THE SYNTAXONOMICAL DIFFERENTIATION OF THE FESTUCO-BROMETEA BR.-BL. & R.TX. 1943 EX KLIKA & HADAC 1944 IN THE BALKANS

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ABSTRACT - Xerophilous vegetation of the class *Festuco-Brometea* covers large areas on the Balkans since in the past pronounced degradation of climax vegetation. The climax vegetation of the area in question is represented with the following communities: *Carpinion orientalis* Blecic & Lakusic 1966 and *Ostryo-Carpinion orientalis* Horvat 1954 emend. 1958, *Quercion farnetto* Horvat 1954 in Sub-Mediterranean belt, and *Seslerio-Ostryon* Lakusic, Pavlovic & Redzic 1982, *Quercion petraeae-cerris* (Lakusic, 1976) Lakusic & B.Jovanovic 1980, *Quercion pubescentis-petraeae* Br.-Bl. 1931, *Fagion moesiacae* Blecic & Lakusic 1970 and *Fagion illyricum* Horvat (1938) 1950 in mediterraneo-montane belt and part of montane belt.

The class *Festuco-Brometea* is presented by thermophilous communities of meadows, rocky meadows and pastures; in these communities., species from Balkan, Illyrian, and the south-eastern European floral element play dominant role. In the investigated part of the Balkans the class is differentiated into the following orders: *Scorzoneretalia villosae* Horvatic 1975 (=*Scorzonero-Chrysopogonetalia* Horvat & Horvatic /1956/1958)p.p.) with alliances *Hypochoeridion maculatae* Horvatic (1956) 1958, *Scorzonerion villosae* Horvatic 1949 and *Satureion subspicatae* Horvat 1962; *Festucetalia valesiacae* Br.-Bl. & R.Tx. 1943 ex Br.-Bl. 1949 with alliances *Cirsio-Brachypodion* Hadac & Klika 1944, *Festucion valesiacae* Klika 1931, *Chrysopogoni-Danthonion* Kojic 1957, *Festucion pseudovinae* Horvat 1962 and *Festucion rupicolae* Soó 1940; *Astragalo-Potentilletalia* K.Micevski 1970 with alliances *Koelerio-Festucion dalmaticae* Randjelovic & Ruzic 1986, *Scabioso-Trifolion dalmatici* Horvatic & Randjelovic 1973, *Armerio-Potentillion* K.Micevski 1978, *Trifolion cherleri* K.Micevski 1970 and *Saturejo-Thymion* K.Micevski 1970.

The order *Brometalia erecti* Br.-Bl. 1936 includes communities of thermophilous meadows in northern and central Europe which has on central part of the Balkans its southern border of distribution. It is presented here by the alliances *Mesobromion erecti* (Br.-Bl. & Moor, 1938) Oberd. 1949 with suballiances *Eu-Mesobromenion* Oberd. 1957, *Filipendulo-Danthonenion alpinae* Redzic 1991 and *Gentiano tergestinae-Crepidenion dinaricae* Redzic 1991, and *Xerobromion erecti* (Br.-Bl. & Moor, 1938) Moravec in Holub *et al*. 1967 with suballiance *Fumano-Scabiosenion leucophyllae* Redzic 1991.

Towards Eumediterranean region, communities from this class often show transitions toward other grassland communities, e.g the order *Koelerietalia splendetis* Horvatic 1975 (=*Scorzonero-Chrysopogonetalia* Horvat & Horvatic, /1956/1958 p.par.), towards southeast with dry meadows from the order *Daphno-Festucetalia* Quezel 1964; in the subalpine belt it is syngenetically connected with vegetation of dry alpine meadows form the order *Seslerietalia juncifoliae* Horvat 1930 in the north-western part, and with the order *Crepidetalia dinaricae* Lakusic 1966 in the south eastern part, with the order *Onobrychidi-Seslerietalia* Horvat 1949 in the central and the eastern part of the Balkans.

KEY WORDS - Balkans, Dinaric Alpes, Festuco-Brometea, Phytocoenology, Syndynamics, Syntaxonomy, Xerophilous Vegetation

NOMENCLATURE - Tutin *et al*. (1964-1980), Hayek (1924-1933).

INTRODUCTION

Anthropogenic influences on Balkan peninsula has been very intensive and diverse in the past. This resulted in significant changes in spatial and temporal organisation of natural or climatogenic phytocoenoses and vegetation cover in general. The results of numerous studies (Horvatic, 1934; 1973; Horvat *et al*., 1974; Blecic and Lakusic, 1976; Lakusic *et al*., 1978; Redzic *et al*., 1984; Jovanovic *et al*., 1986; Parabucski *et al*., 1986; Lovric, 1993) carried out in this region have demonstrated that vegetation cover of the Balkans is very heterogeneous, both in floristic and phytocoenological composition, especially with xerophilous vegetation (dry grasslands, rocky grasslands, pastures) of the class *Festuco-Brometea*.

The communities of the class *Festuco-Brometea* cover significant areas from Submediterranean belt of Adriatic province to subalpine belt in Illyrian and Moesian province ranging in altitude between 200 to 1550-1600 meters. They reach their optimum on shallow limestone soils of rendzine, calcomelanosol and drier calcocambisol types, mainly on steeper inclinations and warmer habitats, in the zone of xerotherm vegetation of the orders *Quercetalia pubescentis* Br.-Bl. (1931 n.nud.)1932, *Ostryo-Carpinetalia orientalis* (Tom.1940) Lakusic, Pavlovic & Redzic 1982 and *Fagetalia sylvaticae* Pawl. 1928 (Horvatic, 1963; 1964).

From the floristic, phytocoenological and ecological standpoint certain types of thermophilous meadows have been studied much more intensively than others, particularly Submediterranean meadows and rocky meadows of the order *Scorzoneretalia villosae* (Segulja, 1969; Horvatic, 1973; 1975;), the communities of the order *Festucetalia valesiacae* (Stjepanovic-Veselicic, 1953; Kojic, 1957; Stevanovic, 1984), as well as the communities of the order *Astragalo-Potentilletalia* (Micevski, 1970; Randjelovic, 1975; Ruzic, 1983). Also significant attention paid to the mesothermophilous meadows from the central European order *Brometalia erecti* in the different part of the Balkans (Horvat, 1962; Petkovsek, 1977; Hulina, 1988 *et al*.).

In spite of all above mentioned there are still numerous not investigated areas, especially in the central and the western part of the Balkans. This is particularly the case with the region of continental Dinaric Alps (Redzic,1984; 1990)

Besides, more extensive works and monographs do not exist, except for the classic overview of Horvat *et al*. (1974). Particularly, comparative analytical and synthetical studies of structure, dynamics, syngenesis and chorological and ecological

differentiation of this very complex syntaxonomical unit are lacking.

Detailed studies on syngenesis and structure, as well as on phytocoenological and chorological differentiation of thermophille meadows on the Balkans, particularly on its western and central part, were carried out recently with full respect of modern methods and trends in modern phytocoenological science.

A part of these results is included in the study carried out by Redzic (1991), and another part, and particularly the part dealing with syntaxonomy, chorology and ecology is presented in this article. The final processing and interpretation of the results with the application of modern methods of numerical syntaxonomy will be presented in a next publication.

Material and Methods

Investigations of thermophilous meadows, pastures, and rocky meadows from the class *Festuco-Brometea* was very intensively carried out in the period 1980-1991, on both vertical and horizontal profile of the western and the central part of the Balkans, with often field trips to the east and the southeast. The classic method of Braun-Blanquet (1964) was implemented. During the study, more than 1000 original phytocoenological releves were made. The similar number of releves made in the broader region of the Balkans by other authors was covered by comparative analysis.

The description of the resulting communities in according the Code of Phytosociological Nomenclature (Barkman *et al*., 1986).

Several hundreds recordings from various communities of this class from other parts of its distribution (western, central and south-western Europe) were also analysed.

GENERAL CHARACTERISTICS OF INVESTIGATED AREA

Investigated area is located between 40^0 and 46^0 latitude and between 12^0 and 22^0 longitude (fig 1).

Geology. The region of Central and Western Balkans is very heterogeneous as regards to geological and petrographic characteristics.

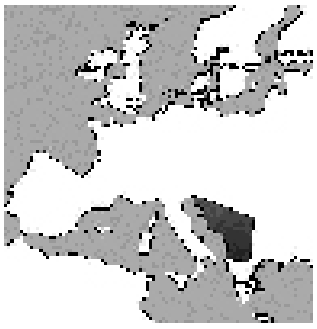

Fig. 1 - Geographical presentation of investigated

Mesozoic limestone sediments dominate in the whole region. In Mediterranean and Sub-mediterranean belt, Paleogenic sediments cover large areas, and in hilly-mountain belt (towards Pannonia) Jurassic and Triassic sediments plays dominant role. Palaeozoic occurs here and there, as well as basic and ultrabasic eruptives.

The largest part of the Balkans was not under the influence of last glaciation, except for the peaks of the highest mountains. However, very expressive indirect influences of glaciation were present. That is demonstrated through

temperature variances, ruining of rocks, formation of colluvium in the valleys, and sediments in karst depressions.

Orography. From the orographic standpoint, this is a very dynamic hilly-mountain region with most of the mountain ranges situated in a north-west to south-east direction. The region is intersected with numerous river valleys with the north-south direction.

Vertical profile from the Adriatic sea towards peaks of mountains is around 2.400 meters.

Numerous karst fields and depressions on the plateaus point to the specific orogenesis of this region. There are clearly differentiated belts on relatively short distances:Eu-mediterranean, Sub-mediterranean, hills, mountain belt, subalpine, alpine and subnival to naval belt.

Ecoclimate. This region is very heterogeneous and dynamic as regards to ecoclimate. On the profile of around 2.400 meters on littoral side, there is regular succession of several ecoclimatic types in each belt from Eu-mediterranean towards subnival and nivale type. This is the region with the highest temperature extremes, variation in precipitation in Europe.

Mean annual temperature in Eu-mediterranean belt is range, varies from 20 ^{0}C to 16 ^{0}C, and in Sub-mediterranean belt from 15 ^{0}C to 12 ^{0}C, in hilly region from 11 ^{0}C to 8 ^{0}C, in mountainous from 7 ^{0}C to 4 ^{0}C, in alpine from 3 ^{0}C to 0 ^{0}C, and in subnivale from 0 ^{0}C to -4 ^{0}C (Lakusic, 1975). Absolute maximal temperature in Eu-mediterranean belt reaches up to 50 ^{0}C, and absolute minimal temperature in mountain belt are up to -42 ^{0}C. During the year certain places (Gorski Kotar, Orjen, etc.) receive more than 3000 mm of precipitation, mostly in the early spring and late fall. During the vegetation period in means area there is a very strong influence of arid climate in that months.

South-west winds are the most frequent which has also the strongest influence on the formation of vegetation cover.

Soil conditions. Pedological space is very mosaic. However, there are certain global patterns in the distribution and genesis of basic types of soils on the whole horizontal and vertical profile. The main pedogenetic factors in this region are humidity and temperature, wind and snow cover. From the most arid towards the most humid habitats the system of pedogenesis begins with formation of litosol, regosol and sirozem, which in more humid conditions and on the slight slopes show gradual transition to calcomelanosol, rendzine, and in even more humid situations in calcocambisol, and terra rossa in Eu-mediterranean belt.

Luvisols are developed on the slight slopes and in absence of strong winds and favourable processes of eluviation and iluviation. On the silicate rocks, humus silicate soils or rankers, as well as distric cambisols and distric luvisols are developed.

Phytogeography. The region of the Balkans is very similar to the richest subtropical regions of the world, concerning a large number of plant species. Particular characteristics of this region are numerous endemic and relic plant species which give special floristic and vegetational, as well as biogeographical features to this region (Horvatic, 1964; Trinajstic and Sugar, 1972; Lakusic *et al*., 1978; Jovanovic *et al*., 1986; Sugar and Plazibat, 1988; Segulja, 1988). On horizontal and vertical profile vegetation can be divided into three regions: Mediterranean with Adriatic province; Eurosiberian-boreoamerican, with Ilirian, Moesian and the province of relic pine fo-

rests, and Alpine high nordic, with province of high Dinaric Alps (Lakusic, 1969).

Results

A comparative analyses of thermophilous meadows from the class *Festuco-Brometea* on the Balkans made clear that there exist around 1000 plant species in these grasslands, whereas more than 100 plant communities on the level of association can be distinguished. All analysed communities have very high floristic resources. The number of species ranges from 90 to 230 per association. A larger part of analysed communities has a chemicryptophyte-chamaephyte character. As regards to the floral elements, a significant role play Illyrian, Balkan and Southeastern Europe (more than 35%) floral elements. This clearly differentiates Balkan communities from *Festuco-Brometea* communities from other geographical regions.

On the basis of the results of investigations, the following syntaxonomic differentiation is proposed:

FESTUCO-BROMETEA Br.-Bl. & R.Tx. 1943 ex Klika & Hadac 1944
BROMETALIA ERECTI (W.Koch 1926) Br.-Bl. 1936
MESOBROMION ERECTI (Br.-Bl. & Moor 1938) Oberd. 1957
(= BROMION ERECTI W.Koch 1926; CIRSIO ACAULI- BROMION ERECTI Redzic 1991)
Eu-Mesobromenion Oberd. 1957 (=Cirsio acauli-Bromenion Redzic 1991)
Mesobrometum Oberd. 1957
Bromo-Plantaginetum mediae Horvat (1931)1949
Gentianello-Danthonietum alpinae Redzic 1991
Bromo-Danthonietum alpinae Sugar 1972
Bromo-Brachypodietum pinnati Petkovsek 1977
Brometum erecti Pavlovic 1955
Seslerietum kalnikensis Horvat 1942
Onobrycho montanae-Brometum Sugar 1986
Filipendulo-Danthonenion Redzic 1991
Hypochoereto-Danthonietum alpinae Redzic 1991
Trifolio pannonici-Danthonietum aplinae Redzic 1991
Danthonietum alpinae-decumbentis Sugar 1983
Gentiano tergestinae-Crepidenion dinaricae Redzic 1991
Gentiano tergestinae-Crepidetum dinaricae Redzic 1991
Diantho-Brometum erecti Redzic 1991
XEROBROMION ERECTI (Br.-Bl. & Moor 1938) Moravec in Holub *et al*. 1967 (=Carici humilis-Bromion erecti Redzic 1991)
Fumano-Scabiosenion leucophyllae Redzic 1991
Potentillo-Scabiosetum leucophyllae Redzic 1991
Stipo capillatae-Dichanthietum ischaemi Redzic 1991
Achilleo nobilis-Genistetum januensis Redzic 1991
Asperuletum purpureae Redzic 1991
Melico-Brometum fibrosii (Petkovic 1981) Petkovic & Tatic 1985
Scabiosetum leucophyllae Abadzic 1973

SCORZONERETALIA VILLOSAE Horvatic 1975
(=Scorzonero-Chryspogonetalia Horvat & Horvatic (1956) 1958 p.par.)
Scorzonerion villosae Horvatic 1949
Danthonio-Scorzoneretum villosae Horvat & Horvatic (1956) 1958
Andropogoni-Diplachnetum serotinae Horvatic 1963
Pseudovino-Poetum bulbosae Horvat 1956
Galio-Festucetum illyricae Lakusic *et al*. 1974
Festuco-Armerietum canescentis Trinajstic & Sugar 1972
Chrysopogoni-Euphorbietum nicaensis Horvatic (1956)1958
Ononidi-Brometum condensati Horvatic (1962)1963
Peucedano-Lathyretum filiformis Riter-Studnicka 1972
Hypochoeridion maculatae Horvatic (1956) 1958
Scorzonero-Hypochoeretum maculatae Horvatic (1956) 1958
Bromo-Caricetum montanae Horvatic (1973) 1975
Festuco-Armerietum canascentis Trinajstic & Sugar 1972
Globulario-Chrysopogonetum grylli Ilijanic, Gazi & Topic 1972
Satureion subspicatae Horvat 1962
Bromo-Caricetum humilis Sugar 1969
Bromo-Seslerietum interruptae Trinajstic 1965
Genisto-Caricetum mucronatae Horvat 1956
Pediculari-Caricetum humilis Horvat 1956
Saturejo-Edraianthetum Horvat 1942
Carici-Centauretum rupestris Horvat 1931
Saturejo-Caricetum humilis Trinajstic 1981
Carici-Centauretum atropurpureae Ht 1962
Carici verni-Scabioosetum leucophyllae Redzic, Lakusic *et al*. 1984
Globulario-Scabiosetum leucophyllae Redzic, Lakusic *et al*. 1984
Stipo pennatae-Genistetum dalmaticae Redzic, Lakusic *et al*. 1984
Edraiantho subalpini-Globularietum Redzic 1991
Minuartio bosniacae-Seslerietum ujhelyii Redzic 1991
Saturejo subspicatae-Festucetum dalmaticae Redzic & Lakusic 1991
Thymi-Teucrietum chamaedrys Redzic & Lakusic 1991
Achilleo nobili-Dorycnietum herbacei Redzic & Lakusic 1991

FESTUCETALIA VALESIACAE Br.-Bl. & R.Tx. ex Br.-Bl. 1949
Cirsio-Brachypodion pinnati Hadac & Klika in Klika & Hadac 1944
Adonido-Brachypodietum Krausch 1959
Festucion valesiacae Klika 1931
Potentillo-Caricetum humilis R.Jovanovic 1955
Galio-Festucetum valesiacae R.Jovanovic 1955
Chrysopogoni-Festucetum valesiacae Veljovic 1971
Nepeto-Festucetum valesiacae Diklic & Milojevic 1976
Carici humilis-Stipetum pulcherrimae R.Jovanovic 1955
Trifolio-Festucetum valesiacae Diklic & Nikolic 1972
Nepeto-Festucetum valesiacae Diklic & Milojevic 1976

Taraxaco-Festucetum valesiacae Stojanovic 1981
Teucrium chamaedrys-Chrysopogon gryllus R. Jovamovic
Bromo (squarosi)-Chrysopogonetum grylii Kojic 1959
Chrysopogoni-Danthonion Kojic 1957
Agrosti-Chrysopogonetum Kojic 1958
Danthonietum alpinae Z. Pavlovic 1955
Teucrio-Chrysopogonetum grylli R.Jovanovic 1954
Koelerio-Danthonietum alpinae Z. Pavlovic (1955) 1974
Agrosti-Asphodeletum albae R.Jovanovic 1978
Inulo-Danthonietum alpinae K.Tomic-Stankovic 1972
Centaureo-Trifolietum velenovskyi Rexhepi 1978
Onobrychido-Trifolietum pannonicae Randjelovic *et al*. 1979
Inulo salicinae-Calamagristietum Vuckovic 1985
Agrostio capillaris-Cynosuretum cristati Vuckovic 1985
Koelerio-Chrysopogonetum grylli Vuckovic 1985
Salvio-Scorzoneretum villosae Hundozi 1980
Trifolio-Trisetetum flavescentis Randjelovic 1975
Festuco-Chrysopogonetum grylli Randjelovic (1975)1978
Chrysopogonetum grylli Vuckovic 1983
Trifolio-Chrysopogonetum grylli Veljovic 1967
Festucion pseudovinae Horvat 1962
Festucetum pseudovinae-valesiacae Horvat 1954
Festucion rupicolae Soo 1940
Botriochloo-Euphorbietum pannonicae Bogojevic 1968
Botriochloo-Stipetum bromoides R. Jovanovic 1968
Trifolio camestre-Chrysopogonetum grylli Butorac 1989

ASTRAGALO-POTENTILLETALIA K. Micevski 1970
Koelerio-Festucion dalmaticae Randjelovic & Ruzic 1986
Sedo-Potentilletum arenariae Ruzic 1978
Diantho-Centauretum diffusae Randjelovic & Ruzic 1982
Festuco-Plantaginetum serpentini Ruzic & Randjelovic
Scabioso-Trifolion dalmatici Horvatic & Randjelovic 1973
Onobrychido-Haynaldietum dasyprum-villosae (Feri 1976) Rexhepi 1976
Astragalo-Calaminthetum alpinae Horvatic & Randjelovic 1973
Teucrio-Artemisietum camphoratae (Feri 1975) Rexhepi 1975
Compresso- Tubrarietum guttatae Rexhepi 1978
Trifolio-Lotetum angustissimi Horvatic & Randjelovic 1973
Armerio-Potentillion K. Micevski 1978
Genisto-Agrostietum bizantinae K. Micevski 1978
Koelerio-Festucetum stojanovi K. Micevski 1978
Trifolion cherleri K. Micevski 1970
Petrorhagio-Trisetetum myrianthi K. Micevski 1972
Helianthemo-Euphorbietum thessalae K. Micevski 1973
Erysimo-Trifolietum K. Micevski 1977
Saturejo-Thymion K. Micevski 1970
Brachypodio-Onobrychietum pindicolae K. Micevski 1971

Astragalo-Morinetum K. Micevski 1971
Echinario-Convolvuletum althoides Rexhepi 1979

Discussion

Numerous researchers (Horvatic, 1963; 1973; 1975; Horvat *et al*. 1974; Riter-Studnicka, 1974; Blecic and Lakusic, 1976; Lakusic *et al*. 1978; Jovanovic *et al*. 1986; Ilijanic and Topic, 1989; Redzic, 1991) have emphasized the complexity of the structure and dynamics in vegetation, and particularly the problems of syntaxonomy of xerophyle meadows and rocky meadows on the Balkans. The issue of syngenesis of this vegetation, as well as the issue of its relationship with eumediterranean rocky meadows and meadows of *Thero-Brachypodietea* class is still very complex. Numerous difficulties in establishment of adequate syntaxonomic and ecological position of these two classes in natural system of vegetation of this heterogeneous region were the result of this situation.

On the basis of comparative phytocoenological and ecological investigations (Horvatic, 1963; Riter-Studnicka, 1956; 1974; Birac, 1973; Poldini, 1980; Lakusic *et al*., 1984; Pignatti-Wikus and Pignatti, 1988; Mucina and Kolbek, 1993), it is possible to establish real ecological borders between eumediterranean vegetation of the class *Thero-Brachypodietea* and *Festuco-Brometea*.

The vegetation of the class *Thero-Brachypodietea* is more or less limited to the belt of *Quercion ilicis*, that is to the Adriatic province of the Mediterranean region. The class *Festuco-Brometea* is developed in lower areas of Herzegovina in the Submediterranean belt, where communities of *Koelerietalia splendentis* Horvatic 1975 dominate (with its most thermophilous communities of the alliance *Chrysopogoni-Satureion)*, ecologically and syngenetically connected with the alliance *Cymbopogo-Brachypodion ramosi* of the class *Thero-Brachypodietea*, and it forms a broad and various belt in the region of forest vegetation of the order *Quercetalia pubescentis* and *Ostryo-Carpinetalia orientalis* climbing up mountains in the Illyrian province in the west and Moesian province in the east and the southeast. Some communities, such as *Bromo-Plantaginetum mediae subalpinum* on the southeastern Dinaric alps, are developed in the subalpine belt accomplishing ecological continuity with meadows from the alliance *Oxytropidion dinaricae* Lakusic 1966. On the continental Dinaric alps, the communities of the suballiance *Gentiano-Crepidenion* also accomplish syndynamical connection with subalpine communities of the *Festucion pungentis*.

Comparative studies carried out by Horvatic (1975), and other investigators (Redzic, 1991; Lakusic and Redzic, 1991; Trinajstic, 1992) have confirmed the need for ecological and phytocoenological differentiation of the very complex order *Scorzonero-Chrysopogonetalia* into two units: *Koelerietalia splendentis*, which includes the most xerotherm rocky meadows and pastures in the lower part of the Submediterranean belt in the zone of the alliances *Carpinion orientalis* and *Quercion trojanae*, and *Scorzoneretalia villosae* which includes Illyrian-Adriatic submediterranean meadows and rocky meadows mostly in the zone of *Ostryo-Carpinion orientalis, Seslerio-Ostryon, Quercion petraeae-cerris, Quercion farnetto, Quercion pubescentis-petraeae*, in karst terrain and in the zone of *Seslerio-Fagenion illyricum*. It is differentiated into three alliances: *Hypohoeridion maculatae (*mediterranean-montane dry meadows), *Satureion subspicatae* (mediterranean-montane rocky meadows and pastures), and *Scorzonerion villosae* (submediterranean thermophyle meadows) (Trinajstic, 1986;

Pavletic, 1988).

Towards continental part of the Balkans, and particularly towards the continental Dinaric alps, the order *Scorzoneretalia* is accomplishes on the order *Brometalia erecti* which is ecologically and phytocoenologically differentiated into two alliances and several suballiances. It is developed in this region on significantlly colder habitats than the previous order. It reaches its optimum in the zone of the alliances *Fagion illiricum,*and *Fagion moesiacae*, and on the drained and shalower soils in the zone of *Carpinion betuli illyricum* and *Piceion abietis*; this particularly refers to the suballiance *Eu-Mesobromenion* (Sugar, 1972). The suballiance *Filipendulo-Danthonenion alpinae* reaches its optimum in the zone of oak forests prolonging chorological and ecological continuity with xerotherm meadows of Moesian province of the alliance *Chrysopogoni-Danthonion* with the optimum in the zone of *Quercion frainetto*. The communities of the alliance *Gentiano tergestianae-Crepidenion dinaricae* are developed on the highest altitudes of above 1500 m, in the zone of dark coniferous forests. They are syngenetically connected with sublapine meadows and turfs of alliances *Festucion bosnacae* and *Seslerion juncifoliae*.

The presence of numerous species make them different from other suballiances of the *Mesobromion*. Species like *Crepis dinarica* and *Gentiana tergestina*, which are typical for this suballiance have the highest indicator value.

The communities of the alliance *Xerobromion* are the most thermophilous within the order *Brometalia*. They have an azonale character and their presence depends on edaphic and orographic conditions. They are mostly developed on windy habitats, southern aspects and shallow limestone soils of melanosol type or degraded calcocambisol in the zone of the alliances *Quercion petraeae-cerris, Fagion moeasiacae, Seslerio-Ostryon*, and *Quercion dalescahmpii* Redzic prov.

Towards the Submediterranean belt, they are connected with communities of the alliance *Satureion subspicatae*, order *Koeleietalia splendentis*. In the central and easternpart of the Balkan peninsula, they alternate with communities from the order *Festucetalia valesiacae*. On colder habitats they achieve syndynamic continuity with the most thermophilous communities of the suballiance *Eu-Mesobromenion* through the communities *Gentianello-Danthonietum alpinae* and *Bromo-Danthonietum alpinae*.

Significant differences with *Xerobromion* communities from Central Europe were discovered by comparative analyses of floristic composition, ecological conditions, as well as syngenesis (Shimwell, 1971a; Kolbek, 1978; Royer, 1987; Franz, 1988; Oberdorfer and Korneck, 1993). For that reason, the communities form the Balkan peninsula are separated into a suballiance *Fumano-Scabiosenion leucophyllae*. Recent investigation (Redzic, 1997) have been emphasized the need for their separation on the level of alliances. The communities of the *Fumano-Scabiosenion leucophyllae* are differentiated by the presence of numerous species. The most important are: *Scabiosa leucophylla, Bupleurum aristatum, Asperula purpurea, Genista januensis, Potentilla tommasiniana* and *Ranunculus millefoliatus*.

The communities of the *Festucetalia valesiacae* reach their optimum in the Submediterranean and Mediterraneo-montane belt of the northwestern Dinaric alps and hilly belt of continental Dinaric alps, as well as in the central and the eastern part of the Balkans. In the southeast, they are connected with thermophilous hilly meadows of the order *Astragalo-Potentilletalia*. In this area they are differentiated into five alliances: *Cirsio-Brachypodion, Festucion pseudovinae*, and *Festucion rupicolae*, which are more developed in steppe region, and *Festucion vallesiacae* and *Chrysopogoni-Danthonion*, which reach their ecological optimum in this region. They

are represented with a very large number of associations. They are mostly developed in the zone of *Quercion frainetto,* as well as in the zone of *Quercion trojanae* on drier and less developed soils (Gajic, 1954; Jovanovic-Dunjic, 1955; Pavlovic, 1955; Danon, 1960; Veljovic, 1967; Stankovic-Tomic, 1975; Misic *et al*., 1978; Rexhepi, 1978; Stojanovic, 1983).

This order is very well differentiated from the order *Brometalia erecti* from the order *Scorzonertetalia villosae*, by the presence of numerous steppe elements such as

Chrysopogon gryllus, Stipa pulcherima, Stipa bromoides, Potentilla arenaria, Euphorbia pannonica, Botriochloa ischaemum.

Communities from the order *Astragalo-Potentilletalia*, which includes the most thermophilous communities within the class *Festuco-Brometea*, have the most southern distribution.

They are mainly developed in the colline zone of the mountain belt of the Aegeian province on shallow limestone soils (Micevski, 1970; 1971). They are differentiated into several alliances and communities. The most important alliances are *Koelerio-Festucion dalmaticae, Scabioso-Trifolion dalmatici, Armerio-Potentillion, Trifolion cherleri* and *Satureio-Thymion* (Micevski, 1971; Randjelovic, 1973; Ruzic, 1983; Randjelovic and Ruzic, 1986).

The communities of the order *Astragalo-Potentilletalia* on the highest altitudes are connected with communities of dry montane pastures of the order *Daphno-Festucetalia* Quezel 1964 which reach their optimum in the southern part of the Balkans (Quezel, 1964; Dimopoulus & Georgiadis, 1995).

The floristic and ecological analysis reveals, that the communities of the *Festuco-Brometea* from the Balkans are significantly different from those in the western and central Europe, and even from those in the eastern Europe, by the presence of numerous species which belong to the Balcan, Illyrian, and the southeast Europe floral element (Braun-Blanquet and Moor, 1938; Shimwell, 1971b; Rodwell *et al*., 1991-1996; Solomakha, 1995; Schaminee *et al*., 1996; Evers, 1997; Kollmann, 1997). The communities of the orders *Scorzoneretalia villosae*, *Festucetalia valesiacae* and *Astragalo-Potentilletalia* are particularlly strongly differentiated, and they contain a lot of floristic and vegetational curiosities in comparison to the communities of the order *Brometalia erecti*. This emphasizes the need for further revision of the status of the class *Festuco-Brometea* and its phytocoenological differentiation as well as its relationships with the most relative rocky meadow and meadow communities. In spite of detailed and revised studies carried out by Horvatic (1973; 1975) on the relationship between Mediterranean and typical Submediterranean meadows and rocky meadows from the class *Brachypodio-Chryspogonetea* , which are included in the Western mediterranean alliance *Thero-Brachypodietea* (Horvatic, 1975), and communities from the class *Festuco-Brometea*, the situation regarding the status, and ecological and phytocoenological position of some communities of the alliances *Peucedanion neumayeri* (order *Scorzoneretalia villosae*) and *Chryspogoni-Satureion* (order *Koelerietalia splendentis*) is not still clear. The comparative studies carried out by Ilijanic and Topic (1989) have illustrated a very high level in specificity of floristic composition, chorology and ecology of communities with dominance of the steppe element *Chrysopogon gryllus* and other communities of the class *Festuco-Brometea* in which this species is just sporadic or not present at all.

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