

FLORA OF THE ORDER QUERCETALIA PUBESCENTIS BR.-BL. 1932 IN THE FOREST VEGETATION OF THE KOSOVO HILLY AREA

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ABSTRACT

This study is a part of floristic and synecological research into the forest vegetation of the Kosovo hilly area, which belongs to the order *Quercetalia pubescentis*. This order is comprised of two types of deciduous forests: thermophyles and mesophyles. The thermophyle forests belong to two alliances: *Ostryo-Carpinion orientalis* and *Quercion farnetto*, whereas the mesophyle forests belong to two other alliances: *Carpinion betuli illyrico-podolicum* and *Fagion illyricum*. In this study, the flora of 4 associations of the alliance *Ostryo-Carpinion orientalis* and 2 associations of the alliance *Quercion farnetto* were analyzed and the study mostly deals with the following associations: *Carpinetum orientalis scardicum*, prov., *Dioscoro-Carpinetum orientalis B-ic*, *Colurno-Ostryetum carpinifolie B-ic*, *Seslerio-Ostryetum Horv.et H-ic*, *Quercetum farnetto-cerris scardicum*, prov., and *Quercetum montanum Cer. et Jov*. A total of 140 relevés encompassing 6 forest communities were analyzed. The analysis of the floral composition of forest communities of Kosovo hilly area are revealed as many as 262 species, of which 130 or 49.61% belong to the association *Carpinetum orientalis scardicum*, which represents the largest number of species, whereas the smallest one belong to the association *Seslerio-Ostryetum* (93 species or 35.49%) in sociological sense. The biological spectrum of all associations and symbols of life forms of each species were also analyzed and are presented in Table 1. The percentages of species of all the associations are separately presented in Table 2. Also, in the analyses of floral geo-elements, 30 groups of these elements have been determined and presented its spectrum.

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[1] INTRODUCTION

The present investigation deals with systematic synecological-vegetational study into the forest vegetation of the Kosovo mountain area, which was earlier has been studied by Krasniqi [1].

This is the most comprehensive study of this vegetation in Kosovo. In this study the following associations have been determined: *Carpinetum orientalis scardicum* with three subassociations (*Carpinetum orientalis scardicum seslerietosum*, *Carpinetum orientalis scardicum quercetosum* and *Carpinetum orientalis scardicum anemonetosum*); *Dioscoro-Carpinetum orientalis*, *Colurno-Ostryetum carpinifolie* with two subassociations (*Colurno-Ostryetum carpinifolie discoretosum*, and *Colurno-Ostryetum carpinifolie typicum*), *Seslerio-Ostryetum*, *Quercetum farnetto-cerris scardicum* with two sub-associations (*Quercetum farnetto-cerris scardicum moltkietosum*, and *Quercetum farnetto-cerris scardicum typicum*), *Quercetum montanum*, all of these thermophylic communities of the order *Quercetalia pubescentis*, as well as the two associations of the mesophyllic communities of order *Fagetalia illyrica Horv.*(associations *Quercio-Carpinetum serbicum* and *Fagetum montanum*), are not included in this paper. These two last associations have been investigated previously by Nikolić [2], but not in the whole

territory of Kosovo, i.e. only in a small part of the Kosovo plain, as part of a research of spores and pollen in lignite pool of Kosovo.

Kosovo is located in the Balkans, with a surface of around 11.000 square kilometers. It is divided into two macro-regions: the Eastern part, which is comprises of The Plain of Kosovo, and the Western part, which comprises of The Plain of Dukagjini [Figure-1].

The relief of Kosovo is young, with a high depth and density of fracturing. It is dominated by the mountainous parts, around 63% of overall surface of the territory. The average altitude of the whole territory is 810 meters. The highest peak is 2656 meters (the peak of Gjeravica) in the Bjeshkët e Namuna, whereas the lowest peak is 260 meters (the valley of Drini i Bardhë). According to their origin, they are divided into tectonic and volcanic mountains. The former, which are built from sedimentary rocks, occupy the largest part of the surface and are located mainly in the western, northern and southern parts. The mountains built from magma rocks are located mainly in the northern and eastern parts in Kosovo [3].

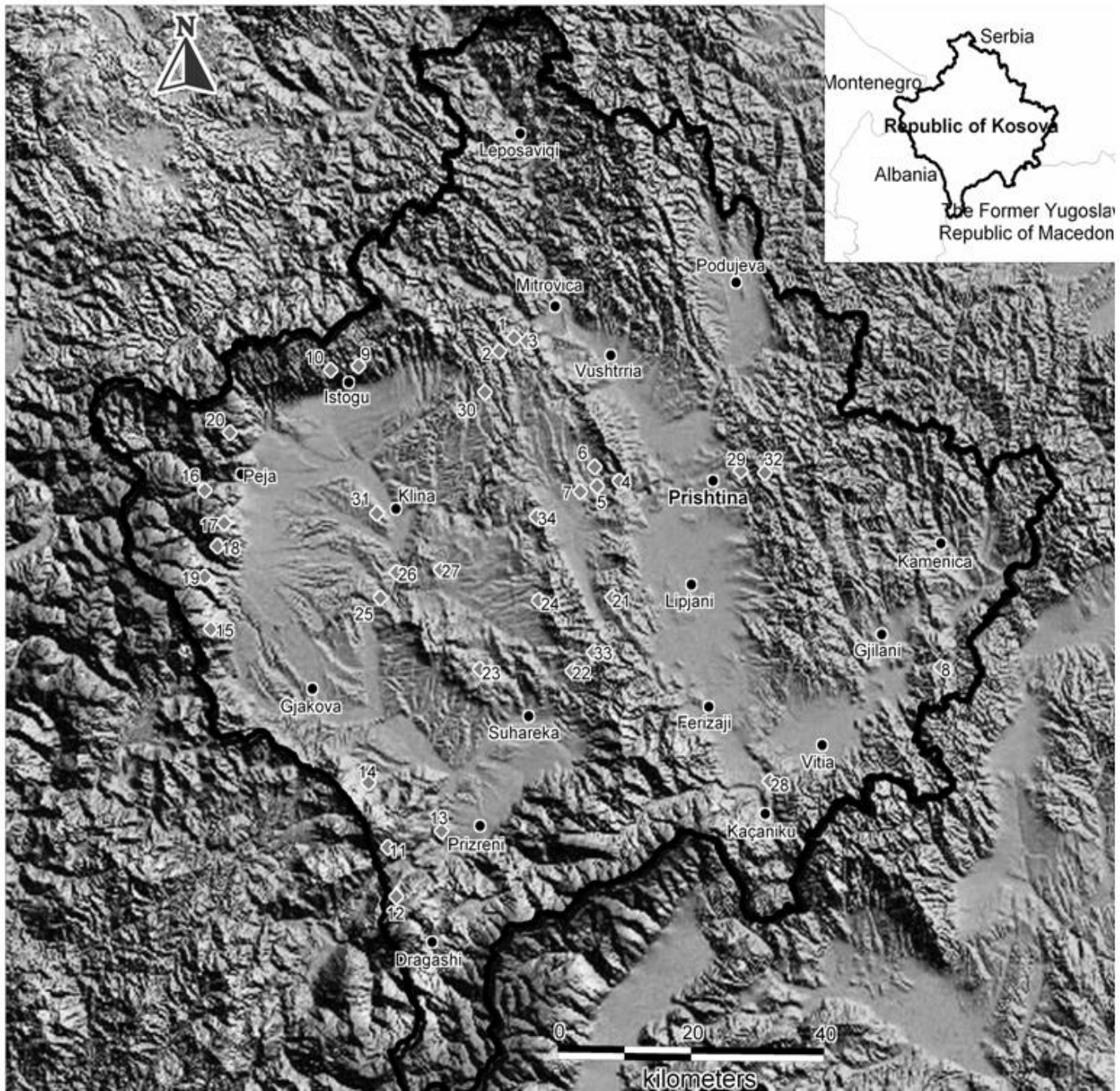


Fig. 1. Map of Kosovo and localities in which relevés of six communities have been registered: *Carpinetum orientalis scardicum* : 1 – Zmiq (Braboniq), 2 – Rosule (Gradevc, Braboniq), 3 – Koleno (Braboniq), 4 – Korriz (Grabovc), 5 – Korriz (Dobrashevc), 6 – Graode (Godanc), 7 – Seq (Murgë), 8 – Markov Kamen (Pogragjë), 9 – Selilo (Istog), 10 – Krshnica (Istog), 11 – Gorozhup (Prizren); *Dioscoreo-Carpinetum orientalis*: 12 – Koritnik (Zhur), 13 – Goma Pole (Vllashnë); *Colurno-Ostryetum carpinifolie*: 12 – Koritnik (Zhur), 14 – Pashtrik (Kushnin), 15 – Shkoza (Koshare); *Seslerio-Ostryetum*: 16 – Koprivik (Pejë), 17 – Maja Lubeniq (Pejë), 18 – Bjeshkët e Strellcit (Pejë), 19 – Golobrd (Pobërgjë), 20 – Peklen (Pejë); *Quercetum farnetto-cerris scardicum*: 21 – Lipovicë (Lipjan), 22 – Biraq (Duhle), 23 – Crni Llug (Prekorupë), 24 – Rreza (Lladrovç), 25 – Mali Dreni (Mrasor), 26 – Cerni Kamen (Volljakë), 27 – Pylli i Kijevës (Rigjevë), 28 – Dushkaja (Kaçanik), 29 – Gërmia (Prishtinë), 30 – Çubrel (Skenderaj), 31 – Boshnjac (Klina); *Quercetum montanum*: 29 – Masivi i Gërmisë (Prishtinë), 32 – Bregu i Butovcit (Prishtinë), 21 – Lipovicë (Lipjan), 33 – Carralëvë (Shtime), 34 – Mali Drenicë (Gllgovc).

The relief of Kosovo was formed during the orogenic phase. The mountains appeared above water during Miocene, whereas ponds, valleys, Fushë-Kosova, during Pliocene. The region of Kosovo represents an important link of the south-eastern branch of Alpine range (Dinaric-Albanic-Hellenic mountain range). Within a small territory one can discern a variety of geological formations of different ages, from the Precambrian to the Quaternary periods [4].

As far as the climate is concerned, Kosovo belongs to the Mediterranean, with a slight influence of the continental climate. Moreover, in the Fushë-Kosova plain one can notice a small influence of the steppe climate. So Kosova in general has wet, relatively short and cold at winter, whereas summers are hot and relatively dry. The average year air temperature revolves from 9.5⁰C (Prishtina) to 12⁰C (Prizren). The average yearly rains revolve from 600 mm/year in the eastern region to 900 mm/year in the western ones (Peja and Gjakova), and over 1.500 mm/year in the Bjeshkët e Namuna [5].

Just like on the other parts of the Balkans, Kosovo has a diverse and rich flora and vegetation, which are mainly due to its geographical position, geological content, relief, climate and the historical development of flora and vegetation in its immediate geological past.

Viewed from its horizontal position, vegetation in Kosovo belongs mainly to the Euro-Siberian vegetative region. According to Horvatić [6], the hot valleys of the low parts of Kosovo belong to the Aegean province. The highest part of Kosovo belongs to the Moesic province, whereas smaller part in North-West belongs to the Illyrian one. The highest zones belong to the Nordic-Alpic region. Therefore, Kosovo is a cross- road of influences of three phyto-geographical regions.

In Kosovo about 2.400 species of vascular flora have been established [7]. If we have in mind that in the Balkans there are approximately 6.800 vascular species, then we can conclude that the flora of Kosovo represents around 35% of this flora. The flora of Kosovo appears to be even more interesting because of the participation of approximately 200 endemic and relict species. Even though the surface of its territory represents 2.3% of the Balkans, the endemic and relicts species represent 11% of these plants within the Balkan Peninsula [8].

[II] MATERIALS AND METHODS

The floral composition of these six forest communities in Kosovo's hilly area was analyzed in detail in the synecological-vegetational research into the forest vegetation of Kosovo.

Forest vegetation was investigated according to the principles of the Zürich-Montpellier school. The scientific names of the species were left unchanged, they are used as registered in the original relevés of phytocenological tables.

In this study, a total of 140 relevés encompassing six communities were analyzed. The species were also analyzed according to biological forms according to Horvat [9]. The floral geoelements were determined according to Horvat, Glavač, Ellenberg [10] and partly to Flora of Albania [11] and Flora of Serbia [12].

[III] RESULTS

The analysis of the floral system of six forest communities in the hilly Kosovo area identified a total 262 species, (11 species are not definite): *Carex sp.*, *Cirsium sp.*, *Crocus sp.*, *Cynanchum sp.*, *Hieratium sp.*, *Galium sp.*, *Iris sp.*, *Orchis sp.*, *Rosa sp. div.*, *Rubus sp.* and *Thymus sp.* The analysis of their life forms and the belonging of their geofloristic elements were not done. In the **Supplementary Table-1** these species are marked with a question mark: *Cirsium silvaticum*, *Verbascum niger* and *Vicia sparsiflora*. Amongst them, *Cirsium silvaticum* is more problematic because of the fact that one cannot encounter it in the existing flora of the region. Because it has been in the association *Dioscoro-Carpinetum orientalis* and association *Quercetum farnetto-cerris scardicum*, perhaps the species *Ptilostemon strictum* is assumed, identified later precisely in the individuals of association with *Quercetum farnetto-cerris scardicum* in Braboniq (near Mitrovica) and Gërmia (near Prishtina). Nevertheless, this remains an arguable topic, since one might be talking also about a different, undetermined species of the genus *Cirsium sp.*, (see the noted species in the analytical tables). Some other arguable species, noted on the analytical tables of these associations are the following, mentioned two synonyms: *Chrysanthemum corymbosum* and *Tanacetum corymbosum*, *Quercus petraea* and *Quercus conferta*, *Rhus cotinus* and *Cotinus coggygria*. In other words, here we are dealing with same species, but evidenced in two forms. Also, *Primula columnae* and *Primula veris* are noted, although the former are considered as subspecies of *Primula veris*. Similarly, problematic is the case with *Veronica chamaedryfolia*, which in current floristic literature does not exist under this name, but only as *Veronica hederifolia*.

From the analytical tables of these six communities, the followings were analyzed: the number of relives, the localities where this investigation took place [Figure-1], number of species, the sea level, and the geological basis. So, in the association *Carpinetum orientalis scardicum* 33 relevés have been noted, containing 130 species, at the sea level from 300 – 940 meters, and on the geological basis of limestone (24 relevés), serpentine (6 relevés) and silicates (3 relevés). In the association *Dioscoro-Carpinetum orientalis* it has been noted 22 relevés, containing 112 species, at the sea level from 260 – 960 meters, and on the geological basis of limestone. On the association *Colurno-Ostryetum carpinifolie* 19 relevés have been carried out, containing 101 species, at the sea level from 750 – 1120 meters, and on the geological basis of limestone. On the association *Seslerio-Ostryetum* only 12 relevés have been analyzed, 93 species have been registered, at the sea level from 700 – 1250 meters, and on the geological basis of limestone. On the association *Quercetum farnetto-cerris scardicum*, 34 relevés

have been carried out, containing 128 species, at sea level from 360 – 760 meters, on silicate geological basis (28 relevés) and of limestone (6 relevés). On the association *Quercetum*

montanum 20 relevés have been noted, containing 105 species, at the sea level from 630 – 960 meters, on the silicate (19 relevés), and on limestone basis (1 relevé).

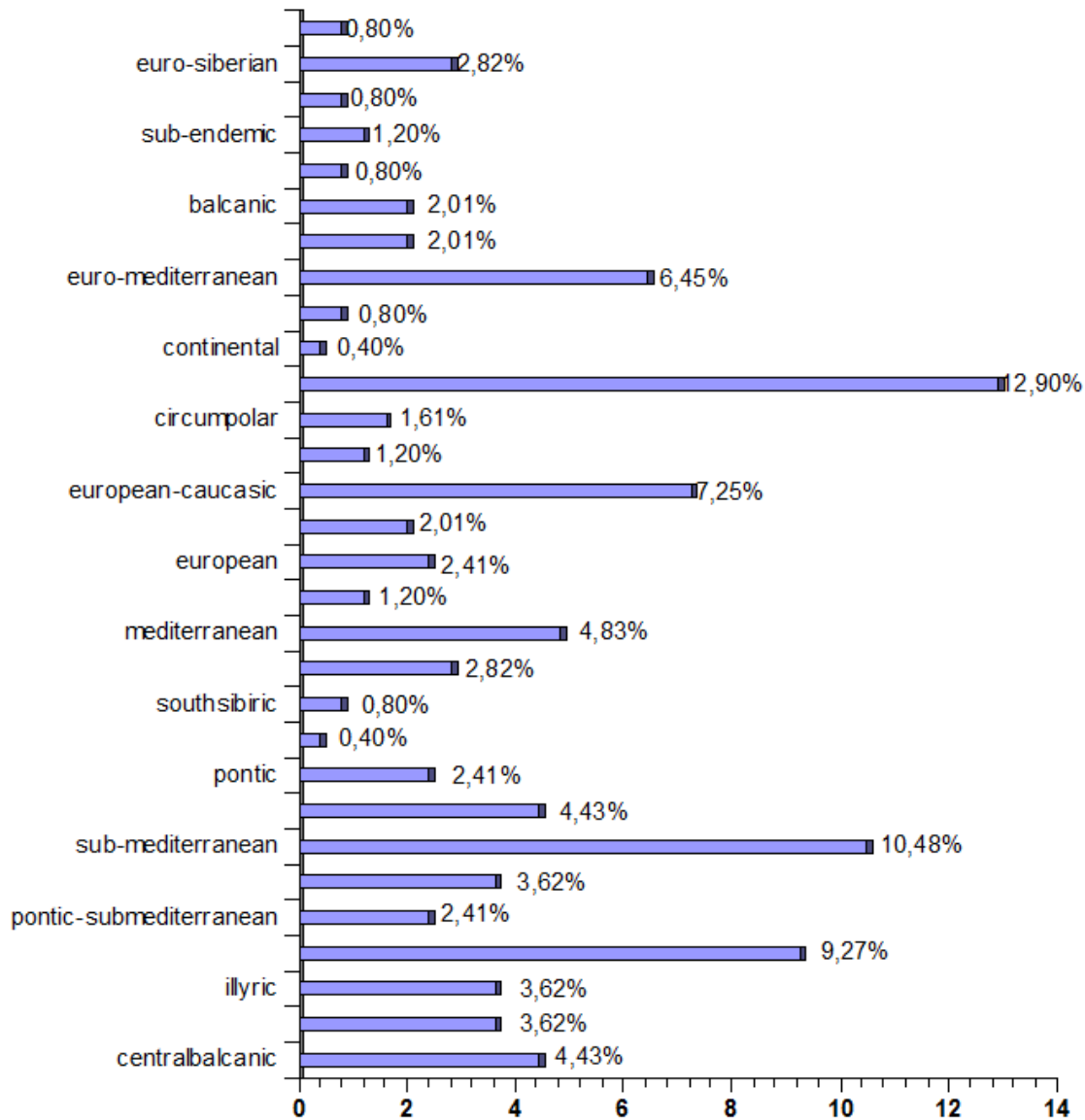


Fig: 2. Spectrum of floral geoelements

In order to shorten the table the species which are registered in one relevé are removed. The following species have been removed from the tree layer: Ph. *Fraxinus excelsior* I (+) of assoc. *Colurno-Ostryetum carpinifolie*; Ph. *Cornus mas* I (+ - 1), Ph. *Malus silvestris* I (+) of assoc. *Quercetum farnetto-cerris scardicum*; Ph. *Prunus avium* I (+) of assoc. *Quercetum montanum*.

The following species have been removed from the shrub layer: Ph. *Quercus macedonica* I (+ - 1), Ph. *Malus florentina* I (+),

of assoc. *Dioscoro-Carpinetum orientalis*; Ph. *Evonymus latifolius* I (+) of assoc. *Colurno-Ostryetum carpinifolie*; Ph. *Juniperus oxycedrus* II (+ - 1) of assoc. *Seslerio-Ostryetum*; Ph. *Sorbus domestica* III (+), Ph. *Prunus spinosa* II (+ - 2), Ph. *Pirus amygdaliformis* I (+), Ph. *Ulmus campestris* I (+) of assoc. *Quercetum farnetto-cerris scardicum*; Ph. *Viburnum lantana* II (+ - 1), Ph. *Acer pseudoplatanus* II (+ - 1), Ph. *Staphylea pinnata* I (1 - 2) of assoc. *Quercetum montanum*.

The following species have been removed from the layer of ground vegetation: *H. Galium purpureum* II (+ - 2), *G. Ornithogalum umbellatum* II (+ - 1), *T. Thlaspi perfoliatum* II (+ - 1), *H. Turritis glabra* I (+ - 1), *T. Bromus squarrosus* I (+ - 1), *H. Cynanchum huteri* I (+ - 1), *H. Polygala amara* I (+ - 2), *H. Waldsteinia geoides* I (+ - 2), *T. Sedum cepaea* I (+ - 2), *H. Hypericum barbatum* I (+), *T. Euphorbia falcata* I (+ - 1), *T. Filago germanica* I (+ - 1), *T. Veronica chamaedrifolia* I (+ - 1), *H. Convolvulus cantabricus* I (+), *T. Trifolium scabrum* I (1 - 2), *Ch. Teucrium polium* I (+ - 2), *G. Delphinium fissum* I (+ - 1), *G. Asphodeline liburnica* I (+ - 1), *G. Allium triquetrum* I (1 - 2), *Ch. Ruscus aculeatus* I (+) of assoc. *Carpinetum orientalis scardicum*; *Ph. Lonicera xylosteum* II (+), *H. Sanicula europaea* II (+ - 2), *Crocus sp.* II (+ - 2), *G. Anemone ranunculoides* I (1 - 1), *H. Hesperis matronalis* I (+ - 1) of assoc. *Dioscoro-Carpinetum orientalis*; *H. Tanacetum corymbosum* III (+), *G. Cystopteris fragilis* II (+), *G. Asphodelus albus* I (+), *G. Polystichum lobatum* I (+), *G. Asplenium adiantum-nigrum* III (+ - 2) of assoc. *Colurno-Ostryetum carpinifolie*; *H. Euphorbia agraria* II (+), *H. Luzula maxima* II (+ - 2), *H. Valeriana officinalis* II (+), *H. Calamintha grandiflora* I (1 - 1) of assoc. *Seslerio-Ostryetum*; *H. Galium silvaticum + schultessi* III (+ - 1), *G. Ranunculus millefoliatus* II (+ - 1), *G. Trifolium medium* II (+ - 2), *Thymus sp.* II (+ - 2), *H. Euphorbia cyparissias* II (+ - 1), *T. Vicia grandiflora* II (+), *H. Verbascum foenicum* II (+), *G. Muscari botryoides* II (+), *T. Geranium robertianum* I (+ - 1), *T. Melampyrum cristatum* I (+), *H. Hypericum hirsutum* I (+), *G. Paeonia decora* I (+ - 2), *H. Campanula rapunculus* I (+ - 1), *H. Lathyrus silvestre* I (+), *G. Carex divulsa* I (+ - 2), *H. Lysimachia vulgaris* I (+), *Rubus sp.* I (+), *H. Saxifraga bulbifera* I (+), *H. Anthemis tinctoria* I (+ - 1), *H. Galium cruciata* I (+), *H. Vicia sparsiflora* (?) I (+ - 1), *H. Veronica officinalis* I (+ - 1) of assoc. *Quercetum farnetto-cerris scardicum*; *Galium sp.* IV (+ - 2), *Verbascum sp.* III (+ - 1), *H. Pulmonaria officinalis* III (+ - 1), *Cirsium sp.* III (+ - 2), *G. Cephalanthera alba* II (+ - 1), *H. Alliaria officinalis* II (+ - 2), *H. Hypericum hirsutum* II (+ - 1), *G. Asperula odorata* II (1 - 2), *G. Miliium effusum* II (+ - 2), *H. Lathyrus pratensis* I (1 - 2), *H. Lamium luteum* I (+ - 1) of assoc. *Quercetum montanum*.

The biological spectrum of the communities has been presented in **Supplementary Table-2**, which shows that in all associations where the dominant group of life forms are hemicriptophytes (from 38.29% to 50.81%), then phanerophytes (20.50% - 28.87%), geophytes (17.21% - 27.83%), chamaephytes (1.03% - 9.38%), therophytes (0.94% - 7.81%) and nanophanerophytes (0.81% - 4.71%).

The spectrum of floral goelements of 237 species confirms that the study area is located on the crossroads of highly diverse influences. This is clearly illustrated by a large number of floral goelements and their combinations [Figure-2].

Below are presented the species of every floral goelements group: **Central- Balcanic species:** *Acer hyrcanum*, *Coronilla*

elegans, *Corylus colurna*, *Cotinus coggygria*, *Eryngium palmatum*, *Evonymus verrucosus*, *Lathyrus venetus*, *Mercurialis ovata*, *Paeonia decora*, *Tilia argentea*, *Waldsteinia geoides*; **Subatlantic-Mediterranean species:** *Acer monspesulanum*, *Anthericum ramosum*, *Asphodelus albus*, *Daphne laureola*, *Luzula forsteri*, *Physospermum aquilegifolium*, *Primula acaulis*, *Sedum cepaea*, *Tamus communis*; **Illyrian species:** *Acer obtusatum*, *Aremonia agrimonoides*, *Epimedium alpinum*, *Erythronium dens-canis*, *Frangula rupestris*, *Genista ovata*, *Helleborus odoratus*, *Lonicera caprifolium*, *Oryzopsis virescens*; **Central-European species:** *Abies alba*, *Acer pseudoplatanus*, *Anemone ranunculoides*, *Carex divulsa*, *Carpinus betulus*, *Dentaria bulbifera*, *Fagus moesiaca*, *Festuca heterophylla*, *Galium silvaticum*, *Genista sagittalis*, *Hedera helix*, *Luzula maxima*, *Melica uniflora*, *Melittis melissophyllum*, *Polygala amara*, *Prunus avium*, *Pulmonaria officinalis*, *Quercus conferta*, *Sedum maximum*, *Stellaria holostea*, *Thalictrum aquilegifolium*, *Tilia platyphyllos*; **Pontic-Sub-mediterranean species:** *Agropirum intermedium*, *Delphinium fissum*, *Dictamnus albus*, *Euphorbia falcata*, *Galanthus nivalis*, *Stachys germanica*; **Sub-Pontic species:** *Anthemis tinctoria*, *Astragalus glycyphyllos*, *Campanula persicifolia*, *Chrysanthemum corymbosum*, *Cynanchum vincetoxycum*, *Lathyrus niger*, *Melampyrum cristatum*, *Prunus spinosa*, *Trifolium alpestre*; **Sub-Mediterranean species:** *Arabis turrata*, *Aristolochia pallida*, *Asarum europaeum*, *Asparagus tenuifolius*, *Calamintha grandiflora*, *Campanula rapunculus*, *Carpinus orientalis*, *Ceterach officinarum*, *Convolvulus cantabricus*, *Cornus mas*, *Coronilla emeroides*, *Cotoneaster tomentosa*, *Euphorbia amygdaloides*, *Filago germanica*, *Fraxinus ornus*, *Galium purpureum*, *Lithospermum purpurocoeruleum*, *Lychnis coronaria*, *Ostrya carpinifolia*, *Quercus pubescens*, *Sedum glaucum*, *Sesleria autumnalis*, *Sorbus torminalis*, *Teucrium chamaedrys*, *Viburnum lantana*; **Sub-Boreal species:** *Fragaria vesca*, *Hypericum perforatum*, *Juniperus communis*, *Lonicera xylosteum*, *Luzula campestris*, *Melampyrum pretense*, *Miliium effusum*, *Prunella vulgaris*, *Solidago virgaurea*, *Sorbus aucuparia*, *Veronica officinalis*; **Pontic species:** *Ajuga laxmani*, *Cytisus nigricans*, *Cytisus supinus*, *Lathyrus inermis*, *Linaria genistifolia*, *Verbascum phoeniceum*; **Boreal species:** *Geranium robertianum*; **South-Sibirc species:** *Lilium martagon*, *Polygonatum officinale*; **Pontic-Mediterranean species:** *Iris graminea*, *Muscari botryoides*, *Prunus mahaleb*, *Rhamnus catharticus*, *Symphytum tuberosum*, *Thlaspi perfoliatum*, *Vicia grandiflora*; **Mediterranean species:** *Allium triquetrum*, *Amelanchier ovalis*, *Asparagus acutifolius*, *Asphodeline liburnica*, *Bromus squarrosus*, *Crataegus orientalis*, *Danaa cornubiensis*, *Evonymus latifolius*, *Juniperus oxycedrus*, *Pirus amygdaliformis*, *Pistacia terrebinthus*, *Teucrium polium*; **Westeuxynic species:** *Quercus cerris*, *Quercus farnetto*, *Quercus macedonica*; **European species:** *Hieratium murorum*, *Hypericum barbatum*, *Sorbus aria*, *Ulmus campestris*, *Valeriana officinalis*, *Vicia sparsiflora*; **Endemic-Balcanic species:** *Acanthus longifolius*, *Digitalis laevigata*, *Forsythia europaea*, *Moltkia doerfleri*, *Stachys scardica*; **European-**

Caucasian species: *Acer campestre*, *Acer platanoides*, *Alliaria officinalis*, *Centaurea triumfetti*, *Crataegus monogyna*, *Doronicum collumnae*, *Elymus europaeus*, *Fraxinus excelsior*, *Geranium sanguineum*, *Helianthemum nummularium*, *Inula salicina*, *Lamium luteum*, *Lathyrus silvestris*, *Malus silvestris*, *Mercurialis perennis*, *Saxifraga rotundifolia*, *Stachys officinalis*, *Ulmus montana*; **Eastern-Submediterranean species:** *Anemone apennina*, *Cyclamen neapolitanum*, *Saxifraga bulbifera*; **Circumpolar species:** *Anemone hepatica*, *Anemone nemorosa*, *Arabis hirsuta*, *Turritis glabra*; **Euro-Asiatic species:** *Acer tataricum*, *Asperula odorata*, *Asplenium adiantum-nigrum*, *Brachypodium silvaticum*, *Calamintha officinalis*, *Cephalanthera rubra*, *Clematis flammula*, *Cornus sanguineus*, *Corylus avellana*, *Dactylis glomerata*, *Euphorbia cyparissias*, *Evonymus europaeus*, *Galium aparine*, *Galium cruciata*, *Hesperis matronalis*, *Hypericum hirsutum*, *Lathyrus pratensis*, *Leucanthemum vulgare*, *Ligustrum vulgare*, *Pirus piraster*, *Polystichum lobatum*, *Primula veris*, *Rosa canina*, *Rosa spinosissima*, *Silene viridiflora*, *Silene vulgaris*, *Trifolium medium*, *Verbascum nigrum*, *Veronica hederifolia*, *Vicia cracca*; **Continental species:** *Asplenium trichomanes*; **Sub-Atlantic species:** *Campanula lingulata*, *Galium aristatum*; **Euro-Mediterranean species:** *Carex halleriana*, *Cephalanthera alba*, *Colutea arborescens*, *Geranium macrorrhizum*, *Laburnum alpinum*, *Ornithogalum umbellatum*, *Potentilla micrantha*, *Ruscus aculeatus*, *Sanicula europaea*, *Scutellaria altissima*, *Siler trilobum*, *Smyrniolum perfoliatum*, *Staphylea pinnata*, *Teucrium montanum*, *Thymus longicaulis*, *Trifolium scabrum*; **Circumboreal species:** *Clinopodium vulgare*, *Convallaria majalis*, *Epipactis palustris*, *Geum urbanum*, *Poa nemoralis*; **Balkan species:** *Comandra elegans*, *Euphorbia agrarian*, *Peltaria alliecea*, *Ranunculus millefoliatus*, *Trifolium pignanti*; **Steno-Mediterranean species:** *Brachypodium distachyon*, *Convolvulus tenuissimus*; **Sub-Endemic species:** *Cynanchum huteri*, *Dioscorea balcanica*, *Malus florentina*; **Cosmopolitan species:** *Cystopteris fragilis*, *Polypodium vulgare*; **European-Siberian species:** *Campanula trachelium*, *Daphne mezereum*, *Lunaria rediviva*, *Platanthera bifolia*, *Serratula tinctoria*, *Veronica chamaedrys*, *Viola silvestris*; **Balkan-Pontic species:** *Paeonia corallina*, *Veronica jacquini*.

[IV] DISCUSSION

The table also shows a high degree of participation of *Fraxinus ornus* in the tree layer, whereas amongst the shrub layer: *Cornus mas*, *Evonymus verrucosus*, *Sorbus torminalis*, *Pirus piraster* and *Quercus petraea*. On the layer of ground vegetation these species are present in all associations: *Veronica chamaedrys*, *Helleborus odorus*, *Lithospermum purpurocoeruleum*, *Fragaria vesca*, *Lathyrus venetus*, *Symphytum tuberosum*, *Stellaria holostea*, *Melica uniflora*, *Viola silvestris*, *Silene viridiflora*, *Stachys scardica*, *Lonicera caprifolium*, *Melitis melissophyllum*, *Primula acaulis*, *Brachypodium silvaticum*, *Polygonatum officinale* and *Dactylis glomerata*.

Some associations are differentiated into sub-associations. Hence, in the association *Carpinetum orientalis scardicum*, differential species of sub-association *Carpinetum orientalis scardicum seslerietosum* are: *Ostrya carpinifolia*, *Prunus mahaleb* and *Sesleria autumnalis*. Differential species of sub-association *Carpinetum orientalis scardicum quercetosum* are: *Quercus macedonica*, *Clematis flamula*, *Pistacia terebinthus*, *Carex halleriana*, *Aristolochia pallida* and *Asparagus acutifolius*, while the third sub-association *Carpinetum orientalis scardicum anemonetosum* characterized with these differential species: *Rhamnus cathartica*, *Viburnum lantana*, *Ligustrum vulgare*, *Acer campestre*, *Acer tataricum*, *Corylus avellana*, *Malus florentina*, *Carpinus betulus*, *Eryngium palmatum* and *Anemone apennina*. The association *Colurno-Ostryetum carpinifolie* is also differentiated into two sub-associations: *Colurno-Ostryetum carpinifolie discoretosum* with these differential species: *Dioscorea balcanica*, *Aristolochia pallida*, *Anemone nemorosa*, *Dentaria bulbifera*, and *Daphne laureola*, whereas the sub-association *Colurno-Ostryetum carpinifolie typicum* with species: *Corylus colurna* and *Sesleria autumnalis*. The association *Quercetum farnetto-cerris scardicum* is differentiated into two sub-associations: *Quercetum farnetto-cerris scardicum moltkietosum* with these differential species: *Moltkia doerfleri*, *Physospermum aquilegifolium*, *Inula salicina*, *Lychnis coronaria*, *Serratula tinctoria*, *Genista ovata* and *Trifolium pignanti*, whereas sub-association *Quercetum farnetto-cerris scardicum typicum* with species: *Eryngium palmatum*, *Cyclamen neapolitanum*, *Acanthus longifolius*, *Dictamnus albus*, *Coronilla elegans* and *Comandra elegans*.

Association *Quercetum farnetto-cerris scardicum* presents the basic climazonal community of the lower zone of Kosovo. This is similar with the association *Quercetum farnetto-cerris serbicum* and association *Quercetum farnetto-cerris macedonicum*, which also belong to the alliance *Quercion farnetto* from the thermophyle order *Quercetalia pubescentis* [6]. This community has wide presence in Kosovo, with a higher concentration in eastern, central and southern parts of Kosovo. The comparisons which have been made between these three associations show clearer differences [1]. Therefore, in *Quercetum farnetto-cerris scardicum* the following species which are not met in associations *Quercetum farnetto-cerris serbicum* and *Quercetum farnetto-cerris macedonicum* have been determined: *Moltkia doerfleri*, *Eryngium palmatum*, *Siler trilobum*, *Coronilla elegans*, *Dictamnus albus* and *Melampyrum cristatum*. On the other side, association *Quercetum farnetto-cerris scardicum* lacks the following species: *Crataegus orientalis*, *Helleborus cyclophyllus*, *Asphodelus albus*, *Hieracium bauchini* and *Stachys germanica*, which are present in the associations *Quercetum farnetto-cerris serbicum* and *Quercetum farnetto-cerris macedonicum* [1]. Due to the differences Krasniqi [1] differentiates this association into two sub-associations. One of them (*Quercetum farnetto-cerris scardicum moltkietosum*) is very particular, because amongst

other things, it is unique due to its endemic species *Moltkia doerfleri*. This species grows mainly in the area of Lipovica massif (around 15 km southwest of Prishtina). It has a geological basis that is built in mainly from metamorphic and less limestone rocks. Because of this unique composition, Krasniqi [13] identifies in this material the association *Quercetum frainetto-cerris scardicum* as a particular geographical variant. The characteristic species of this association are as follows: *Quercus conferta*, *Quercus cerris*, *Fraxinus ornus*, *Sorbus torminalis*, *Pirus piraster*, *Physospermum aquilegifolium*, *Cytisus supinus*, *Silene viridiflora*, *Genista tinctoria*, *Iris graminea*, which have a high degree of presence.

The other communities of the alliance *Quercion farnetto (confertae)*, such as association *Quercetum montanum* in Kosovo has also climazonal character, but with a limited presence. This community has been researched mainly in Fushë Kosovë (Gërmia, Lipovica, Carraleva, Mali Drenicë) [Figure-1].

The communities of the alliance *Ostryo-Carpinion orientalis* in Kosovo present orographic and climacteric conditioned groupings. Such associations are as follows: *Carpinetum orientalis scardicum*, *Dioscoro-Carpinetum orientalis*, *Colurno-Ostryetum carpinifolie* and *Seslerio-Ostryetum*. The individuals of these associations have been researched mainly in the central parts of Kosovo and in the Dukadjin [Figure-1].

[V] CONCLUSION

This study is a part of systematic synecological-vegetational research into the forest vegetation of the hilly area in Kosovo. The flora of 6 communities of the hilly region of Kosovo, which belongs to the thermophilic order *Quercetalia pubescentis*, among which, 140 relevés, with 262 species, registered in the analytical table of these associations have been analyzed: *Carpinetum orientalis scardicum*, *Dioscoro-Carpinetum orientalis*, *Colurno-Ostryetum carpinifolie*, *Seslerio-Ostryetum*, all of them of the alliance *Ostryo-Carpinion orientalis*, as well as the associations: *Quercetum farnetto-cerris scardicum* and *Quercetum montanum*, of the alliance *Quercion farnetto (confertae)*. From the sinecological Table we can see that the species with a higher presence in most of the associations are: *Fraxinus ornus*, *Quercus pubescens*, *Quercus cerris*, *Carpinus orientalis*, *Ostrya carpinifolia*, *Quercus petraea*, *Tilia platyphyllos*, *Carpinus orientalis*, *Fagus moesiaca*, *Acer hyrcanum*, *Acer campestre*, *Acer obtusatum*, *Sorbus torminalis*, *Crataegus monogyna*, *Cornus mas*, *Evonymus verrucosus*, *Pirus*

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piraster, *Juniperus communis*, all of them in the tree and shrub layer, whereas in the layer of ground vegetation are following species: *Veronica chamaedrys*, *Fragaria vesca*, *Lathyrus venetus*, *Melica uniflora*, *Dactylis glomerata*, *Stachys scardica*, *Lathyrus niger*, *Polygonatum officinale*, *Symphytum tuberosum* [Supplementary Table-1].

The spectrum of life forms is dominated by hemicryptophytes (38.29% - 50.81%), then phanerophytes (20.50% - 28.87%) and geophytes (17.21% - 27.83%). Other life forms represented with a small number of species in these associations [Supplementary Table-2]. The association with a larger number of species is *Carpinetum orientalis scardicum* (130 species or 49.61%) followed by the associations *Quercetum farnetto-cerris scardicum* (128 species or 48.85%), *Dioscoro-Carpinetum orientalis* (112 species or 42.74%), *Quercetum montanum* (105 species or 40.07%), *Colurno-Ostryetum carpinifolie* (101 species or 38.54%) and *Seslerio-Ostryetum* (93 species or 35.49%) [Figure-2].

From the analysis of floral geoelements of the 248 species, the highest number belongs to the following groups: Euro-Asiatic (32 species or 12.90%), Sub-Mediterranean (26 species or 10.48%), Central-European (23 species or 9.27%), European-Caucasic (18 species or 7.25%), Euro-Mediterranean (16 species or 6.45%), Mediterranean (12 species or 4.83%), Sub-Boreal (11 species or 4.43%) and Central-Balcanic (11 species or 4.43%). Other floral geoelements are represented with a small number of species (from 1 – 9) [Figure-1].

The most widespread communities are the associations *Quercetum farnetto-cerris scardicum* and *Quercetum montanum*, which have a climazonal character, whereas the associations *Carpinetum orientalis scardicum*, *Dioscoro-Carpinetum orientalis*, *Colurno-Ostryetum carpinifolie* and *Seslerio-Ostryetum* have a limited presence and present orographic and climacteric grouping [Figure-1].

CONFLICT OF INTEREST

Author declares no conflict of interest.

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SUPPLEMENTARY TABLES ARE AVAILABLE ONLINE AT: www.iioab.org

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