NOMENCLATURE ADJUSTMENTS AND NEW SYNTAXA OF THE ARCTIC, ALPINE AND ORO-MEDITERRANEAN VEGETATION

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Abstract
During preparation of the European checklist of vegetation units (EuroVegChecklist), it became clear that some earlier described syntaxa need to be typified in order to stabilize nomenclature and some new syntaxa need to be described. Here we propose nomenclature adjustments and formal description of four new alliances for the Arctic, alpine and oro-Mediterranean vegetation of Europe, Greenland and Anatolia. First, we typify the class *Juncetea trifidi*. Second, we describe four new alliances, such as the *Puccinellion nuttallianae* (Low-Arctic salt steppes of Greenland; class *Saxifrago tricuspidatae-Calamagrostietea purpurascentis*), *Dryado octopetalae-Caricion arctisibiricae* (Arctic tundra vegetation of north-eastern European Russia; class *Carici rupestris-Kobresietea bellardii*), *Leontopodio nivalis-Elynion myosuroidis* (southern European alpine tundra vegetation; class *Carici rupestris-Kobresietea bellardii*) and *Lagotido uralensis-Caricion ensifoliae* (alpine tundra vegetation of the Southern Ural Mountains; class *Juncetea trifidi*). Two new associations are described within the first two of these alliances. Finally, we present an interpretation of the alliance *Muscario-Scillion nivalis*.

Keywords: alpine grasslands, Anatolia, Europe, EuroVegChecklist, Greenland, International Code of Phytosociological Nomenclature (ICPN), syntaxonomy, tundra.

Izvleček
Med pripravo evropskega seznama vegetacijskih enot (EuroVegChecklist) je postalo jasno, da je potrebno za utrditev nomenklature nekatere zgodnje opise sintaksonov veljavno tipizirati oziroma opisati nove sintaksonne. V članku predlagamo nomenklaturne popravke in formalne opise štirih novih zvez za arktično, alpinsko in oro-mediteransko vegetacijo Evrope, Grenlandije in Anatolije. Najprej smo tipifizirali razred *Juncetea trifidi*. Kot drugo smo opisali štiri nove zveze: *Puccinellion nuttallianae* (nizke arktične slane stepe Grenlandije; razred *Saxifrago tricuspidatae-Calamagrostietea purpurascentis*), *Dryado octopetalae-Caricion arctisibiricae* (vegetacija arktične tundre severovzhodne evropske Rusije; razred *Carici rupestris-Kobresietea bellardii*), *Leontopodio nivalis-Elynion myosuroidis* (vegetacija južno-evropske alpinske tundre; razred *Carici rupestris-Kobresietea bellardii*) in *Lagotido uralensis-Caricion ensifoliae* (vegetacija alpinske tundre gorovja južnega Urala; razred *Juncetea trifidi*). V teh zvezah smo opisali dve novi asociaciji. Na koncu predstavljamo interpretacijo zveze *Muscario-Scillion nivalis*.

Ključne besede: alpinska travišča, Anatolija, Grenlandija, Mednarodni kodeks fitocenološke nomenklature (ICPN), syntaksonomija, tundra.

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**Nomenclature:** Vascular plants: Euro+Med PlantBase (www.emplantbase.org, accessed on 14 Sep 2014); The Plant List (www.theplantlist.org, accessed on 14 Sep 2014) for species not included in the Euro+Med PlantBase; Egorova (1999) for subspecies of *Carex bigelowii*; Conti et al. (2005) for subspecies of *Androsace vitaliana*. Mosses: Hill et al. (2006). Lichens: Santesson et al. (2004).

1. **INTRODUCTION**

During the preparation of the publication ‘Vegetation of Europe: Hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities’ (Mucina et al. submitted; hereafter referred to as ‘EuroVegChecklist’), thousands of published syntaxonomical concepts of European phytosociological classes, orders and alliances were assessed. Syntaxonomic names related to these concepts were checked, especially whether they comply with the rules of the International Code of Phytosociological Nomenclature (Weber et al. 2000; ICPN hereafter). In many cases, these revisions revealed a need for formal description of new vegetation units, nomenclature changes or adjustments, or stabilization of the currently used names by typification. In order to separate these technical nomenclatural issues from the EuroVegChecklist itself, we have embarked on publishing a series of papers complementing the EuroVegChecklist by formally describing new syntaxa, providing nomenclature adjustments and discussing the contentious syntaxonomic concepts.

This paper, focusing on Arctic, alpine and oro-Mediterranean vegetation is one of the series. It aims to (1) contribute to stabilization of syntaxonomic nomenclature by typification of the originally broadly-conceived class of *Juncetea trifidi*, (2) formally describe four new alliances accepted in the EuroVegChecklist, and (3) clarify the syntaxonomic position of a problematic alliance reported from the Balkans and Anatolia.

2. **JUNCETEA TRIFIDI:**

**TYPOIFICATION OF AN OLD BUT SOMETIMES WRONGLY REJECTED CLASS NAME**

*(by Milan Chytrý)*

In the original diagnosis of the class *Juncetea trifidi* Hadač in Klika et Hadač 1944 (‘*Juncetea trifidi* Hadač 1944’), Klika & Hadač (1944: 281–283) included four orders, all validly described by Braun-Blanquet (in Braun-Blanquet & Jenny 1926), such as the *Androsacetalia alpinae* Br.-Bl. 1926, *Salicetalia herbaceae* Br.-Bl. 1926, *Caricetalia curvulae* Br.-Bl. 1926 and *Rhodoretio-Vaccinietalia* Br.-Bl. 1926. Grabherr (1993: 343–344) considered the class name *Juncetea trifidi* Hadač in Klika et Hadač 1944 as a *nomen nudum* according to Art. 2b of ICPN, and also as a *nomen ambiguum* because of the broad delimitation of this class presented by Klika & Hadač (1944). Therefore Grabherr (1993) included the alpine grasslands on acidic bedrock in the class *Caricetalia curvulae* Br.-Bl. 1948. Similarly, Mucina (1997) and Dúbravcová & Jarolímek (2007) assumed that the name *juncetea trifidi* Hadač in Klika et Hadač 1944 lacked a sufficient original diagnosis. Consequently Mucina (1997) used a younger name *juncetea trifidi* Hadač 1946 for this class, and Dúbravcová & Jarolímek (2007) used the name *Caricetea curvulae* Br.-Bl. 1948, considering the *Juncetea trifidi* Hadač 1946 being also a *nomen ambiguum*.

Here we argue that the name *Juncetea trifidi* Hadač in Klika et Hadač 1944 is not a *nomen nudum*. Although Klika & Hadač (1944) included only few recent papers in the list of references, these authors indicated in the introductory Czech text (p. 249) that their survey of syntaxa expands on an earlier survey published in the book *Praktikum rostlinné sociologie, půdoznalství, klimatologie a ekologie* (Klika & Novák 1941): “It is clear that some unification is needed, and our overview aims at it. It is a follow up of the corresponding part of the ‘Praktikum rostlinné sociologie, půdoznalství, klimatologie a ekologie’. Praha, Melantrich 1941. To save space, we refer to it in some parts. For higher units we indicate a list of diagnostic species of classes, orders and alliances. These, along with a brief ecological characterization, enable distinguishing particular units.” (translated from Czech). Further (on p. 257) they referred again to this book and to Volume 4 of *Bibliographia Phytosociologica* (Tüxen et al. 1943) for the list of references to the author citations of syntaxa: “Papers are found in a corresponding list of references in the ‘Praktikum...’; papers from the for-
mer Polish Carpathians and Slovakia are listed in Bibliographia Phytosociologica Fasc. 4. ‘Germania Pars II.’ Hannovera 1943, which contains a list of literature related to the Sudeten lands, Slovakia, former Poland and former Carpathian Ruthenia.” (translated from Czech). Therefore, several class names were published validly by Klika & Hadač (1944) by using an indirect reference to an earlier original diagnosis according to Art. 2b of ICPN. This interpretation of the new names published in Klika & Hadač (1944) was also accepted, for example, by Michl et al. (2010: 147). Original diagnoses of the orders included in the original diagnosis of the class name *Juncetea trifidi* Hadač in Klika et Hadač 1944 and containing the name-giving species *Juncus trifidus* are also referred to indirectly through the *Praktikum* (Klika & Novák 1941), which contains the reference to ‘Braun-Blanquet (1926)’. Although in most cases this paper is referred to as ‘Braun-Blanquet & Jenny (1926)’, it can be also referred to as ‘Braun-Blanquet (1926)’ because the author statement (in German) on the title page of the paper reads: ‘J. Braun-Blanquet unter Mitwirkung von Hans Jenny’ (‘J. Braun-Blanquet with collaboration of Hans Jenny’). Otherwise, as the title of the paper, the series and the volume number in which it is published are correctly cited (except for ‘Neue Denksschr. …’ instead of ‘Denksschr.’), this bibliographic reference is unambiguous in the sense of the Art. 2b of ICPN.

The *Juncetea trifidi* Hadač in Klika et Hadač 1944 is also not a *nomen ambiguum*, in spite of the fact that nowadays the four orders of its original diagnosis are included to four vegetation classes (*Thlaspietea rotundifolii* Br.-Bl. 1948, *Salicetalia herbacea* Br.-Bl. 1948, *Juncetea trifidi* Hadač in Klika et Hadač 1944 and *Loiseleurio procumbentis-Vaccinietea* Egger ex Schubert 1960) as recognized by the EuroVegChecklist and most of the current European literature. According to the Art. 36 of ICPN, the reason for proposing a *nomen ambiguum* status could be its frequent use “in a false sense that excludes its type so that its re-introduction in its original correct sense would be a source of continual errors” (Weber et al. 2000). However, this is not the case here since, to our knowledge, no lectotype has ever been selected from the four available orders included in the original diagnosis of the class. In nearly all syntaxonomic overviews that used the class name *Juncetea trifidi* Hadač in Klika et Hadač 1944 (e.g. Oberdorfer 1993, Coldea 1997, Malinovsky & Kricsfalussy 2000, Kočí 2007, Matuszkiewicz 2007) this name was used for vegetation of alpine grasslands on acidic soils such as those classified within the *Caricetalia curvulae* Br.-Bl. in Br.-Bl. et Jenny 1926, i.e. one of the orders included in the original diagnosis of this class. Rivas-Martínez et al. (2002) published a proposal to conserve the name *Caricetalia curvulae* Br.-Bl. 1948 against the name *Juncetea trifidi* Hadač in Klika et Hadač 1944, but there was no reason for doing so.

In order to stabilize the use of the validly described class name *Juncetea trifidi* Hadač in Klika et Hadač 1944, we typify it by choosing the order name *Caricetalia curvulae* Br.-Bl. in Br.-Bl. et Jenny 1926 as its nomenclature type (*lectotypus hoc loco designatus*).

3. **Puccinellion nuttallianae**: A NEW ALLIANCE OF THE ARCTIC SALINE STEPPES

*(by Fred J. A. Daniëls)*

**Puccinellion nuttallianae Daniëls all. nov. hoc loco**

Included concepts: *Puccinellia deschampsioides* associations of the *Puccinellia deschampsioides-Braya linearis* Societion Group in Böcher (1954: Table 24: 1–11, 20–22)

Name-giving species: *Puccinellia nuttalliana* (Schult.) Hitchc. (syn.: *Puccinellia deschampsioides* T. J. Sørensen)

Nomenclature type (*holotypus hoc loco designatus*): *Puccinellietum nuttallianae* Daniëls in Chytrý et al. 2015 (this paper, see below)

Diagnostic taxa of the alliance: *Artemisia campestris* subsp. *borealis*, *Braya humilis*, *B. linearis*, *Calamagrostis purpurascens*, *Draba daurica*, *D. incana*, *Gentiana detonsa*, *Lomatogonium rotatum*, *Plantago maritima* subsp. *borealis*, *Primula stricta*, *Puccinellia nuttalliana*, *Hennediella heimii* and *Cladonia pyxidata*.

This alliance belongs to the class *Saxifrago tricuspidatae-Calamagrostietea* purpurascens Drees et Daniëls 2009 and the order *Saxifrago tricuspidatae-Calamagrostietalia purpurascens* Drees et Daniëls 2009. It comprises the Low-Arctic salt-steppe vegetation of xero- and mesophytic grasslands containing (sub)halophilous species. This vegetation occurs on loess or clay deposits accumulated at foot slopes of mountain ridges and on the shores of salt lakes in the continent-
tal Low-Arctic regions of Greenland characterized by very dry and relatively warm summers and very dry and cold winters. The substrates are subjected to extreme fluctuations in soil moisture regime. So far the plant communities of this alliance have mainly been known from the inland of West Greenland (Drees & Daniëls 2009). The group of plant communities of the \textit{Puccinellion nuttallianae} was assigned by Böcher (1954) to the ‘\textit{Puccinellia deschampsioides-Braya linearis} Societio\textit{ Group}’ within the ‘\textit{Puccinellia deschampsioides-Gentiana detonsa} Type’ and the ‘\textit{Puccinellia borealis-Calamagrostis purpurascens-Arctostaphylos uva-ursi} Vegetation Complex’. This complex comprises the sub-Low Arctic continental xerophytic grasslands, dwarf-shrub vegetation as well as associated willow scrub.

\textbf{Puccinellietum nuttallianae Daniëls ass. nov. hoc loco}

Nomenclature type relevé (\textit{holotypus hoc loco designatus}): Böcher (1954: relevé 4 in Table 24 of the ‘\textit{Puccinellia-Cornicularia societio}’

Character and dominant species: \textit{Puccinellia nuttalliana}

Constant taxa: \textit{Artemisia campestris} subsp. \textit{borealis}, \textit{Puccinellia nuttalliana}, \textit{Silene taimyrensis}, \textit{Cephalozia} spp., \textit{Caloplaca citrina}, \textit{Cetraria aculeata}, \textit{Cladonia pyxidata}, \textit{Cyanophyceae} spp.

Böcher (1954) described the \textit{Artemisia borealis-Calamagrostis purpurascens-Arctostaphylos uva-ursi} complex from continental south-western Greenland, including three ‘types’. One of these is the \textit{Puccinellia deschampsioides-Gentiana detonsa} Type, comprising two ‘sociation groups’: the \textit{Puccinellia deschampsioides-Braya linearis} Societio\textit{ Group} and the \textit{Sisyricium montanum} Societio\textit{ Group}. The former sociation group comprises \textit{Puccinellia deschampsioides} sociations, \textit{Calamagrostis purpurascens} sociations, \textit{Kobresia myosuroides} sociations and \textit{Dryas integrifolia} sociations. Each sociation is distinguished by its floristic composition and species dominance derived from vegetation plots from different sites. In the syntaxonomic classification of the Braun-Blanquet approach, these Böcher’s vegetation units could be recognised as associations. The \textit{Puccinellia-Cornicularia} sociation rich in \textit{Artemisia borealis} is interpreted here as a new association – the \textit{Puccinellietum nuttallianae}.

4. \textbf{DRYADO OCTOPETALAE-CARIANTON ARCTISIBIRICAE: A NEW ALLIANCE OF THE ARCTIC TUNDRA}

(by Natalia Koroleva)

\textit{Dryado octopetalae-Caricion arctisibiricae} Koroleva et Kulyugina \textit{all. nov. hoc loco}

Syn.: \textit{Carici arctisibiricae-Dryadion octopetalae} Koroleva et Kulyugina 2010 \textit{prot.} (Arts. 2b & 3b)

Name-giving taxa: \textit{Dryas octopetala} L., \textit{Carex bigelowii} subsp. \textit{arctisibirica} (Jurtz.) Á. Löve et D. Löve

Nomenclature type (\textit{holotypus hoc loco designatus}):

\textit{Dryado octopetalae-Caricetum arctisibiricae} Koroleva et Kulyugina in Chytrý et al. 2015 (this paper, see below)

Diagnostic taxa: \textit{Astragalus alpinus} subsp. \textit{arcticus}, \textit{Carex bigelowii} subsp. \textit{arctisibirica}, \textit{Dryas octopetala}, \textit{Eritrichium villosum}, \textit{Pedicularis oederi}, \textit{Salix reticulata}, \textit{ Saxifraga hieracifolia}, \textit{S. hirculus}, \textit{Thalictrum alpinum}

This new alliance belongs to the class \textit{Carici rupestris-Kobresietea bellardii Ohba 1974} and the order \textit{Thymo arctici-Kobresietalia bellardii} Ohba 1974. The alliance was proposed by Koroleva & Kulyugina (2010) as a preliminary concept (\textit{nomen provisorium}) and without an original diagnosis, hence it was invalidly published according to the Arts. 2b and 3b of ICPN. Here we perform the formal validation of this alliance.

The alliance comprises closed-canopy (cover of 70–80%, in places up to 100%) tundra vegetation dominated by \textit{Dryas octopetala} and \textit{Carex bigelowii} subsp. \textit{arctisibirica} with \textit{Salix polaris}, \textit{S. reticulata} and mesophytic hypo-Arctic grasses showing high constancy values. The moss layer is well-developed and composed of mesophytic pleurocarpous mosses. This vegetation includes the species-richest plant communities in the sub-Arctic tundra.

The \textit{Dryado octopetalae-Caricion arctisibiricae} is similar to the \textit{Kobresio-Dryadion} Nordhagen 1943, which occurs mainly in Svalbard and the Scandinavian mountains. In contrast to the \textit{Kobresio-Dryadion}, \textit{Dryado-Caricion} lacks species such as \textit{Carex atra}, \textit{C. hepburnii}, \textit{C. misandra} and \textit{C. rupesiris}, and it is of more mesophytic nature because of the co-dominance of \textit{Dryas octopetala} and \textit{Carex bigelowii} subsp. \textit{arctisibirica} and the constant presence of herbs and grasses.
The vegetation of this alliance occurs on small to medium-sized, well-drained, relatively warm and moderately snow-protected hilltops and on south- and west-facing slopes of hills (‘musyurus’). It occupies clayey, sandy and gravelly soils, in some places with frost-boiling patches. It occurs in the southern and typical tundra of north-eastern European Russia, namely in the Malozemel’skaya Tundra, Bol’shezemel’skaya Tundra and the Pay-Khoy Mountains on the yugorskyi Peninsula (bioclimatic zones D and C, and partly also E according to the Circumpolar Arctic Vegetation Map; Walker et al. 2005). It is rather rare in the western part of this area (Malozemel’skaya Tundra) and becomes more widely distributed to the east of Bol’shezemel’skaya Tundra and the Pay-Khoy Mountains.

The differences between the Dryas-dominated plant communities of Fennoscandia and those of the Pechora Plain could be partly explained by different geology and Quaternary environmental history. Fennoscandia was entirely glaciated, and the repeated glacier retreats were leaving behind well-drained soils developed on bare rocks, coarse moraine debris and fluvio-glacial deposits. In contrast, glaciations and sea transgressions in the Pechora Plain accumulated mainly glacial till and fluvial deposits.

Differentiation of the North European Dryas-dominated tundra at the alliance level corresponds to the eco-geographical division of the Arctic (Aleksandrova 1980), according to which the tundra of the Kola Peninsula and of the northern Pechora Plain differ at the level of sub-provinces; the former is related to the Kola Sub-province of the East-European-West-Siberian Province of sub-Arctic tundra, and the latter is related to the East-European Sub-province. This differentiation also matches the floristic division of the Arctic (Yurtzev 1994), in which the northern Pechora Plain belongs to the specific Kanin-Pechora Sub-province.

**Dryado octopetalae-Caricetum arctisibiricae**  
Koroleva et Kulyugina ass. nov. hoc loco

Nomenclature type relevé (holotypus hoc loco designatus): Russia, Yugorskyi Peninsula, Pay-Khoy Mountains, top of the hill near Sareyakhato Lake, 69°01’21.4”N, 62°11’7.9”E, altitude 213 m, total vegetation cover 100%; sampled by E. Kulyugina using the 8-degree Braun-Blanquet scale in June 2010.

Vascular plants (cover: 95%): *Carex bigelowii* subsp. *arctisibirica*, *Dryas octopetala* 2b, *Salix polare* 2b, *Persicaria vivipara*, *Salix lanata*, *Vaccinium vitis-idaea*, *Astragalus alpinus* subsp. *arcticus*, *Equisetum scirpoides*, *Festuca ovina*, *Hedysarum hedysaroides* subsp. *arcticum*, *Luzula nivalis*, *Myosotis asiatica*, *Pedicularis sp.*, *Petasites frigidus*, *Poa arctica*, *Pyrola grandiflora*, *Ranunculus monophyllus*, *Salix reticulata*, *Stellaria longipes*, *Valeriana capensis*, *Eutrema edwardsii*, *Persicaria bistorta*, *Saxifraga hieracifolia*, *S. hirculus*.

Bryophytes (70%): *Hylocomium splendens* 3, *Leptobryum pyriforme*, *Ptilidium ciliare*, *Tomentypnum nitens*, *Dicranum angustum*, *D. majus*, *D. spadiceum*, *Poliyrichum hyperboreum*.

Lichens (5%): *Peltigera aphthosa*, *Thamnolia vermicularis*, *Cetraria islandica*, *Cladonia amaurorae*, *C. arbuscula*, *C. gracilis*, *C. macroceras*, *C. subfucata*, *Flavocetraria cucullata*, *F. nivalis*, *Lobaria limita*, *Peltigera canina*, *Stereocaulon alpinum*.

## 5. **LEONTOPODIO NIVALIS-ELYNION MYOSUROIDIS**: A NEW ALLIANCE OF THE SOUTHERN EUROPEAN ALPINE TUNDRA

(by Romeo Di Pietro)

**Leontopodio nivalis-Elynion myosuroidis** (Blasi et Di Pietro in Blasi, Di Pietro, Fortini et Catonica 2003) Di Pietro et Mucina all. nov. et stat. nov. hoc loco

(Leontopodio nivalis-Kobresion myosuroidis all. nov., stat. nov. et nom. mut. propos.)

Basionym: *Leontopodio nivalis-Elynenion myosuroidis* Blasi et Di Pietro in Blasi, Di Pietro, Fortini et Catonica 2003 (as suballiance)

Synonym: pro parte min.: Seslerion apenninae Furnari in Bruno et Furnari 1966

Name-giving species: *Leontopodium niveale* (Ten.) Hand.-Mazz., *Kobresia myosuroides* (Vill.) Fiori (syn.: *Elyna myosuroides* (Vill.) Janch.)

Nomenclature type: *Leontopodio nivalis-Elynetum myosuroidis* Feoli-Chiapella et Feoli 1977 (identical with the holotype of the *Leontopodio nivalis-Elynenion myosuroidis*)

Character taxa: *Achillea barrelieri* subsp. *barrelieri*, *A. barrelieri* subsp. *mucronulata*, *Adonis distorta*, *Alyssum cuneifolium*, *Androsace vitaliana* subsp. *praetutiana*, *Artemisia umbelliformis* subsp. *eri-
The syntaxonomy of the natural grasslands in the alpine belt of the Central Apennines has been studied by various authors starting from Furrer & Furnari (1960). All the papers published before 1980 classified the primary grasslands of the alpine belt to the alliance Seslerion apenninae Furnari in Bruno et Furnari 1966 (order Seslerietalia tenuifoliae Horvat 1930 or Seslerietalia apenninae Lakušić 1969; class Elyno-Seslerietea or Festuco-Seslerietea). Pedrotti et al. (1982) were the first to make reference to the Ohba’s class Carici-Kobresietea wherein they included the association Carici-Elynetum myosuroidis. Subsequently Biondi et al. (1999, 2000) added more associations (Leontopodium-Elynetum, ‘Caricetum rupestris-kitaibelianae’ and Seslerio-Dryadetum octopetala) that were classified by the latter authors to the alliance Oxytropido-Elynion. Blasi et al. (2003), in partial agreement with the proposal made by Oriolo (2001) for the Eastern Alps, classified these associations and the new association Galio-Silenetum acaulis to a new suballiance – the Leontopodio nivalis-Elynetum myosuroidis of the Seslerion apenninae. This suballiance was proposed in order to distinguish the primary ‘alpine tundra’ from the primary and secondary grasslands occurring in the subalpine and montane belts. Later Blasi et al. (2005) and Di Pietro et al. (2008) included in the Leontopodia-Elynenion further two new associations (Leontopodium nivalis-Seslerietum and Helianthemo alpestris-Festucetum italicae) described from the Majella Massif. Finally, Lancioni et al. (2011), although having confirmed the concept of the Leontopodia-Elynenion for the Central Apennines, proposed to re-classify the Leontopodium-Elynenion from the Seslerion apenninae (Elyno-Seslerietea) to the Oxytropido-Elynenion (Carici-Kobresietea).

In order to recognize the floristic, coenological and biogeographic features of the alpine belt vegetation in the Apennines and to match this biogeographic phenomenon within the syntaxonomical framework currently accepted for the other mountain ranges of southern Europe, we propose here to up-rank the suballiance Leontopodium nivalis-Elynenion myosuroidis Blasi et Di Pietro in Blasi, Di Pietro, Fortini et Catonica 2003 to the rank of an alliance. The nomenclature type is the association Leontopodium nivalis-Elynenion myosuroidis Feoli-Chiapella et Feoli 1977 designated as the type of the suballiance Leontopodium-Elynenion by Blasi et al. (2003). The lectotype of the association Leontopodium-Elynenion was designated by Biondi et al. (2000).
The Leontopodio-Elyinion includes Kobresia myosuroides swards of the windy ridges, Silene acaulis cushion-like tundra and pioneer communities of Carex firma, C. rupestris and Dryas octopetala. The Sesleria juncifolia primary dry grasslands of the alpine belt are also included in the Leontopodio-Elyinion. The characteristic component of the alliance includes Apennine endemics, amphi-Adriatic elements and south-eastern European mountain species that do not reach the Alps. The group of circumboreal species that was formerly considered as characteristic of the Leontopodio-Elynenion (Blasi et al. 2003) has been re-interpreted here as the group of species delimiting the Leontopodio-Elyinion against the Seslerion apenninae. The decision not to include the alpine vegetation of the Apennines in the alliance Oxytropido-Elyinion, originally described for the Alps (Gams 1936, Braun-Blanquet 1949) and also applied by some authors (Ohba 1974, Feoli-Chiapella & Feoli 1977) to the Italian Peninsula, has several reasons. Firstly, many species of the Oxytropido-Elyinion are absent in the Apennines and the Balkans (e.g. Agrostis alpina, Antennaria carpathica, Erigeron uniflorus, Festuca quadriflora, Lloydia serotina, Oxytropis halleri, O. jaccquinii). Secondly, the communities of the Oxytropido-Elyinion are spatially in contact with the Seslerietalia caeruleae communities whereas the communities of the Leontopodio-Elyinion are in contact with the Seslerietalia tenuifoliae communities. Species such as Sesleria caerulea or Carex sempervirens appear with high-frequency in the Oxytropido-Elyinion communities but are completely absent from the Leontopodio-Elyinion where they are substituted by the amphi-Adriatic elements such as Sesleria juncifolia and Carex kitaibeliana. In the classification of the Leontopodio-Elyinion to the higher syntaxa, we prefer the criterion of biogeographical history over the strictly floristic one. On the basis of this criterion the relict stands of the primary alpine tundra occurring on the summits of the highest sub-Mediterranean mountain ranges are viewed as impoverished remnants of vegetation that dominated these areas during the Pleistocene glacial maxima and enabled repeated establishment of the Arctic flora in the southern European mountains. Although the Holocene climatic amelioration resulted in incursion of South European and Mediterranean-montane elements into this vegetation, we include the Leontopodio-Elyinion to the arctic-circumboreal order Oxytropido-Elynetalia of the class Carici-Kobresietae.

The distribution of the Leontopodio nivalis-Elyinion is the same as proposed by Blasi et al. (2003) for the original suballiance, i.e. restricted to the Central Apennines. The following associations are currently included in this alliance:

1. Leontopodio nivalis-Elynetum Feoli-Chiapella et Feoli 1977
2. Carici kitaibelianae-Elynetum Pedrotti 1982
3. Seslerio juncifoliiae-Dryadetum Biondi et al. 1999
4. Caricetum rupestris-kitaibelianae Biondi et al. 2000
5. Galio magellensis-Silenetum acaulis Blasi et al. 2003
6. Helianthemo alpestris-Festucetum italicae Blasi et al. 2005
7. Leontopodio nivalis-Seslerietum juncifoliae Blasi et al. 2005

However, if a less restrictive syntaxonomical approach is adopted, the Leontopodio-Elyinion distribution could be extended to include the highest altitudes of the mountain ranges of the central and southern Balkan Peninsula (Simon 1958, Lakušić 1970, Horvat et al. 1974) due to the occurrence of shared amphi-Adriatic high-altitude species such as Artemisia umbelliformis subsp. eriantha, Carex kitaibeliana, Leontopodium niveale and Sesleria juncifolia. Except for the fundamental paper of Ohba (1974), who included the order Crepidetalia dinaricae in the class Carici-Kobresietae, all the syntaxonomical schemes for the Balkan Peninsula (Lakušić 1969, 1970, Horvat et al. 1974, Redžić 2003, Redžić et al. 2011, Šalja & Redžić 2012) included the vegetation of the alpine belt either to the Seslerietalia tenuifoliae (western Balkans) or to the Onobrycho-Seslerietalia (central-eastern Balkans); both orders belong to the Elyno-Seslerietea. However in the south-western Dinarides and in Bulgaria there are several mountain ranges that support a true alpine belt (e.g. Durmitor, Prokletije, Šar-Planina-Korab, Pirin, Rila) where some relics of the circumboreal arctic-alpine glacial flora still occur (Stevanović et al. 2009). Using the criterion of biogeographical history as mentioned above the Elyno-Edraianthetum serpyllifolii Lakušić 1964, Elyno-Edraianthetum alpini Lakušić 1964 and Trifolio-Caricetum rupestris Horvat ex Horvat et al. 1974 would find their optimal syntaxonomical position in the class Carici-Kobresietae, most probably within the extended Leontopodio nivalis-Elyinion or another, regional alliance of the Carici-Kobresietae. If an
Apennine-Balkan delimitation of the Leontopodium-Elyinion was accepted, the mountain ranges of Korab, Prokletije, Rila and Pirin would represent the southernmost limit of the Carici-Kobresietae in south-eastern Europe.

6. **LAGOTIDO URALENSES-CARICION ENSIFOLIAE: A NEW ALLIANCE OF ALPINE GRASSLANDS OF THE SOUTHERN URALS**

(by Milan Chytrý & Ladislav Mucina)

**Lagotido uralensis-Caricion ensifoliae Chytrý et Mucina all. nov. hoc loco**

Nomenclature type (holotypus hoc loco designatus): Rhodio-Caricetum ensifoliae Ishbirdin, Mullanagulov et Yanturin 1996

Pseudonym: Anemonoastrostucion ovinae sensu Ishbirdin, Mullanagulov et Yanturin 1996 non Chytrý, Pešout et Anenchenov 1993

Name-giving taxa: Lagotis uralensis Schischk., Carex bigelovii subsp. ensifolia (Gorodkov) Holub

Diagnostic taxa: Anemone narcissiflora subsp. biarmiensis, Campanula rotundifolia, Carex bigelovii subsp. ensifolia, Cerastium krylovii, Festuca igoschiniae, Hieracium iremelense, Juncus tridifus, Lagotis uralensis, Ligusticum mutellinoides, Persicaria alpina, Poa alpigena, Saussurea ×uralensis, Vaccinium uliginosum, V. vitis-idaea, Aulacomnium turgidum, Hylocomium splendens, Polytrichum commune, Cladonia islandica, C. laeavigata, Cladonia arbuscula, C. rangiferina, C. stellaris and Flavocetraria cucullata.

This vegetation was described in detail by Ishbirdin et al. (1996), however, it was classified as part of the Anemonoastrostucion ovinae Chytrý et al. 1993 – an alliance originally described from the alpine mountain tundra near Lake Baikal in southern Siberia (Chytrý et al. 1993). Both the mountain tundra in the Baikal region and that in the Urals are characterized by several species typical of the Arctic tundra and absence of the alpine species typical of more southern mountain ranges, therefore they belong to the order *Junceta trifidi* Daniëls 1994. However, the species composition of the stands in the Urals is transitional between corresponding communities occurring in the European and Siberian mountain ranges, from which they are geographically isolated by extensive plains. Moreover, they contain several endemic species. Given the alliance concept used for the high-mountain grasslands in the EuroVegChecklist, this clearly supports the status of the Ural alpine tundra vegetation as a discrete alliance.

7. **MUSCARIO-SCILLION NIVALIS: THE MYSTERY OF AN ELUSIVE ALLIANCE**

(by Ladislav Mucina)

This alliance belongs to the class *Juncetalia trifidi* Hadač in Klika et Hadač 1944 and the order *Juncetalia trifidi* Daniëls 1994. It includes the alpine tundra vegetation occurring above the timberline in the summit area of the Southern Ural Mountains, specifically on Mt Iremel’ at altitudes above 1100 m. This vegetation comprises open stands of graminoids and herbs with a well-developed layer of bryophytes and lichens. The herb layer is usually dominated by graminoids such as Carex bigelovii subsp. ensifolia, C. vaginata, Festuca igoschiniae, Juncus tridifus and at wet sites also Eriophorum vaginatum. It includes several endemic taxa of the Ural Mountains such as Anemone narcissiflora subsp. biarmiensis, Cerastium krylovii, Festuca igoschiniae, Hieracium iremelense, Lagotis uralensis and Saussurea ×uralensis. Dwarf shrubs Vaccinium uliginosum and *V. vitis-idaea* are common. The moss layer is dominated by the mosses Aulacomnium turgidum, Hylocomium splendens, Polytrichum commune and Rhytidium rugosum, and lichens Cladonia islandica, C. laeavigata, Cladonia arbuscula, C. rangiferina, C. stellaris and Flavocetraria cucullata.

Lovrić & Rac (1989) described the Muscario-Scillion nivalis Lovrić et Rac 1989 (‘Muscari-Scillian nivalis’ (Quez. prov.) Lov. et Rac 1988” on p. 34 or ‘Muscari-Scillian nivalis’ Lov. & Rac” on p. 40 in Table 1). This unit is supposed to encompass the ‘snow-bed’ vegetation of the Balkans and the Asia Minor, typical of deep high-altitude karstic sinkholes experiencing longer snow cover, snow-rich stormy winters, and drought and intensive insolation in summer. According to these authors this vegetation is ecologically very different from the typical snow-bed vegetation of the Salicetalia herbaceae. We agree with this assessment to the degree that the snow-beds in this area (and to a small extent also those of the Greek Peninsula) should
be considered as belonging to a different class – the *Trifolio anatolici-Polygoneta arenastri* Quézel 1973. The concept of a single alliance (*Muscario-Scillion nivalis*) over the large geographic expanses (from the northern Balkans as far as the Turkish-Iranian border) is, however, highly unrealistic and not supported by the data presented in Lovrić & Rac (1989).

Lovrić & Rac (1989) classified twelve associations (names are given in original connotation) within this alliance (here we use the original forms of the names):

1. ’Narciso-Gentianetum nivalis Lov. et Rac (1988)’
2. ’Muscario-Scilletum nivalis (Lov. et Rac) prov.’
3. ’Mycosotido-Gentianetum nivalis Lov. (1975) 1988’
4. ’Croco-Trifolietum pilczii prov.’
5. ’Croco-Scilletum subnivalis (Quez. prov. 1965) Lov. et Rac 1989a’
6. ’Gentiano-Scilletum subnivalis Lov. et Rac’
7. ’Ornithogalo-Muscarietum bourgaei Quezel (1973)’
8. ’Corydalo-Fritillarietum pinardii (Krause in Rikli 1948) prov.’
9. ’Fritillario-Scilletum nivalis Lov. et Rac (1989)’
10. ’Arabido-Scilletum ingridae Lov. et Rac (1989a)’
11. ’Muscario-Scilletum armenae prov.’
12. ’Sibbaldio-Gentianetum nivalis Lov. et Rac’

The *Muscario-Scillion nivalis* Lovrić et Rac 1989 appears to be (serendipitously) validly described because at least the ’Ornithogalo-Muscarietum bourgaei Quezel (1973)’ (recte: *Muscario bourgaei-Ornithogaletum brevipedicellati* Quézel 1973; orig. form (Quézel 1973: 205): ’Association à Muscaria bourgaei et Ornithogaleum brevipedicellatum’) was validly described at the time of the description of the *Muscario-Scillion nivalis*, referred to its original diagnosis by an unambiguous bibliographic reference to Quézel (1973) and indicated at p. 135 as the type of the alliance name (in Croatian: ’nomenklaturni prototip cijele sveze Muscario-Scillion’). Moreover, the diagnostic species of the alliance are listed in Table 1 of Lovrić & Rac (1989).

By inclusion of all the mentioned associations, eight of which appear to be merely *nomen nuda*, the authors created a biogeographically, ecologically and especially floristically very heterogeneous syntaxon spanning Croatia (associations 1, 2, 3), Macedonia and Hellas (ass. 4, 5, 6), Anatolia (ass. 7, 8, 9, 10, 11) and Lazistan (ass. 12). Due to obscure nature of most of the associations included in the original diagnosis and poor relevé material presented in Lovrić & Rac (1989), it is impossible at this stage to establish the syntaxonomy of the communities listed in the *Muscario-Scillion nivalis* coined for the East Mediterranean snowfields, from the Dinarides and the central and south-eastern mountain ranges of the Balkan Peninsula.

Lovrić & Rac (1989) classified their *Muscario-Scillion nivalis* into the ‘*Trifolio-Polygonetalia* Quez.’ (obviously the *Trifolio anatolicae-Polygonetalia arenastri* Quézel 1973) and further into the ‘*Arrhenatheretalia* Br.-Bl.’. However, because of the selection a nomenclatural type from Anatolia, the *Muscario-Scillion nivalis* becomes a synonym of the *Bolanthion frankenioidis* Quézel 1973 (p. 202 and seq.). This alliance was classified within the order *Trifolio anatolici-Polygonetalia arenastri* Quézel 1973 and the class *Trifolio anatolici-Polygonetea arenastri* Quézel 1973 (see also Quézel et al. 1993).

Thus the syntaxonomic summary should read:

*Trifolio anatolici-Polygonetalia arenastri* Quézel 1973
*Trifolio anatolici-Polygonetalia arenastri* Quezel
*Bolanthion frankenioidis* Quézel 1973
Syn.: *Muscario-Scillion nivalis* Lovrić et Rac
1989

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