

NOTES ON PHYTOSOCIOLOGY OF *JUNIPERUS EXCELSA* IN MACEDONIA (SOUTHERN BALKAN PENINSULA)

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Abstract

Juniperus excelsa is an East Mediterranean species found also in marginal, sub-mediterranean regions of the southern part of the Balkan Peninsula. It prefers shallow soils in the warmest habitats of the zone of thermophilous deciduous forests. In the past the rank of alliance and the name of *Juniperion excelsae-foetidissimae* have been suggested for the vegetation dominated by *Juniperus excelsa* in the Balkan Peninsula. In this paper we present the valid description of the alliance in accordance with the International Code of Phytosociological Nomenclature. The validation of the *Juniperion excelsae-foetidissimae* required description of a new association – the *Quercro trojanae-Juniperetum excelsae*. The *Juniperion excelsae-foetidissimae* is classified within the order of *Quercetalia pubescentis* Klika 1933 (the *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959).

Keywords: East Mediterranean, forest, *Juniperion excelsae-foetidissimae*, nomenclature, *Quercetea pubescentis*, vegetation.

Izvešček

Juniperus excelsa je vzhodnomediterranska vrsta, ki jo najdemo tudi v submediteranskih predelih južnega Balkana. Najdemo jo lahko na najtoplejših rastiščih na plitvih tleh v območju termofilnih listopadnih gozdov. V preteklosti so na Balkanskem polotoku vegetacijo, kjer dominira vrsta *Juniperus excelsa*, uvrščali v zvezo *Juniperion excelsae-foetidissimae*. V prispevku je prikazan veljaven opis zveze v skladu z mednarodnim kodeksom fitocenološke nomenklature. Osnova za veljaven opis zveze je tudi veljaven opis nove asociacije – *Quercro trojanae-Juniperetum excelsae*. Zvezo *Juniperion excelsae-foetidissimae* smo nadalje uvrstili v red *Quercetalia pubescentis* Klika 1933 (*Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959).

Ključne besede: gozd, *Juniperion excelsae-foetidissimae*, nomenklatura, *Quercetea pubescentis*, vegetation, vzhodno Sredozemlje.

Abbreviation and nomenclature:

DBH – diameter at breast height; ICPN – International Code of Phytosociological Nomenclature, 3rd ed. (Weber et al. 2000); nomenclature of plant species follows Flora Europaea (Tutin et al. 1964–1980).

1. INTRODUCTION

In course of compilation of a checklist of high-rank syntaxa of Europe (Mucina et al. in prep.), we have found that the *Juniperus excelsa* forests occurring in the southern regions of the Balkan

Peninsula were not classified within a validly (according to the ICPN; Weber et al. 2000) described syntaxon. The name *Juniperion excelsae-foetidissimae*, used to accommodate this type of vegetation in the past (e.g. Jovanović et al. 1986, Rodwell et al. 2002), turned out not to be validly published.

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This short contribution is aimed at presenting the valid description of the *Juniperion excelsae-foetidissimae* as well as of its nomenclatural type – the *Quercus trojanae-Juniperetum excelsae*.

2. VALIDATION AND DESCRIPTION OF SYNTAXA

***Juniperion excelsae-foetidissimae* Em ex Matevski et al. all. nova hoc loco**

Synonyms: *Juniperion excelsae-foetidissimae* Em 1985 (phantom name); “*Juniperion excelsae-foetidissimae* Em in Jovanović et al. 1986” (art 2b; *nomen nudum*)

Character species: *Juniperus excelsa*, *J. foetidissima*
Differential species: *Rhamnus rhodopeus*

Holotypus hoc loco: Quercus trojanae-Juniperetum excelsae (for the protologue of this association see below)

Juniperus excelsa (*Cupressaceae*) is a tall shrub or tree up to 20 m tall, with a trunk as large as 2 m in diameter (at DBH level). Its crown is conical, but later it becomes broader and open. *Juniperus excelsa* is an East Mediterranean element (see Jalas & Suominen 1973: Map. 192) and can be found also in sub-mediterranean regions of southern Europe, namely in Albania, Macedonia, Bulgaria, and Greece. In Macedonia it is found on limestone gravel, serpentine and other types of bedrocks supporting shallow soils in warm habitats at altitudes 100–1200 m (Micevski 1985, Farjon 2005). In these regions *Juniperus excelsa* forms locally open forests, which show different floristic composition from those described from Asia Minor (Quézel et al. 1980, Türe et al. 2005) and Crimea (Jakucs 1960, Didukh 1996, Vasylenko et al. 2009). The *Juniperus excelsa* dominated forests have been classified into following syntaxa: the *Quercion calliprini* (*Quercetalia ilicis*, *Quercetalia ilicis*) by Quézel et al. (1980) in N Anatolia; the *Quercion anatolicae* (*Quercus-Carpinetalia orientalis*, *Quercetalia pubescentis*) by Türe et al. (2005) in NW Anatolia, and the *Juniperion excelsae-Quercion pubescentis* (*Fraxino orni-Cotinetalia*, *Quercetalia pubescentis*) by Jakucs (1960) or the *Jasmino fruticantis-Juniperion excelsae* (*Fraxino orni-Cotinetalia*, *Quercetalia pubescentis*) by Solomakha (1995), Didukh (1996) and Vasylenko et al. (2009), both latter from Crimea.

All these communities can be found in the regions characterised by submediterranean climate (dry period during summer, maximum of precipitation in the period from October to February, mild winter). The communities can be found mainly on southern aspect over shallow, skeletal soils derived from carbonate bedrock. These extreme ecological conditions, common to all communities dominated by *Juniperus excelsa*, support development of forests dominated by coniferous vegetation in the zone of deciduous forest mainly dominated by zonal oak forests. The *Juniperus excelsa* forests are of southern provenience (Quézel et al. 1980) and are considered to possess a relict character.

These open forests are built of only few woody species of which *Juniperus excelsa*, *J. foetidissima*, *J. ocedrus* and *Quercus pubescens* are found frequently across all known localities. In addition, the Euxinian floral element (e.g. *Colutea cilicica*) is more pronounced in the east (in Crimea and Anatolia), whereas the studied Balkan communities have local endemic *Rhamnus rhodopeus*. The canopy in these communities is not dense, and hence many species from neighbouring grasslands are found in the understorey – serving as regionally important diagnostic species emphasising the distinction between regional *Juniperus excelsa* alliances.

In the Balkan, the concept of the *Juniperion excelsae-foetidissimae* was proposed by Em (in Jovanović et al. 1986) as “*Juniperion excelsae-foetidissimae* Em 1985”. There is no publication dated 1985 by Em where this name would have been actually published and the proposal of the name in Jovanović et al. (1986) offers only a *nomen nudum*, hence the syntaxon has not been validly published (following the ICPN, 3rd edition).

Jovanović et al. (1986); (see also Rodwell et al. 2002) suggested that the *Juniperion excelsae-foetidissimae* should be classified within the *Erico-Pinetea*. Our preliminary field data suggest, however, that species of thermophilous deciduous forests outnumber those of the relict montane pine woods. An analogous borderline taxonomical case is that of the *Fraxino orni-Ostryion* distributed along the southern fringes of the Alps and sharing floristic and ecological similarities with the regionally well-represented class of *Erico-Pinetea*. Further south (in the Dinarides) this forest vegetation, however, undoubtedly belongs to the *Quercetalia pubescentis* (Čarni et al. 2009).

The alliance of *Juniperion excelsae-foetidissimae*

is classified in the *Quercetalia pubescentis* Klika 1933 (the *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959).

As there is at present no validly published association classified with this alliance, and therefore a new association is described in the sequel:

***Quercro trojanae-Juniperetum excelsae* ass. nova
hoc loco**

Synonyms: “*Juniperetum excelsae-foetidissimae* Em 1962” (phantom name); *Juniperetum excelsae-foetidissimae* Em in Jovanović et al. 1986 (art. 2b, *nomen nudum*)

Holotypus hoc loco: Table 1/relevé. 1, in this paper.

Em (in Jovanović et al. 1986) proposed the name “*Juniperetum excelsae-foetidissimae* Em 1962”, however this name had not been used in his work published in 1962. The form of this name is suggesting that this association could correspond to the association here described as new. The name *Juniperetum foetidissimo-excelsae* was later used by Türe et al. (2005) for an association described from the NW Anatolia. Since we cannot be sure that the Em’s association (in Jovanović et al. 1986) matches the concept of the our new association exactly, and because of the fact that the name *Juniperetum foetidissimo-excelsae* had been already used by Türe et al. (2005) for another syntaxonomic contents, we decided to coin a new name – the *Quercro trojanae-Juniperetum excelsae*.

The stands of this association are found in well-insolated and warm habitats, having shallow soils derived from limestone bedrock. The extreme site conditions enable *Juniperus excelsa* to outcompete *Quercus trojana* and other oak species that dominate the oak forests in the neighbouring area. The diagnostic species of this association are *Juniperus excelsa* and *Juniperus foetidissima* (both character species of the association) and *Juniperus oxycedrus* (species with high frequency).

Juniperus excelsa might have arrived to the Balkan Peninsula during a warmer period of early Pliocene when there was also land connection between Asia Minor and the Balkans. It survived the repeated climatic oscillations of the Pleistocene in a similar manner as did some token relicts such as *Aesculus hippocastanum*, *Forsythia europaea*, *Haberlea rhodopensis*, *Ramonda serbica*, *R. nathaliae* in refugial habitats (Médail & Diadema 2009).

There were several other vegetation units characterised by dominating *Juniperus excelsa* reported from Macedonia. Em (1962) suggested the *Pruno webii-Juniperetum excelsae* Em 1962 (*nomen nudum*) from the southern Macedonia, and divided this association into two subassociations, such as the *phillyridetosum* and the *celtidetosum*. The former subassociation is found in lowlands, however with increasing altitude thermophilous species, such as *Quercus coccifera*, *Phillyrea media* and *Prunus webii* disappear. The latter subassociation can be found at higher altitudes (at about 900 m). The stands of this syntaxon are found on the Golem Grad Island in the Prespa Lake. The same author (Em 1989) mentioned the *Biaro-Juniperetum excelsae* to occur from the Golem Grad Island, however failed to provide any other data allowing comparisons with other *Juniperus excelsa* communities. The short list of species Em (1962) presented to characterise *Pruno webii-Juniperetum* and in 1989 does not allow any serious comparison with the new association *Quercro trojanae-Juniperetum excelsae* either. At this stage we can only state that the *Quercro trojanae-Juniperetum excelsae* is differentiated from the lowland *Juniperus excelsae*-dominated communities (such as the *Pruno webii-Juniperetum excelsae* Em 1962) by presence of *Quercus trojana*, *Q. frainetto*, *Q. cerris*, and by lack of thermophilous species such as *Carpinus orientalis*, *Paliurus spina-christi* and *Asparagus acutifolius*.

Syntaxonomical scheme

Quercetea pubescentis Doing-Kraft ex Scamoni et Passarge 1959

Quercetalia pubescentis Klika 1933

Juniperion excelsae-foetidissimae Em ex Matevski et al. 2010

Quercro trojanae-Juniperetum excelsae Matevski et al. 2010

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4. REFERENCES

- Braun-Blanquet, J. 1964: Pflanzensoziozoologie. Grundzüge der Vegetationskunde. 3rd ed. Springer, Wien, 865 pp.
- Čarni, A., Košir, P., Karadžić, B., Matevski, V., Redžić, S. & Škvorc, Ž. 2009: Thermophilous deciduous forests in southeastern Europe. *Plant Biosystems* 143: 1–13.
- Didukh, Ya. 1996: The communities of the class *Quercetea pubescenti-petraeae* of the Crimean Mountains. *Ucrain. Phytocoenol. Coll., Ser. A* 1: 63–77.
- Em, H. 1962: Šumske zajednice četinaru u NR Makedoniji. *Biol. Glasn.* 15: 1–21.
- Em, H. 1989: Ist der verkahlende Zügelbaum (*Celtis glabrata* Stev.) autochton auf der Insel Golem Grad im Prespa-See? *Bios – Volume dedicated to prof. Konstatin Ganiatsas (Thessaloniki)*, pp. 65–66.
- Farjon, A. 2005: A monograph of *Cupressaceae* and *Sciadopitys*. Royal Botanic Gardens, Kew, 643 pp.
- Jakucs, P. 1960: Nouveau classement cénologique de bois de chênes xérotiques (*Quercetea pubescentis-petraeae* cl. nova) de l'Europe. *Acta Botanica Hungarica* 6: 267–303.
- Jalas J. & Suominen J. 1973: Atlas florae europaeae. 2. Gymnospermae (*Pinaceae* to *Ephedraceae*). The Committee for Mapping the Flora of Europe and Societas Biologica Fennica Vannamo, Helsinki, 40 pp.
- Jovanović, B., Lakušić, R., Rizovski, R. & Zupančič, M. 1986: Prodrum phytocoenosis Jugoslaviae. Naučno veće vegetacijske karte Jugoslavije, Bribir-Ilok, 46 pp.
- Médail, F. & Diadema, K. 2009: Glacial refugia influence plant diversity patterns in the Mediterranean Basin. *Journal of Biogeography* 36: 1333–1345
- Micevski, K. 1985: Flora na SR Makedonija 1 (1). MANU, Skopje, 152 pp.
- Quézel, P., Barbero, M., Akman, Y. 1980: Contribution à l'étude de la végétation forestière d'Anatolie septentrionale. *Phytocoenologia* 8: 365–519.
- Rodwell, J.S., Schaminée, J.H.J., Mucina, L., Pignatti, S., Dring, J. & Moss, D. 2002: The diversity of European vegetation. An overview of phytosociological alliances and their relationship to EUNIS habitats. EC-LNV, Report EC-LNV 2002/054, Wageningen, 168 pp.
- Solomakha, V.A. 1995: Sintaksoni roslinnosti Ukraini za metodom Braun-Blanke ta ikh osobnosti. Naukove vydaniya biologichnogo fakultetu Nacional'nogo Kyyevskogo universitetu im. Tarasa Shevchenka, Kyyv, 116 pp.
- Tutin, T.G., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A., editors 1964–1980: *Flora Europaea*. Vols 1–5. Cambridge University Press, Cambridge.
- Türe, C., Tokur, S. & Ketenoglu, O. 2005: Contribution to the syntaxonomy and ecology of forest and shrub vegetation in Bithynia, Northwestern Anatolia, Turkey. *Phyton (Horn)* 45: 81–115.
- Vasylenko, S.M. & Kuzmanenko, O.L. 2009: Characteristic of the *Juniperus excelsa* Bieb. population of Kyzyltash (Southern-eastern Crimea): density, age structure, phytosociological and ecological features. *Chornomors'k. Bot. Zh.* 5: 98–106.
- Weber, H.E., Moravec, J. & Theurillat, J.-P. 2000: International Code of Phytosociological Nomenclature. 3rd edition. *Journal of Vegetation Science* 11: 739–768.

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Table 1

Relevé 1. Macedonia, Magarino, below Sirhansko Kale Hill (41°00'03.0" N, 20°55'23.3" E), 23-06-2009, altitude: 1046 m, inclination: 40°, aspect: WSW, plot size: 100 m², no stone on surface, cover of tree layer: 70 %, cover of shrub layer: 60 %, cover of herb layer: 20 %, cover of moss layer: 2 %. Authors: M. Kostadinovski, U. Šilc. (holotypus of the association)

Relevé 2. Macedonia, Magarino, below Sirhansko Kale Hill (41°0'20.3" N, 20°56'14.0" E), 15-06-2009, altitude 903 m, inclination: 12°, aspect: EES, plot size: 100 m², stoniness: 1 %, cover of tree layer: 90 %, cover of shrub layer: 90 %, cover of herb layer: 40 %, cover of moss layer: 10 %. Authors: M. Kostadinovski, A. Marinšek, U. Šilc.

Relevé 3. Macedonia, Magarino, below Sirhansko Kale Hill (41°00'22" N, 20°55'50" E), 17-06-2009, altitude: 1118 m, inclination: 30°, aspect: ESE, plot size: 100 m², stoniness: 30 %, cover of tree layer: 30 %, cover of shrub layer: 90 %, cover of herb layer: 95 %; no moss layer. Authors: A. Čarni, V. Matevski, A. Paušič.

Species with only one occurrence in the table (herb layer):

Rel. 1. *Fragaria moschata* 2, *Ventenata dubia* 1, *Campylopusium spathulatum* subsp. *spruneriana* +, *Clinopodium vulgare* +, *Galium aparine* +, *Geranium lucidum* +, *Helleborus odoratus* +, *Pilosella vulgaris* agg. +, *Juniperus oxycedrus* (juv.) +, *Lathyrus sphaericus* +, *Phleum phleoides* +, *Trifolium cherleri* +, *Trifolium dalmaticum* +, *Trifolium phleoides* +, *Trifolium pratense* +, *Vicia cracca* +, *Vicia onobrychoides* +

Rel. 2. *Geranium robertianum* subsp. *purpureum* 1, *Trifolium scabrum* 1, *Arabis turrita* +, *Aremonia agrimonoides* +, *Bellis perennis* +, *Centaurea grisebachii* +, *Clematis vitalba* +, *Draba muralis* +, *Galium tricornutum* +, *Hieracium praealtum* subsp. *baucini* +, *Hypericum perforatum* +, *Iris sintenisii* +, *Leontodon crispus* subsp. *crispus* +, *Lonicera xylosteum* (juv.) +, *Orchis morio* +, *Poa trivialis* subsp. *syvicola* +, *Quercus pubescens* (juv.) +, *Taraxacum officinale* agg. +, *Tragopogon pratensis* +

Rel. 3. *Carex halleriana* 3, *Anisantha tectorum* 1, *Stipa bromoides* 1, *Aethionema saxatile* +, *Alyssum trichostachyum* subsp. *stenophyllum* +, *Anthyllis vulneraria* subsp. *macedonica* +, *Arabis hirsuta* +, *Turritis pseudoturritis* +, *Arenaria serpyllifolia* +, *Asperula purpurea* +, *Buglossoides incrassata* +, *Bupleurum flavicans* +, *Caucalis daucooides* +, *Coronilla scorpioides* +, *Geranium dissectum* +, *Helianthemum salicifolium* +, *Helichrysum plicatum* +, *Hypericum rumeliacum* subsp. *blepharophyllum* +, *Iris attica* +, *Koeleria splendens* +, *Lathyrus cicera* +, *Linum austriacum* +, *Medicago rigidula* +, *Melica ciliata* +, *Minuartia hybrida* +, *Nigella damascena* +, *Ophrys apifera* +, *Oryzopsis virescens* +, *Pimpinella tragi* subsp. *lithophylla* +, *Scandix australis* +, *Sedum acre* +, *Steptorhamphus tuberosus* +, *Thymus tosevii* +, *Trifolium campestre* +, *Verbascum* sp. +, *Xeranthemum annuum* +

Species with only one occurrence in the table (moss layer):

Rel. 1. *Musci* indet. +

Rel. 2. *Pleurozium schreberi* 1

Table 1: Relevé table of the *Quercus trojanae*-*Juniperetum excelsae*. The abundance-dominance sampling scale follows Braun-Blanquet (1964).

Tabela 1: Vegetacijska tabela asociacije *Quercus trojanae*-*Juniperetum excelsae*. Skala prisotnosti in pokrovnosti je v skladu z Braun-Blanquet (1964).

Relevé number	1	2	3
Tree layer (E ₃):			
<i>Juniperus excelsa</i>	3	4	3
<i>Juniperus foetidissima</i>	1		
<i>Quercus frainetto</i>	+		
<i>Clematis vitalba</i> (liana)		+	
Shrub layer (E ₂):			
<i>Juniperus oxycedrus</i>	3	3	2
<i>Quercus trojana</i>	1		+
<i>Lonicera etrusca</i>	+		+
<i>Rosa</i> sp.	+	+	
<i>Juniperus excelsa</i>		1	4
<i>Rhamnus rhodopeus</i>		+	+
<i>Prunus spinosa</i>		+	+
<i>Quercus frainetto</i>	1		
<i>Quercus pubescens</i>	1		
<i>Quercus cerris</i>	+		
<i>Rubus canescens</i>		+	
<i>Cornus mas</i>		+	
<i>Fraxinus ornus</i>			+
Herb layer (E ₁):			
<i>Dactylis glomerata</i> ssp. <i>hispanica</i>	+	1	+
<i>Medicago minima</i>	+	1	+
<i>Sanguisorba minor</i> ssp. <i>muricata</i>	+	1	+
<i>Acinos alpinus</i> ssp. <i>meridionalis</i>	+	+	+
<i>Brachypodium sylvaticum</i>	1	+	
<i>Geum urbanum</i>	+	+	
<i>Lonicera etrusca</i> (juv.)	+	+	
<i>Myosotis arvensis</i>	+	+	
<i>Potentilla laciniosa</i>	+	+	
<i>Thymus longicaulis</i>	+	+	
<i>Trifolium physodes</i>	+	+	
<i>Poa bulbosa</i>	+		+
<i>Cerastium brachypetalum</i>	+		+
<i>Geranium robertianum</i> ssp. <i>purpureum</i>	1		+
<i>Veronica chamaedrys</i>		1	+
<i>Carduus thoermeri</i>		+	+
<i>Crupina vulgaris</i>		+	+
<i>Eryngium campestre</i>		+	+
<i>Crucianella angustifolia</i>		+	+
<i>Teucrium chamaedrys</i>		+	+
<i>Scabiosa fumarioides</i>		+	+