia oroboides* and *Hacquetia epipactis* (relevés 1, 9 in Table 1), or *Isopyrum thalictroides* and *Hacquetia epipactis* (relevés 8, 9 in Table 1) etc. In such cases, the reason for choosing one or the other association should be sought in some other parameters, such as: altitude, exposition, parent material, soil depth, soil pH value, etc., and in this particular case of the ass. *Hacquetio-Fagetum* also in the chorology. In fact, the range of *Hacquetia epipactis* – being considerably narrower than that of *Lamium orvala* or *Vicia oroboides* – the perimeter of the association should be limited to the basis, in this case of the range of *Hacquetia epipactis.* In the example of the relationship between the *Lamium orvala* and *Omphalodes verna* there remains the question, on the one hand, of the "pure" beech forests (*Lamio orvalae-Fagetum*) and, on the other hand, of the mixed beech and fir forests (*Omphalodo-Fagetum*). In the pure beech forests of the alliance *Aremonio-Fagion, Vicio oroboidi-Fagetum* is floristically closer to the associations of the alliance *Fagion sylvaticae* (= *Eu-Fagion*), such as *Galio odorati-Fagetum* or *Carici pilosae-Fagetum.*

At the end of these considerations we have to bear in mind that all pure beech forests and the majority of mixed beech-fir forests, are for the most part anthropogenically transformed, and that the floristic stucture of particular pure beech forest associations will depend largely on the methods of management in the so-called "private" and "state" forests. Regarding the floristical differences between the virgin-forest, natural and exploitable mixed beech-fir forests, we have already written several reports (Trinajstić 1970, 1995a).

5. POVZETEK

Asociacija *Hacquetio-Fagetum* Košir 1962 (*Aremonio-Fagion*) na Hrvaškem

Od časa, ko so opustili koncept, po katerem so vse bukove gozdove jugovzhodno od Alp in največjega dela Dinaridov uvrščali v enotno asociacijo (Horvat 1938), se je število asociacij naglo povečevalo. Princip členitve enotne asociacije bukovih gozdov (*Fagetum sylvaticae croaticum* Ht. 1938) je temeljil na dodajanju imena vrste k obveznemu "*Fagetum*", za katero so posamezni avtorji menili, da bi najbolje prikazovala vsebino takšne nomenklaturne kombinacije. Avtorji so v največji meri izbirali tiste vrste (npr. *Vicia oroboides, Hacquetia epipactis, Dentaria trifolia* (= *"Cardamine savensis"*), *Omphalodes verna, Helleborus niger* in druge), ki so bile označne kot ilirikoidne (Trinajstić 1992, 1995b, 1997).

Izmed nekaj sintaksonomsko analiziranih asociacij ("*Querco-Fagetum, Hacquetio-Fagetum, 'Enneaphyllo'-Fagetum, 'Savensi'-Fagetum, Arunco-Fagetum, Isopyro-Fagetum*) je vzbudila posebno pozornost asociacija *Hacquetio-Fagetum* (Košir 1962, 1979). To asociacijo za Hrvaško omenja Trinajstić (1995a), sintezni prikaz pa sta kasneje objavila Vukelić & Baričević (2002). Zato smo na osnovi 9 popisov naredili analizo floristične sestave asociacije *Hacquetio-Fagetum* iz Velike Kapele, Samoborskega gorja, Cesargradske gore, Strahinjščice, Brezovice in Ivanščice na Hrvaškem.

V floristični sestavi smo zabeležili 119 vrst. Število vrst v posameznem popisu je med 42 in 73 ali povprečno 60 (59,8) vrst. Dominantna značilna vrsta asociacije je *Hacquetia epipactis*, ki ima 100-odstotno prisotnost. Areal te vrste je tudi areal asociacije *Hacquetio-Fagetum*. Zveza *Aremonio-Fagion* je zastopana z 22 vrstami, red *Fagetalia* in razred *Querco-Fagetea* z 91, 22 vrst pa je spremljevalk.

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Table 1 (Tabela 1): Ass. *Hacquetio-Fagetum* Košir 1962

Nr. of. veget. relevé:	1	2	3	4	5	6	7	8	9	Σ
Size veget. relevé m²:	200	500	500	900	400	200	400	900	500	
Nr. of Species pro relevé:	52	57	73	65	71	71	55	42	53	
Char. Ass.:										
B *Ilex aquifolium*	.	.	.	1.2	2.3	.	.	.	.	2
C *Hacquetia epipactis*	2.2	1.2	3.3	2.3	2.3	1.3	2.3	1.2	1.3	9
Ruscus hippoglossum	.	.	.	+	+	.	+.2	+.2	+.2	5
Epimedium alpinum (loc.)	.	.	.	1.3	3.3	3.3	.	.	.	3
Char. All. *Aremonio-Fagion*:										
A *Prunus avium*	+	.	+	.	.	.	.	+	.	3
B *Euonymus latifolia*	.	.	.	.	+	+	2.1	2.3	+	5
Staphylea pinnata	.	.	.	+.2	+	.	+	.	3.3	4
Rhamnus fallax	.	+	.	.	.	.	.	.	.	1
C *Cyclamen purpurscens*	+	.	+	+	+	+	+	.	+	7
Aposeris foetida	+	.	3.4	2.3	+	1.2	+.2	.	.	6
Lamium orvala	.	+	+	+	.	.	.	+	1.1	5
Helleborus niger	.	1.2	.	+	+	1.1	.	.	.	4
Helleborus dumetorum subsp. *atrorubens*	1.1	.	.	+	+	.	.	.	.	3
Prunus avium	1.1	.	.	.	.	+	.	+	.	3
Aremonia agrimonoides	.	+.2	+	+	.	.	.	.	.	3
Actaea spicata	.	+	+	.	.	.	.	.	+	3
Isopyrum thalictroides		.	.	.	.	.	.	+.3	1.1	2
Cardamine trifolia	.	+.2	.	.	.	.	.	.	+	2
Vicia oroboides	+	.	.	.	.	.	.	.	+	2
Homogyme sylvestris	.	.	.	.	+	+	.	.	.	2
Staphylea pinnata	.	.	.	.	.	.	.	+	+	2
Omphalodes verna	.	1.3	.	.	.	.	.	.	.	1
Calamintha grandiflora	.	+	.	.	.	.	.	.	.	1
Knautia drymeia	.	.	+	.	.	.	.	.	.	1
Melica nutans	.	.	.	.	+	.	.	.	.	1
Aruncus dioicus	.	.	.	.	+	.	.	.	.	1

Nr. of. veget. relevé:	1	2	3	4	5	6	7	8	9	Σ
Size veget. relevé m^2:	200	500	500	900	400	200	400	900	500	
Nr. of Species pro relevé:	52	57	73	65	71	71	55	42	53	
Ilex aquifolium	.	.	.	.	.	+	.	.	.	1
Senecio ovirensis	.	.	.	.	.	+	.	.	.	1
Euphorbia carniolica	.	.	.	.	.	+	.	.	.	1
Char. Order *Fagetalia*:										
A *Fagus sylvatica*	4.4	4.2	5.5	3.1	5.5	4.4	5.5	3.1	4.4	9
Quercus petraea	.	.	+	+	+	1.1	.	.	.	4
Carpinus betulus	+	.	.	.	.	.	.	+	1.1	3
Acer pseudoplatanus	+	.	.	.	.	+	.	.	+	3
Acer campestre	.	.	.	.	+	.	.	+	+	3
Tilia platyphyllos	.	.	.	.	.	+	.	.	.	1
B *Fagus sylvatica*	1.1	1.1	+	3.3	1.1	3.3	1.1	+.2	+.2	9
Rubus hirtus	1.3	+	+	+	+	.	2.3	2.3	+	8
Rosa arvensis	+.2	+	+.3	+.2	+	.	+	.	+	7
Daphne mezereum	+	.	+	+	+	+	.	.	+	6
Acer peudoplatanus	+	+	.	.	+	.	+	+	+	6
Ulmus glabra	+	.	+	.	+	+	.	.	.	4
Acer campestre	+	.	+	.	.	+	+	.	.	4
Corylus avellana	.	.	1.2	+.2	.	.	+.2	.	.	3
Acer platanoides	+	.	.	.	+	.	.	.	1.1	3
Carpinus betulus	+	.	+	+	.	.	.	.	.	3
Sorbus aria	.	.	+	.	+	+	.	.	.	3
Crataegus laevigata	.	.	.	.	.	.	+	+	+	3
Lonicera xylosteum	.	+.2	+	.	.	.	.	.	.	2
Abies alba	.	+	.	.	.	.	.	.	+	2
Lonicera caprifolium	.	.	.	.	+	+	.	.	.	2
Fraxinus excelsior	.	+	.	.	.	.	.	.	.	1
Viburnum opulus	.	+	.	.	.	.	.	.	.	1
Pyrus communis	.	.	+	.	.	.	.	.		1
Tilia platyphyllos	.	.	.	.	+	.	.	.	.	1
Tilia cordata	.	.	.	.	.	.	.	+	.	1
C *Asarum europaeum*	+.2	2.2	1.3	1.3	+.2	+.2	1.3	+.2	.	8
Sanicula europaea	+	+.2	1.2	1.3	+	.	+	+	+	8
Dryopteris filix-mas	+	.	+.2	+.2	+.2	.	1.1	2.2	2.2	7
Mercurialis perennis	.	2.3	+	.	+	+	1.3	1.3	1.3	7
Dentaria bulbifera	.	+	+	.	1.1	1.1	1.2	1.2	+	7
Galium odoratum	+.3	.	+.3	.	+.3	+	1.1	+.3	+.3	7
Pulmonaria officinalis	1.1	.	+.2	+	+	+	+	+	.	7
Lamium galeobdolon	+	+	.	+	+	+	+	+	.	7
Carex sylvatica	+.2	+.2	.	+.2	.	+.2	+.2	.	+.2	6
Dentaria enneaphyllos	.	1.1	.	.	.	2.1	1.1	1.1	1.1	5
Fagus sylvatica	.	1.1	.	+	.	.	+	1.3	+	5
Polygonatum multiflorum	.	.	+	+	.	.	+.3	+	1.1	5

Nr. of. veget. relevé:	1	2	3	4	5	6	7	8	9	Σ
Size veget. relevé m^2:	200	500	500	900	400	200	400	900	500	
Nr. of Species pro relevé:	52	57	73	65	71	71	55	42	53	
Euphorbia amygdaloides	+.2	1.2	.	+	+	.	.	+	.	5
Euphorbia dulcis	+	.	1.1	+	+	+	.	.	+	5
Lathyrus vernus	1.1	.	+	+	+	.	.	.	+	5
Lilium martagon	.	.	+	+	.	+	.	+	+	5
Paris quadrifolia	.	.	.	.	+	+	+	+	+	5
Brachypodium sylvaticum	.	+.2	1.2	+.2	.	+.2	.	.	.	4
Symphytum tuberosum	.	.	1.2	+	+	+	.	.	.	4
Galium sylvaticum	+	.	.	1.1	+	+	.	.	.	4
Carex digitata	.	+.2	+.2	+.2	+.2	.	.	.	.	4
Athyrium filix-femina	+.2	.	.	+.2	.	.	.	+.2	+.2	4
Hepatica nobilis	.	1.2	1.2	.	.	+	.	.	.	3
Campanula trachelium	+	1.1	1.1	.	.	.	.	.	.	3
Phyllitis scolopendrium	.	.	.	.	.	.	+.2	+.2	+.2	3
Viola reichenbachiana	+	+	.	.	.	.	+	.	.	3
Arum maculatum	+	.	.	.	.	.	.	+	+	3
Polystichum aculeatum	.	.	+.2	.	.	.	.	+.2	.	2
Neottia nidus-avis	.	.	+	.	.	.	.	+	.	2
Phyteuma spicatum	.	.	.	+	+	.	.	.	.	2
Leucoium vernum	.	.	.	.	.	.	+	+	.	2
Festuca altissima	.	.	.	1.2	.	.	.	.	.	1
Carex pilosa	+.2	.	.	.	.	.	.	.	.	1
Poa nemoralis	.	+.2	.	.	.	.	.	.	.	1
Astragalus glycyphyllos	.	.	.	+.2	.	.	.	.	.	1
Abies alba	.	+	.	.	.	.	.	.	.	1
Veronica urticifolia	.	+	.	.	.	.	.	.	.	1
Allium ursinum	.	.	+	.	.	.	.	.	.	1
Cephalanthera damasonium	.	.	+	.	.	.	.	.	.	1
Doronicum austriacum	.	.	.	+	.	.	.	.	.	1
Quercus petraea	.	.	.	+	.	.	.	.	.	1
Acer campestre	.	.	.	+	.	.	.	.	.	1
Phyteuma ovatum	.	.	.	.	.	+	.	.	.	1
Helleborus dumetorum	.	.	.	.	.	+	.	.	.	1
Fragaria moschata	.	.	.	.	.	+	.	.	.	1
Thalictrum aquilegifolium	.	.	.	.	.	+	.	.	.	1
Lunaria rediviva	.	.	.	.	.	.	.	.	+	1
Galanthus nivalis	.	.	.	.	.	.	.	.	+	1
Char. Class *Querco-Fagetea*:										
A *Acer obtusatum*	.	.	.	.	+	+	.	.	.	2
B *Cornus sanguinea*	+	.	+.3	.	1.2	+	+	.	.	5
Cornus mas	.	.	+	+.2	.	+	+	.	.	5
Viburnum lantana	+	.	+	.	+	1.1	.	.	.	4
Crataegus monogyna	+	.	.	+.2	+	+	.	.	.	4

Nr. of. veget. relevé:	1	2	3	4	5	6	7	8	9	Σ
Size veget. relevé m^2:	200	500	500	900	400	200	400	900	500	
Nr. of Species pro relevé:	52	57	73	65	71	71	55	42	53	
Ligustrum vulgare	.	.	.	+.2	+	+	+	.	.	4
Fraxinus ornus	.	.	+	.	+	+	.	.	+	4
Sambucus nigra	.	.	.	.	.	.	1.2	+	.	2
Euonymus verucosus	.	+	+	.	.	.	.	.	.	2
Acer obtusatum	.	.	.	+	.	.	.	.	.	1
Rhamnus catharticus	.	.	.	.	.	.	+	.	.	1
C *Hedera helix*	+.3	1.3	+	+.3	+	+	+.3	1.3	1.3	9
Anemone nemorosa	+	2.3	.	1.1	.	.	3.3	3.3	+	6
Tamus communis	+	.	+	+	+	+	+.2	.	.	6
Senecio fuchsii	+	.	1.1	+	.	.	.	.	+	5
Mycelis muralis	1.1	+	+	.	+	.	.	.	.	4
Clematis vitalba	+	+	+	.	+	.	.	.	.	4
Primula vulgaris	.	1.2	+	.	.	+	+	.	.	3
Glechoma hirsuta	.	.	.	.	.	.	.	+	+	3
Potentilla micrantha	.	.	+	+.2	.	.	.	.	.	2
Fraxinus ornus	+	.	.	+	.	.	.	.	.	2
Veronica chamaedrys	.	+	+	.	.	.	.	.	.	2
Listera ovata	.	.	+	.	.	+	.	.	.	2
Tanacetum corymbosum	.	.	.	.	+	+	.	.	.	2
Convallaria majalis	.	.	+	.	.	.	.	.	.	1
Geum urbanum	.	.	+	.	.	.	.	.	.	1
Mercurialis ovata	.	.	+	.	.	.	.	.	.	1
Campanula persicifolia	.	.	.	.	.	+	.	.	.	1
Vincetoxicum hirundinaria	.	.	.	.	.	+		.	.	1
Companions:							.			
C *Pteridium aquilinum*	1.1	.	+	1.1	+	+	.	.	.	5
Gentiana asclepiadea	.	+	.	+	+	+	.	+	.	5
Aconium vulparia	.	.	.	1.1	.	+	.	+	+	4
Ajuga reptans	+	+	+	.	.	+	+.2	.	.	4
Polypodium vulgare	.	.	.	+	.	.	.	.	+.2	3
Fragaria vesca	.	+	+.3	.	.	.	+.2	.	.	2
Luzula pilosa	.	.	+	.	.	.	.	.	.	2
Circaea lutetiana	+	.	.	+	.	.	.	.	.	2
Prenanthes purpurea	.	+	.	+	.	.	.	.	.	2
Castanea sativa	.	.	+	.	.	+		.	.	2

A / Trees, B / Shrubs, C / Herbs

Table 2 (Tabela 2): Ass. *Hacquetio-Fagetum* Košir 1962

Nr. of column:	1	2	3	4	5	Σ
Author:	T/P	RB	Ht	M/Z	K	
Nr. of relevés:	9	7	13	10	24	63
Nr. of species	119	107	117	94	121	202
Ass.						
B *Ilex aquifolium* (reg.)	2	.	1	.	3	6
C *Hacquetia epipactis*	9	7	13	10	24	63
Ruscus hypoglossum (reg.)	5	2	8	17	3	35
Ilex aquifolium (reg.)	1	.	.	.	.	1
Diff. Ass.:						
C *Epimedium alpinum*	3	.	2	9	14	38
All. (*Aremonio-Fagion*):						
A *Prunus avium*	3	.	.	.	4	7
B *Euonymus latifolia*	5	2	2	.	4	13
Staphylea pinnata	4	3	3	.	.	10
Prunus avium	.	.	5	2	.	7
Rhamnus fallax	1	.	.	.	.	1
C *Cyclamen purpurascens*	7	7	11	8	19	52
Actaea spicata	3	2	10	2	12	29
Lamium orvala	5	1	11	2	9	28
Vicia oroboides	3	1	11	3	9	26
Aremonia agrimonoides	3	1	5	6	11	26
Prunus avium	5	3	2	2	5	17
Helleborus niger	4	.	2	5	18	29
Melica nutans	1	.	5	4	5	15
Senecio ovirensis	1	4	5	.	2	12
Knautia drymeia	1	2	2	.	5	10
Cardamine trifolia	2	.	1	3	1	7
Aruncus dioicus	1	2	2	.	1	6
Omphalodes verna	1	.	.	8	3	12
Euphorbia carniolica	1	.	2	6	.	9
Isopyrum thalictroides	2	2	4	.	.	8
Homogyne sylvestris	2	.	1	.	5	8
Helleborus dumetorum subsp.*atrorubens*	3	.	3	.	.	6
Erythronium dens-canis	.	1	5	.	.	6
Calamintha grandiflora	1	.	.	.	3	4
Staphylea pinnata	2	.	1	.	.	3
Euonymus latifolia	.	1	.	.	.	1
Taxus baccata (reg.)	.	.	1	.	.	1
Spiraea chamaedryfolia	.	.	1	.	.	1
Order (*Fagetalia sylvaticae*):						
A *Fagus sylvatica*	9	7	13	10	24	63
Acer pseudoplatanus	3	3	1	4	14	25

	Nr. of column:	1	2	3	4	5	Σ
	Author:	T/P	RB	Ht	M/Z	K	
	Nr. of relevés:	9	7	13	10	24	63
	Nr. of species	119	107	117	94	121	202
	Quercus petraea	4	3	3	4	10	24
	Acer campestre	3	.	1	3	5	12
	Carpinus betulus	3	1	4	.	2	10
	Ulmus glabra	.	.	1	.	5	6
	Tilia platyphyllos	1	.	.	.	2	3
	Acer platanoides	.	1	1	.	.	2
	Malus sylvestris	.	1	1	.	.	2
	Sorbus aucuparia	.	1	.	.	.	1
	Corylus avellana	.	.	1	.	.	1
	Abies alba	.	.	.	.	1	1
B	*Fagus sylvatica*	9	7	13	10	24	63
	Daphne mezereum	6	5	12	9	23	55
	Acer pseudoplatanus	6	3	11	7	18	45
	Acer campestre	4	2	6	8	12	34
	Ulmus glabra	4	2	5	1	10	22
	Rosa arvensis	7	.	13	9	16	45
	Corylus avellana	3	.	6	6	6	21
	Viburnum opulus	1	.	1	3	5	10
	Rubus hirtus	8	4	.	.	9	21
	Lonicera xylosteum	2	.	.	4	9	15
	Acer platanoides	3	4	.	.	6	13
	Quercus petraea	.	.	2	1	9	12
	Lonicera alpigena	.	2	3	.	5	10
	Abies alba	2	1	.	.	6	9
	Lonicera caprifolium	2	.	3	.	4	9
	Tilia platyphyllos	1	1	2	.	.	4
	Carpinus betulus	3	.	4	.	.	7
	Daphne laureola	.	1	5	.	.	6
	Crataegus laevigata	3	.	.	.	.	3
	Fraxinus excelsior	1	.	.	.	.	1
	Pyrus communis	1	.	.	.	.	1
	Tilia cordata	1	.	.	.	.	1
C	*Asarum europaeum*	8	5	8	10	20	51
	Pulmonaria officinalis	7	3	11	5	21	47
	Mercurialis perennis	7	7	9	4	18	45
	Euphorbia amygdaloides	5	5	8	10	15	43
	Sanicula europaea	8	7	10	7	10	42
	Dentaria bulbifera	7	2	12	6	15	42
	Polygonatum multiflorum	5	4	10	8	15	42
	Salvia glutinosa	5	3	7	9	16	40
	Viola reichenbachiana	3	6	8	6	16	39

Nr. of column:	1	2	3	4	5	Σ
Author:	T/P	RB	Ht	M/Z	K	
Nr. of relevés:	9	7	13	10	24	63
Nr. of species	119	107	117	94	121	202
Carex sylvatica	6	1	10	7	15	39
Dentaria enneaphyllos	5	4	10	2	7	38
Galium odoratum	6	5	13	4	10	38
Carex digitata	4	4	11	8	11	38
Dryopteris filix-mas	7	5	10	4	8	34
Paris quadrifolia	5	2	8	5	10	30
Lamium galeobdolon	7	5	2	6	8	28
Hepatica nobilis	3	5	4	6	9	27
Neottia nidus-avis	2	1	2	5	9	19
Campanula trachelium	3	5	5	3	1	17
Fagus sylvatica	5	2	5	3	1	16
Carex pilosa	1	1	6	1	2	11
Galium sylvaticum	4	5	10	.	19	38
Lilium martagon	5	6	11	.	13	35
Lathyrus vernus	4	6	12	.	4	27
Euphorbia dulcis	5	4	10	.	7	26
Phyteuma spicatum	2	3	5	.	8	18
Arum maculatum	3	1	6	.	5	15
Polystichum aculeatum	2	1	4	.	3	10
Acer pseudoplatanus	.	4	6	2	6	18
Cephalanthera damasonium	1	.	4	1	8	14
Phyllitis scolopendrium	3	1	3	.	1	8
Helleborus dumetorum + odorus	1	.	.	7	3	11
Acer platanoides	.	5	3	.	2	10
Galanthus nivalis	1	1	7	.	.	9
Quercus petraea	1	2	5	.	.	8
Doronicum austriacum	1	2	2	.	.	5
Festuca altissima	1	.	1	.	1	3
Cruciata glabra	.	.	2	6	.	8
Fragaria moschata	1	.	.	1	4	6
Acer campestre	1	.	3	.	.	4
Corydalis cava	.	1	3	.	.	4
Bromus ramosus	.	2	1	.	1	4
Allium ursinum	1	1	.	.	.	2
Abies alba	1	.	1	.	.	2
Lunaria rediviva	1	.	1	.	.	2
Epipactis helleborine	.	1	.	1	.	2
Rosa arvensis	.	6	.	.	.	6
Brachypodium sylvaticum	.	.	.	6	.	6
Scilla bifolia	.	.	5	.	.	5
Stellaria holostea	.	.	4	.	.	4

Nr. of column:		1	2	3	4	5	Σ
Author:		T/P	RB	Ht	M/Z	K	
Nr. of relevés:		9	7	13	10	24	63
Nr. of species		119	107	117	94	121	202
	Crocus napolitanus	.	.	4	.	.	4
	Corylus avellana	.	3	.	.	.	3
	Festuca drymeia	.	3	.	.	.	3
	Dentaria trifolia	.	.	.	.	3	3
	Valeriana tripteris	.	.	.	.	3	3
	Leucojum vernum	2	.	.	.	.	2
	Geranium phaeum	.	.	2	.	.	2
	Carpinus betulus	.	.	2	.	.	2
	Poa nemoralis	1	.	.	.	.	1
	Veronica urticifolia	1	.	.	.	.	1
	Phyteuma ovatum	1	.	.	.	.	1
	Thalictrum aquilegiifolium	1	.	.	.	.	1
	Stachys sylvatica	.	1	.	.	.	1
	Dentaria polyphylla	.	.	1	.	.	1
	Milium effusum	.	.	1	.	.	1
	Adoxa moschatellina	.	.	1	.	.	1
	Ranunculus ficaria	.	.	1	.	.	1
	Scrophularia nodosa	.	.	1	.	.	1
	Viburnum opulus	.	.	1	.	.	1
	Cephalanthera longifolia	.	.	.	1	.	1
	Ulmus glabra	.	.	.	.	1	1
	Class (*Querco-Fagetea*):						
A	*Acer obtusatum*	2	.	1	1	.	4
	Ostrya carpinifolia	.	.	2	.	4	6
	Sorbus torminalis	.	.	.	2	3	5
	Sorbus aria	.	2	.	.	1	3
	Fraxinus ornus	.	1	.	.	1	2
	Quercus cerris	.	.	.	.	4	4
B	*Crataegus monogyna*	4	6	11	6	15	42
	Viburnum lantana	4	3	6	6	14	33
	Clematis vitalba	4	1	7	6	14	31
	Fraxinus ornus	4	3	5	7	12	31
	Sorbus aria	3	6	8	1	8	22
	Cornus sanguinea	5	5	6	.	15	31
	Ligustrum vulgare	4	.	1	8	10	23
	Berberis vulgaris	.	4	2	4	9	19
	Euonymus verrucosa	2	.	2	3	9	16
	Cornus mas	5	2	4	4	.	15
	Acer obtusatum	1	.	2	7	.	10
	Pyrus pyraster	.	1	4	4	.	9
	Sorbus torminalis	.	3	.	1	3	7

Nr. of column:		1	2	3	4	5	Σ
Author:		T/P	RB	Ht	M/Z	K	
Nr. of relevés:		9	7	13	10	24	63
Nr. of species		119	107	117	94	121	202
	Sambucus nigra	2	1	1	.	.	4
	Rosa pendulina	.	1	.	.	2	3
	Rhamnus catharticus	1	.	1	.	.	2
	Chanaecytisus supinus	.	.	3	.	.	3
C	*Hedera helix*	9	7	13	8	24	61
	Anemone nemorosa	6	2	11	6	14	39
	Primula vulgaris	3	2	5	10	18	38
	Tamus communis	6	4	8	9	10	37
	Symphytum tuberosum	4	2	8	2	11	27
	Platanthera bifolia	.	2	3	3	16	24
	Mycelis muralis	4	4	8	3	9	28
	Convallaria majalis	1	6	6	2	.	15
	Melica uniflora	4	1	.	3	3	11
	Carex flacca	.	1	.	8	14	23
	Melittis melissophyllum	.	1	3	.	10	14
	Senecio fuchsii	5	1	.	3	5	14
	Tanacetum corymbosum	2	4	4	.	.	10
	Listera ovata	2	.	6	.	.	8
	Cephalanthera rubra	.	.	.	3	5	8
	Veronica chamaedrys	2	.	5	.	.	7
	Glechoma hirsuta	3	3	.	.	.	6
	Iris graminea	.	2	2	.	.	4
	Potentilla micrantha	2	.	1	.	.	3
	Fraxinus ornus	2	.	1	.	.	3
	Hypericum montanum	.	1	1	.	.	2
	Carex alba	.	.	.	.	6	6
	Digitalis grandiflora	.	.	.	3	.	3
	Vincetoxicumn hirundinaria	1	.	.	.	.	1
	Geum urbanum	1	.	.	.	.	1
	Mercurialis ovata	1	.	.	.	.	1
	Clinopodium vulgare	.	.	.	1	.	1
	Valeriana officinalis	.	.	.	1	.	1
	Companions:						
A	*Picea abies*	.	.	.	3	.	3
B	*Picea abies*	.	.	.	5	.	5
	Castanea sativa	1	.	.	.	.	1
C	*Fragaria vesca*	2	3	7	4	3	19
	Pteridium aquilinum	5	.	8	6	18	37
	Gentiana asclepiadea	5	.	7	8	6	26
	Solidago virgaurea	.	6	5	4	5	20
	Ajuga reptans	4	.	4	7	3	18

Nr. of column:	1	2	3	4	5	Σ
Author:	T/P	RB	Ht	M/Z	K	
Nr. of relevés:	9	7	13	10	24	63
Nr. of species	119	107	117	94	121	202
Prenanthes purpurea	2	3	6	.	5	16
Oxalis acetosella	.	2	4	3	7	16
Luzula pilosa	2	.	1	5	5	13
Castanea sativa	2	1	1	.	4	8
Heracleum sphondylium	.	4	8	.	2	14
Hieracium cf. *sylvaticum*	.	5	5	.	4	14
Aconitum vulparia	4	1	6	.	.	11
Polypodium vulgare	3	2	4	.	.	9
Circaea lutetiana	2	.	1	.	4	7
Serratula tinctoria	.	3	1	.	1	5
Peucedanum austriacum	.	2	1	.	1	4
Luzula luzuloides	.	3	5	.	.	8
Aegopodium podagraria	.	.	6	.	1	7
Maianthemum bifolium	.	.	1	3	.	4
Picea abies	.	1	.	2	.	3
Eupatorium cannabinum	.	.	2	.	1	3
Vaccinium myrtillus	.	.	.	2	1	3
Juniperus communis	.	1	1	.	.	2
Asplenium trichomanes	.	1	.	1	.	2

Companions in one column only**:** *Melampyrum nemorosum* 2, *Hieracium racemosum* 2, *Buphtalmum salicifolium* 2, *Laserpitium latifolium* 1, *Poa angustifolia* 1 (RB); *Epilobium montanum* 2, *Geranium robertianum* 1, *Lilium carniolicum* 1, *Alliaria petiolata* 1 (Ht); *Veratrum album* 5, *Galium verum* 3 (M/Z); *Viola odorata* 1, *Polygala chamaebuxus* 1, *Laburnum alpinum* 1, *Aquilegia vulgaris* 1, *Calamagrostis varia* 1, *Hieracium pilosella* 1, *Ortilia secunda* 1, *Galium mollugo* 1, *Festuca heterophylla* 1, *Hypericum perforatum* 1 (K)

A / Trees; B / Shrubs; C / Herbs – TP (Trinajstić & Pavletić); RB (Regula-Bevilacqua 1978); M/Z (Marinček & Zupančič 1977); K (Košir 1979)