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A new *Sesleria juncifolia* association from south-eastern Italy and its position in the amphi-Adriatic biogeographical context

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Abstract – The *Sesleria juncifolia* calcareous grasslands in the Apulia region (southern Italy) were studied on the basis of 24 phytosociological relevés. According to UPGMA cluster analysis division and NMDS ordination the relevés were classified into four major groups which gave rise to three sub-associations (Gargano) and a geographically impoverished variant (Alta Murgia). The new association *Stipo austroitalicae-Seslerietum juncifoliae* ass. nova was proposed. Due to the relict and scattered distribution of *Sesleria juncifolia* in Apulia region, the variances in species composition amongst the different subassociations are mainly influenced by local factors. The community *Stipo-Seslerietum* should be included in the south-eastern Italian alliance *Hippocrepido-Stipion austroitalicae* while at the rank of order it exhibits intermediate coenological features between the Central-South Apennine endemic suborder *Festuco-Seslerienalia nitidae* and the North-West Balkan order *Scorzonero-Chrysopogonetalia*.

Key words: Apulia, Balkans, biogeography, grassland, Italy, phytosociology, *Sesleria juncifolia,* syntaxonomy, vegetation

Introduction

The genus *Sesleria* is one of the most important South-Eastern European grass groups, especially in the mountain areas where *Sesleria* species often play a dominant role. Of all the various taxa belonging to this genus, the *Sesleria juncifolia* complex is restricted to southern Europe, where it exhibits a typically amphi-Adriatic disjunct range (Fig. 1a) composed of two different sub-units: the western Balkans (from the Italian Karst to the southern Albania) and the Apennines (from the northern Tuscany to the northern Calabria). The taxonomical debate about the overall number of taxa belonging to the *Sesleria juncifolia* complex has always been a critical issue (see Deyl 1946, 1980; Ujhelyi 1959; Strgar 1981; Ubaldi 2006;

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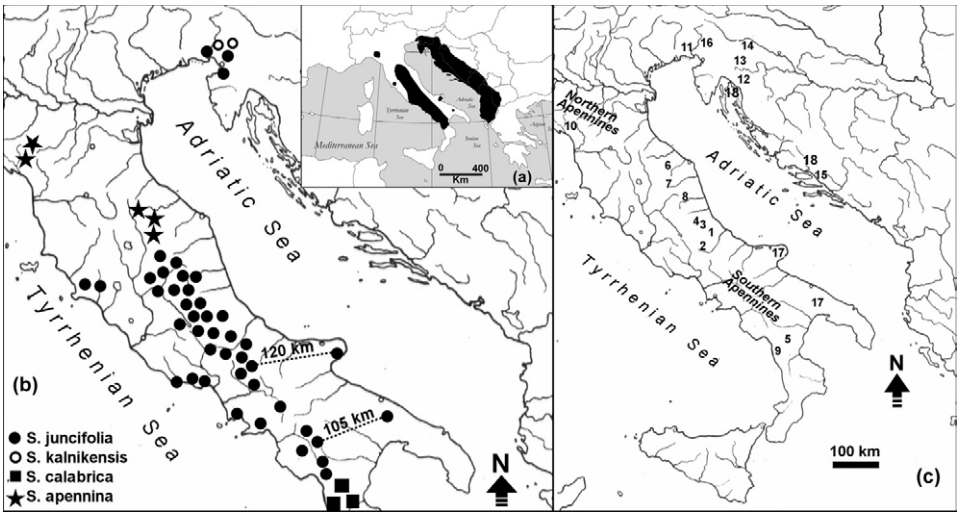

Fig. 1. Amphi-Adriatic distribution of the *Sesleria juncifolia* complex (**a**). Distributional map of the populations of *S. juncifolia* occurring within the Italian Peninsula showing the isolation of the Apulian populations from the sourrounding *S. juncifolia* sites (**b**). Geographical location of the *Sesleria juncifolia* s.l. associations included in the synoptic table (**c**).

ALEGRO 2007) that has still not been completely resolved. As far as the Italian peninsula is concerned, the occurrence of four distinct taxa (*S. juncifolia* Suffren, *S. kalnikensis* Ják., *S. apennina* Ujhelyi, *S. calabrica* (Deyl) Di Pietro) has been recently hypothesised on the basis of karyological, morphological and biogeographical features (DI PIETRO et al. 2005, DI PIETRO 2007). Likewise all the other species belonging to the same complex, *Sesleria juncifolia* is a montane species having its synecological optimum in the upper montane and subalpine belts of the major central-southern Apennines limestone massifs where it is the guide species in several types of dry grasslands (BRUNO and FURNARI 1966, PETRICCIONE and PERSIA 1995, BIONDI et al. 1999, BLASI et al. 2005, COSTANZO et al. 2009, DI PIETRO 2010). Furthermore the wide ecological amplitude of this species allows it to give rise to grassland communities not only in the lower montane belt, as is the case of *Carici macrolepidis--Seslerietum* of Mount Cucco (BIONDI et al. 2004) and *Seslerio-Stipetum appenninicolae* of Sibillini mountains (CATORCI et al. 2007), but in the hilly belt too, as is the case with *Genisto-Seslerietum juncifoliae* in the Rosandra valley in the Friuli Venezia-Giulia region and adjacent Slovenia (POLDINI 1980, KALIGARIČ 1994) and in the Rossa Gorges and Furlo Gorges in the Marches region (BRILLI-CATTARINI 1972). Scattered residual populations of *Sesleria juncifolia* are even found on the coastal and sub-coastal cliffs of Capri island, Circeo Promontory and Mount Leano (Tyrrhenian side of the Italian peninsula) at about 300 m a.s.l. under typical Thermo-Mediterranean bioclimatic conditions. This wide coenological and altitudinal pattern of the *Sesleria juncifolia* s.l. grasslands is comparable to that occurring in the western Balkans for both the high and for the low altitude zones (Krk and Pag islands) (HORVAT et al. 1974, REDZIC 1999).

According to PIGNATTI (1982) the presence of *Sesleria juncifolia* in Apulia region was restricted to the Gargano Peninsula, where it was known for Monte degli Angeli, Monte

Sant' Angelo, Monte Calvo and Pulsano (FENAROLI 1974). Subsequently this species was found in other sites of the Gargano area (WAGENSOMMER and DI PIETRO 2006, WAGENSOMMER 2010) and in few isolated sites in Alta Murgia National Park (Fig. 6). These new records have resulted in *S. juncifolia* being removed from the list of endangered species at a regional level. Nevertheless, according to the subcriteria B1 (100 km^2 < EOO < 5,000 km^2) and B2 (10 km^2 < AOO < 500 km^2) and to the option »a« (7 locations in the whole region) of the IUCN rules (IUCN, 2006), in the Apulia region *Sesleria juncifolia* is to be considered as a species at risk of becoming »endangered« (according to the IUCN »B« criterion *S. juncifolia* is: NT B1+2ab iii).

During field research into the ecology and conservation of the rare species of Gargano National Park (DI PIETRO and WAGENSOMMER 2008), several dry grasslands communities dominated by *S. juncifolia* were found (green squares in Fig. 2). In the present research some new *S. juncifolia* communities stands were also identified (the red squares in Fig. 2). Because the occurrence of these *Sesleria juncifolia* communities was unknown to Italian botanists, no phytosociological data were available on this topic in Italian botanical literature. The presence of *S. juncifolia* communities in Apulia is a very peculiar fact, especially considering the prominent role of the Mediterranean climate in the region, the low altitudes of the main Apulian ranges (Mount Cornacchia, 1,151 m, is the highest regional peak) and their isolation from the other mountainous massifs of the Apennines. In fact the Gargano and Alta Murgia *S. juncifolia* communities are those that exhibit the longest distance as the crow flies from the nearest other *S. juncifolia* population occurring in Peninsular Italy (Fig. 1b). The geographical isolation of Gargano and Alta Murgia areas sums up to the lithological and ecological isolation of these areas which is due to the occurrence of large silty--clayey plains which surround the Gargano and Alta Murgia limestone systems. The aim of the present paper is to provide a phytosociological description of the Apulian *Sesleria juncifolia* communities and to make a floristic, coenological and syntaxonomical comparison with the similar *Sesleria juncifolia* communities described so far for the Italian and the Balkan peninsulas.

Study area

The study area is divided into two parts: Gargano promontory and Alta Murgia plateau (Fig. 2B). The promontory of Gargano, known as the »spur« of the Italian peninsula, is a succession of broad plains and low-lying hills jutting into the Adriatic Sea from the east coast of Italy, in Foggia province. It is 65 km long and 40 km at its widest, with an area of about 2,100 square km and it acts as an island emerging from the Tavoliere plain. Mount Gargano is composed entirely of limestone, surrounded by terraces of various geologic periods. The highest peak is Mount Calvo (1,065 m), while the only other peaks exceeding one thousand meters are Montenero (1,014 m) and Mount Spigno (1,008 m). The intense karst activity affecting the limestone bedrock leads to the superficial water drainage being restricted to torrential rivers, while the coastal lakes (Lesina, and Varano) in the north-western side of the promontory are very important. According to BLASI (2003) the Apulian *Sesleria juncifolia* sites are included in the following phytoclimatic units: Dry Meso-Mediterranean; Subhumid Meso-Mediterranean; Humid/Subhumid Mesotemperate (Fig. 2A). The potential vegetation of Gargano is almost completely composed of oak woodlands

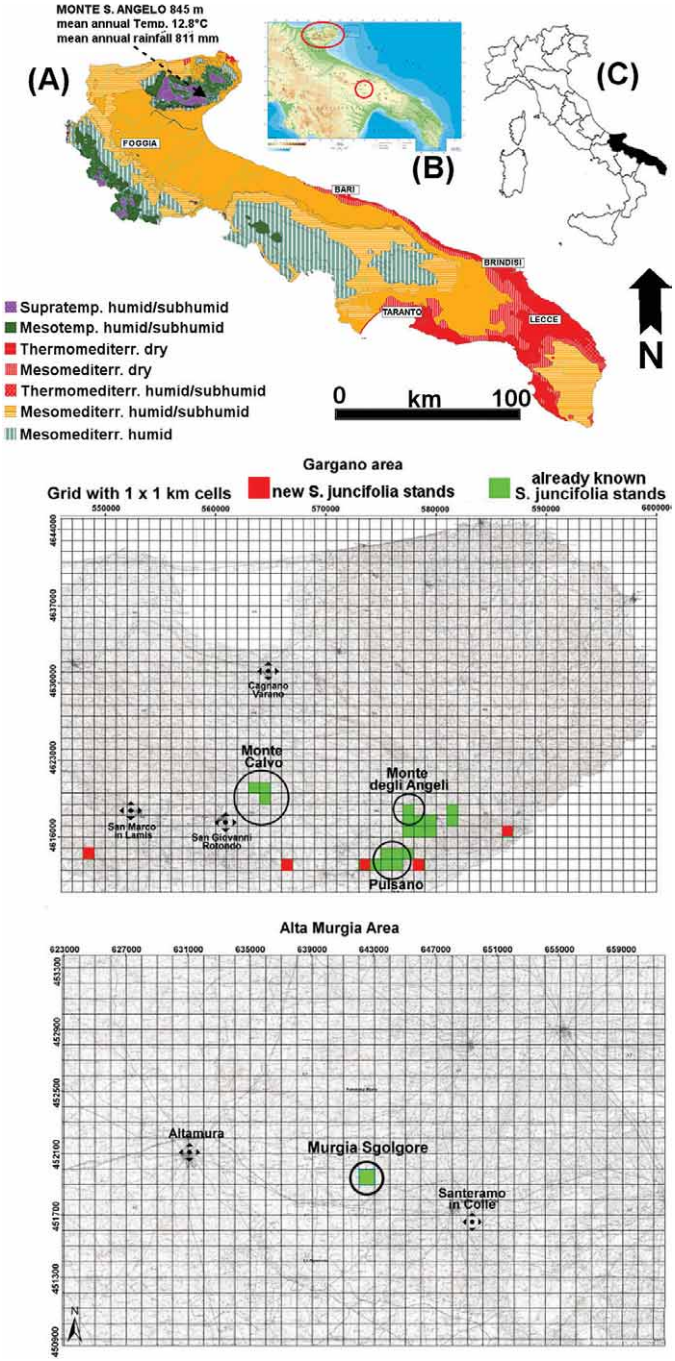

Fig. 2. Upper part: **A** – Bioclimatic map of Apulia region (modified after BLASI 2003) **B** – Apulia region physical map with the areas including *Sesleria juncifolia* population circled in red. **C** – Apulia region in the Italian political map. Lower part: 1 km × 1 km grid of distribution of *Sesleria juncifolia* stands in the Gargano and Alta Murgia territories.

(*Quercus ilex, Q. pubescens, Q. cerris*) except for the important site of »Umbra Foresta« which is covered by a wide beech forest and of pine woods along the coasts. The *Sesleria juncifolia* communities are restricted to the southern slope of Gargano, which is characterized by the presence of deep vertical valleys (Vallone di Pulsano, Valle dell'Inferno, Valle del Surdo, etc). The Alta Murgian relief is a wide limestone plateau included in the territory of Bari and Barletta-Andria-Trani provinces and it is the core of the Alta Murgia National Park, which covers an area of about 680 square kilometres. The bedrock is formed by Cretaceous limestone usually covered with Pleistocene calcarenite and this geological character has determined a lot of karstic phenomena represented by swallow holes, dolinas, poljes. The highest peaks are Torre Disperata (686 m) and Mount Caccia (680 m). The deep changes caused by the human action have shaped the physiognomy of the original vegetation to the extent that it is impossible or very difficult to carry out a precise and certain analysis of the potentialities of this territory. At present the Alta Murgia Park is marked by very extended steppe-like grasslands which in the 92/43/EEC Directive are for the most included in the prior Habitat 62A0 (Eastern sub-mediterranean dry grasslands), and for a minor part in the other prior Habitats 6220 and 6210.

Materials and methods

The study was carried out via a phytosociological and statistical analysis of relevés of dry grasslands with the dominance of *Sesleria juncifolia* performed in Apulia region (south-eastern Italy). Subsequently a phytogeographical and phytosociological comparison with the literature data regarding the *Sesleria juncifolia* communities of the rest of Italy and of the western Balkan Peninsula was provided. Twenty-four relevés, according to the Braun-Blanquet (1964) approach, were performed in May 2007–2009. All the cover data were recorded according to the Braun-Blanquet scale and transformed into the scale proposed by van der Maarel (1979) and Noest et al. (1989). A matrix of 24 relevés × 148 species was subjected to a divisive hierarchical classification (using the chord distance algorithm to produce the dissimilarity matrix and the minimum variance linkage as agglomeration criterion on quantitative data) and to nmds ordination (Syn-tax 2000 package, Podani 2001). Four main types of vegetation were distinguished from a coenological point of view and a syntaxonomical assignment was subsequently proposed. Moreover a synoptic table composed of the frequency columns of all *Sesleria juncifolia* s.l. associations described in Italy and in the western Balkans (On-line supplement appendix 4; Fig. 1c) was prepared and subsequently subjected to cluster analysis using the same statistical procedures mentioned above. In order to attenuate the influence of the high cover/abundance values of the grasslands' guide species, in the cluster analysis procedures the various taxa belonging to the *Sesleria juncifolia* complex were reported under the single collective name of *S. juncifolia* s.l. Owing to the thermophilous character of the Apulian communities, comparison with the Balkan *Sesleria juncifolia* communities was restricted to those associations which showed similar ecological features. On the contrary the *S. juncifolia* communities belonging to the *Elyno-Seslerietea* class and occurring in the subalpine and alpine belts of the Balkans were not included in this comparative cluster analysis. For the identification of plant taxa the diagnostic key published in Licht (2008) was used. The nomenclature of the taxa follows Conti et al. (2005) and Euro+Med PlantBase, whilst life form and chorotype systems follow Pignatti (1982). Life form and chorological analyses consider whether a particular species

occurs or not in a cluster (normal values), its frequency (frequency values), and its cover values (cover). The physiognomical role of each species was investigated by calculating its specific cover index (BRAUN-BLANQUET 1964). In naming the phytosociological syntaxa, we adhered to the rules contained in the third edition of the International Code of Phytosociological Nomenclature (ICPN) (WEBER et al. 2000).

Results

Phytosociological relevés

The dendrogram resulting from the hierarchical classification (Fig. 3) highlighted two main clusters: cluster »A« included the *S. juncifolia* communities of Gargano promontory, while cluster »B« included the residual impoverished *Sesleria juncifolia* communities of the Alta Murgia area. Cluster »A« is subdivided into two further subclusters. Subcl. A_2 includes the Sesleria grasslands occurring within the steep slopes of the Pulsano gorge. Subcl. A_1 includes the *Sesleria* grasslands placed at higher altitude. In particular, cluster A_{1-1} includes the grasslands of the top of Mount Calvo while cluster A_{1-2} is related to the summit area of Mount S. Angelo. The result of the cluster analysis was confirmed by the NMDS ordination (Fig. 4), although no any correlation between axis and environmental parameters was identified.

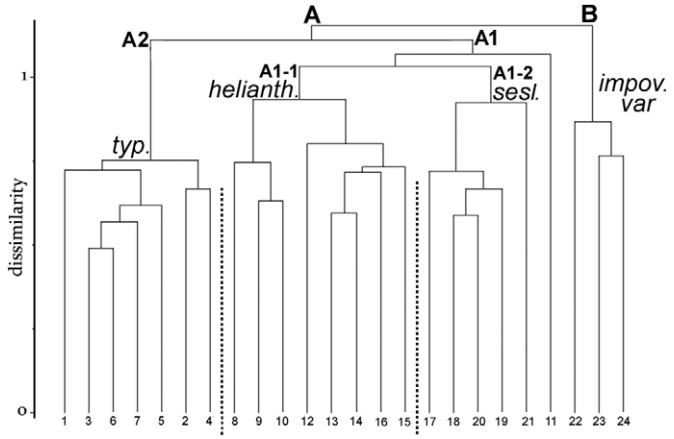

Fig. 3. Cluster analysis dendrogram of the Apulian *Sesleria juncifolia* communities relevés.

The geographical isolation from the rest of the *Sesleria juncifolia* communities occurring in the Apennines and in the Balkans have resulted in the Apulian *Sesleria juncifolia* dry grasslands developing very peculiar floristic and coenological features for which none of the syntaxa already published is suitable at present. For this reason we propose the new association:

Stipo austroitalicae-Seslerietum juncifoliae **Di Pietro et Wagensommer ass. nov hoc loco**

Holotypus: Table 1, rel. 2. For locations and dates of relevés in Tab. 1, see On-line supplement appendix 1; sporadic species are listed in the Online supplement appendix 2.

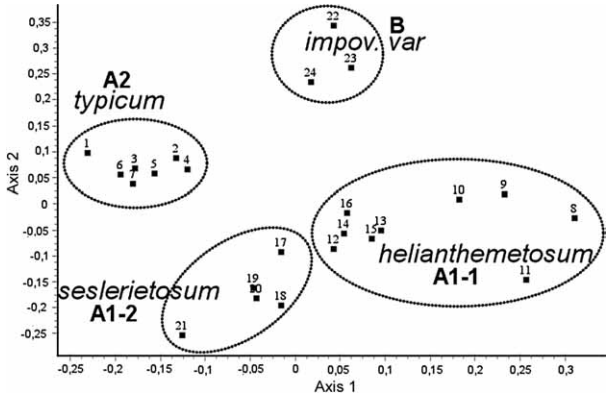

Fig. 4. NMDS Ordination of the Apulian *Sesleria juncifolia* communities relevés with the partition of the clusters identified by the cluster analysis.

Diagnosis: *Stipo austroitalicae-Seslerietum juncifoliae* dry grasslands are developed on limestone outcrops, ridges and carbonate-rich talus slopes, and are strongly dominated by *Sesleria juncifolia* which is joined by a complex of common calcicolous stress-tolerant species such as *Plantago holosteum, Pimpinella tragium, Galium corrudifolium, Koeleria splendens, Anthyllis vulneraria* subsp. *rubriflora* and by a group of species having a very restricted distribution such as *Stipa austroitalica, Leontodon apulus, Centaurea subtilis, Satureja cuneifolia, Genista michelii* (etc.). The sites are characterised by nutrient-poor calcareous xeric soils (especially lithosols) and are typically exposed to extreme microclimatic conditions such as drought and high temperature amplitude. *Stipo-Seslerietum* occurs, in form of isolated and highly fragmented stands, at altitudes which range between 400 and 1,050 m.

Bioclimate: Meso-Mediterranean/Meso-temperate thermotypes; lower dry/upper sub--humid umbrotype.

Characteristic species: *Stipa austroitalica, Leontodon apulus, Dianthus tarentinus, Anthyllis vulneraria* subsp. *rubriflora.*

Dynamics: *Stipo-Seslerietum* forms primary grasslands on the small-size talus slopes developed within Gargano southern slope gorges. On deep soils *Stipo-Seslerietum* behaves like a secondary stage of *Ostryo-Quercetum ilicis* or *Cyclamino-Quercetum virgilianae* at lower altitudes or *Ostrya carpinifolia* woods at higher altitudes.

Distribution: *Stipo-Seslerietum* is endemic to the Apulia region. The majority of the sites occur in the Gargano promontory while only few relic populations occur in the Alta Murgia plateau.

Stipo-Seslerietum is divided into three sub-associations: *typicum* (Gargano promontory southern slopes gorges); *helianthemetosum apennini* (top of Mount Calvo); *seslerietosum autumnalis* (Mount S. Angelo ridges):

***Stipo austroitalicae-Seslerietum juncifoliae typicum* Di Pietro et Wagensommer subass. nov hoc loco.** Holotypus: Table 1, rel. 2

The most typical aspect of *Stipo-Seslerietum* is found within the steep slopes of the gorges which cut across the southern side of the Gargano promontory (Fig. 5a) where small

Tab. 1. *Stipo austroitalicae-Seslerietum juncifoliae* Di Pietro et Wagensommer ass. nov.

relevés number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		typ.											typ.					typ.						
altitude m a.s.l.	510	500	500	500	490	500	500	1000	1040	1020	1040	1025	1030	1025	1015	1015	860	860	870	865	860	580	582	578
aspect	W	W	WSW	S	W	SW	WSW	SE	SE	E	E	S	S	S	W	W	N	N	N	N	N	N	E	NE
slope (°)	80	15	5	30	10	35	15	75	70	65	0	60	40	35	70	10	50	55	5	70	50	50	55	30
rockyness: A=high; M=med.; S=scarce	AA	M	A	A	M	M	M	65	60	55	A	AA	A	A	AA	S	AA	AA	A	AA	AA	AA	AA	AA
detritus: A=high; M=med.; S=scarce	.	A	M	M	A	A	A	.	.	.	S	.	.	.	.	S	S	S	.	.	.	.	.	.
cover (%)	70	70	80	70	75	70	75	55	65	60	85	40	60	80	70	90	75	70	70	70	65	65	60	60
area m^2	20	10	7	10	8	45	30	45	50	60	15	9	9	7	10	9	40	35	15	40	50	25	20	25
Sesleria juncifolia	2	4	5	4	4	4	4	2	3	3	2	3	3	3	4	5	4	4	4	4	3	3	3	3
Stipa austroitalica	1	1	1	1	2	1	2	1	1	1	.	+	+	1	+	1	2	1	+	1	.	1	.	1
Leontodon apulus	+	+	+	.	+	+	.	1	1	2	1	.	+	+	.	+	2	1	1	2	+	1	2	2
Anthyllis vulneraria subsp. rubriflora	+	+	.	1	.	.	+	1	1	1	2	.	+	+	+	1	2	1	2	1	.	.	.	.
Dianthus tarentinus	+	+	.	.	.	.	+	.	+	+	.	.	+	+	.	.	+	+	+	.	.	.	+	.
Stipo austroitalicae-Seslerietum juncifoliae subass. typicum																								
Centaurea subtilis	2	2	2	1	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Genista michelii	1	2	2	+	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Satureja cuneifolia	1	+	2	+	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fumana ericifolia	1	+	1	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thesium humifusum	+	+	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Stipo austroitalicae-Seslerietum juncifoliae helianthemetosum apennini																								
Helianthemum apenninum	.	.	.	.	1	.	.	2	2	2	+	+	+	+	1	1	.	.	.	.	.	.	.	.
Plantago holosteum	.	.	.	.	.	.	.	3	3	2	+	.	1	1	+	+	.	.	.	.	.	.	.	.
Medicago prostrata	.	.	.	.	.	.	.	2	2	+	+	.	+	.	.	1	.	.	.	.	.	.	.	.
Stipo austroitalicae-Seslerietum juncifoliae seslerietosum autumnalis																								
Sesleria autumnalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	1	+	.	.	.
Doronicum columnae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	2	2	.	.	.
Aubrieta columnae subsp. italica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	2	.	.	.
Alyssum diffusum subsp. garganicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	1	+	.	.	.
Viola merxmuelleri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.
Stipo austroitalicae-Seslerietum juncifoliae residual Alta Murgia form																								
Helianthemum oelandicum subsp. incanum	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	2	3

Tab. 1. – continued

relevés number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Elaeoselinum asclepium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	+	+
Euphorbia nicaeensis subsp. japygica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+
Hippocrepido glaucae-Stipion austroitalicae																								
Hippocrepis glauca	+	+	.	+	.	.	.	1	+	.	.	1	2	2	+	2	1	.	.	.	.	.	.	.
Cytisus spinescens	+	+	+	+	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thymus spinulosus	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	1	+	+
Scorzonera villosa subsp. columnae	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	+	+
transgr. Cytiso-Bromion																								
Sideritis italica	.	.	.	.	.	.	.	1	+	1	.	.	+	2	2	.	.	1	+	1	+	.	.	.
Onobrychis alba subsp. alba	.	1	.	1	+	+	1	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea deusta	.	.	.	+	.	.	.	+	.	+	.	.	.	.	.	.	.	+	.	+	+	.	.	.
Crepis lacera	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	+	1	.	.	.	.
Scorzonero-Chrysopogonetalia/Artemisio-Brometalia																								
Galium corrudifolium	.	+	+	1	1	+	+	+	2	2	+	1	+	+	2	2	+	1	+	1	2	2	+	.
Koeleria splendens	+	1	.	.	.	.	1	1	1	+	+	.	+	+	.	1	2	.	.	+	.	.	+	1
Pimpinella tragium	.	+	.	.	+	+	+	.	+	2	.	2	.	+	1	.	2	2	1	2	1	.	.	.
Euphorbia spinosa	.	.	.	+	.	.	.	1	1	+	.	+	+	.	+	.	.	.	.	.	.	.	.	.
Cytisus decumbens	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	1	1	2	2	1	.	.	.	.
Onosma angustifolia	.	2	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Onosma echioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	+	1
Convolvulus elegantissimus	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	+	+
Muscari neglectum	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	+	1	.	+	.	.	.	.
Aethionema saxatile	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Jurinea mollis	.	.	.	.	.	.	.	+	.	1	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Phagnalon rupestre subsp. illyricum	+	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stachys recta subsp. subcrenata	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum austriacum subsp. tommasinii	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cephalaria leucantha	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Teucrium chamaedrys	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Carex liparocarpos	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.
Allium sphaerocephalon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.

Tab. 1. – continued

relevés number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Arabis collina subsp. collina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.
Scabiosa columbaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.
Euphorbia myrsinites	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
Eryngium amethystinum	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Artemisia alba	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus illyricus	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Thlaspi praecox	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Orchis pauciflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Alyssum diffusum s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Silene paradoxa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Leontodon cichoraceus	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuco-Brometea																								
Festuca circummediterranea	.	.	+	+	+	.	.	1	1	1	.	.	.	.	1	1	.	.	.	.	.	2	+	.
Minuartia verna subsp. attica	.	.	.	.	.	.	.	1	1	.	+	+	.	.	.	+	.	+	.	.	.	.	.	.
Bromus erectus	.	.	.	.	.	.	.	2	1	+	3	+	+	+	.	+	1	.	.	.	.	.	.	.
Valeriana tuberosa	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	.	.	.	.	.
Polygala nicaeensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.
Bromus hordeaceus	.	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sanguisorba minor	.	.	.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brachypodium rupestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	+	2	.	.	.	.
Inula montana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.
Centaurium erythraea	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus nutans	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex caryophyllea	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium pilosella	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Orchis antropophora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Anthoxantum odoratum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Cisto-Micromerietea																								
Rhamnus saxatilis subsp. infectoria	.	1	+	1	1	1	+	.	.	.	.	.	.	+	.	.	.	.	+	.	.	+	+	+
Sedum ochroleucum	+	+	.	1	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+
Satureja montana subsp. montana	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	1	2	+	1	.	.	.	+

Tab. 1. – continued

relevés number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Teucrium capitatum	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	+	.	.	+	.	.	.	.	+
Ceterach officinarum	.	.	.	.	.	.	.	.	+	+	.	1	.	.	.	.	.	.	.	+	+	.	+	.
Teucrium montanum	1	.	+	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asperula aristata subsp. longiflora	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	+	.	.	.	.	1	.	.	.
Emerus major subsp. emeroides	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	2	1	+	.	.	.
Athamanta sicula	.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	.	.	.	.	1	+	.	.	.
Cistus creticus subsp. eriocephalus	.	+	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Ruta graveolens	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
Cistus salvifolius	.	.	.	.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fumana thymifolia	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Micromeria graeca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+
Helichrysum italicum subsp. italicum	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Genista tinctoria	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asparagus acutifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Asplenietea trichomanes																								
Inula verbascifolia	+	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lomelosia crenata subsp. dallaportae	1	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum caespitosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
Hieracium acanthodontoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Scabiosa taygetea subsp. garganica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Asplenium trichomanes	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Polypodium interjectum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Aurinia saxatilis subsp. megalocarpa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Hellenocarum multiflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Sedum hispanicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Sedum dasyphyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Lygeo-Stipetea & Tuberarietea																								
Reichardia picroides	+	+	+	.	.	.	+	.	1	+	.	.	.	.	.	.	.	.	.	.	.	1	.	+
Brachypodium retusum	.	+	.	+	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trachynia distachya	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Briza maxima	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.

Tab. 1. – continued

relevés number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Urospermum dalechampii	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crupina crupinastrum	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Cynosurus echinatus	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Catapodium rigidum	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+
Bromus madritensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+
Bartsia trixago	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis sancta	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Xeranthemum inapertum	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa annua	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum strictum subsp. strictum	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypochoeris achyrophorus	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bombycilaena erecta	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asterolinon linum-stellatum	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bupleurum baldense	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ononis ornithopodioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Avena barbata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Euphorbia exigua subsp. exigua	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Other species																								
Ornithogalum comosum	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	+
Acinos alpinus	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	1	+	.	.	.
Hirschfeldia incana subsp. incana	.	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Triticum ovatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+
Diplotaxis tenuifolia	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Silene vulgaris	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Carlina corymbosa	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Silene conica	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygala monspeliaca	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.
Cerastium pumilum	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.
Geranium columbinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.
Vicia pubescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
Sporadic species	.	1	.	1	1	.	.	2	.	.	1	.	.	.	.	1	.	.	.	.	.	4	2	1

rocky outcrops emerge from a matrix composed of limestone debris. This subassociation is developed at the lowest altitude (400–520 m). The characteristic species of this subassociation are *Genista michelii*, *Centaurea subtilis* and *Satureja cuneifolia,* whose distribution in the Gargano area is almost only restricted to this habitat type.

***Stipo austroitalicae-Seslerietum juncifoliae helianthemetosum apennini* Di Pietro et Wagensommer subass. nov hoc loco.** Holotypus: Tab. 1, rel. 13

As this sub-association is restricted to the top of Mount Calvo, the highest summit of Gargano, it is the aspect of *Stipo-Seslerietum* which is developed at the highest altitude (exceeding 1,000 m) and which best exhibits the physiognomical features of a typical dry grassland (Fig. 5b). Although it is mainly developed on rocky habitats, it can also be found on flat surfaces where *Bromus erectus* can play a co-dominant role together with *Anthyllis vulneraria* subsp. *rubriflora* and *Plantago holosteum*. The characteristic species of this sub-association are *Helianthemum apenninum*, *Plantago holosteum* and *Medicago prostrata*.

***Stipo austroitalicae-Seslerietum juncifoliae seslerietosum autumnalis* Di Pietro et Wagensommer subass. nov hoc loco.** Holotypus: Tab. 1, rel. 18

This subassociation is restricted to the north facing slopes of Monte degli Angeli (Fig. 5c) where *Sesleria juncifolia* become dominant in the steepest part of the slopes, at altitudes ranging between 820 and 870 m, where a higher degree of rockiness is found. Aspects that are exclusively north-facing together with the vicinity of *Ostrya carpinifolia* woodlands lead to the peculiar co-existence of *Sesleria juncifolia* and *Sesleria autumnalis* which has never been recorded elsewhere in the Italian Peninsula. The characteristic species of this subassociation are *Sesleria autumnalis*, *Doronicum columnae* and *Aubrieta columnae* subsp. *italica*.

Fig. 5. *Stipo-Seslerietum typicum* in Pulsano valley (**a**), *Stipo-Seslerietum helianthemetosum* on the top of Mount Calvo (**b**), *Stipo-Seslerietum seslerietosum autumnalis* on the ridges of Monte degli Angeli (**c**).

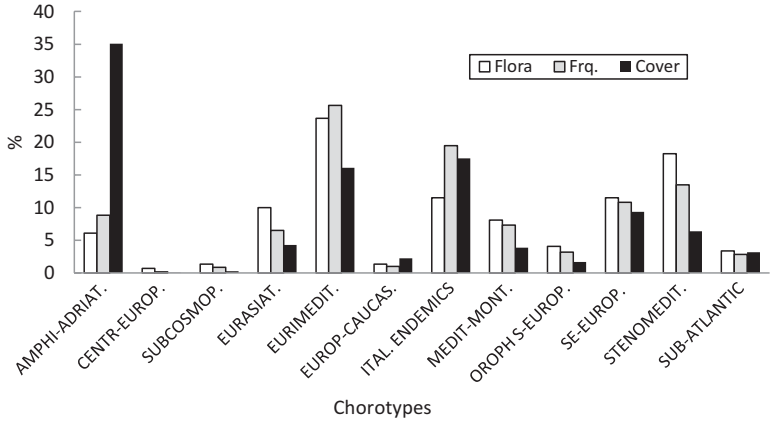

Fig. 6. Chorological spectrum of *Stipo austroitalicae-Seslerietum juncifoliae* calculated on the presence (Flora), frequency (Frq.), cover of a given chorotype in the phytosociological table.

Stipo austroitalicae-Seslerietum juncifoliae impoverished form

The Alta Murgia *Sesleria juncifolia* communities exhibit a floristic composition slightly different from that of the Gargano communities due to the presence of some endemics or amphi-Adriatic species the distribution of which is restricted to southern Apulia and the southern Balkans (e.g. *Hellenocarum multiflorum, Euphorbia nicaeensis* subsp. *japygica*). This fact, however, does not change the coenological and biogeographical features of the community as well as this does not allow the use of any other syntaxonomical references than *Stipo-Seslerietum*. The sporadic occurrence of *Sesleria juncifolia* populations in Alta Murgia restricted to a few isolated rocky outcrops has led us to classify these communities as an impoverished variant of *Stipo-Seslerietum* rather than as a distinct sub-association.

Synoptic columns

Sporadic species in synoptic table 4 are listed in the Online supplement appendix 3; the associations included are listed in the Online supplement appendix 4.

As far as the synoptic table is concerned, the dendrogram resulting from the hierarchical classification of the selected *S. juncifolia* associations (Fig. 8) highlighted two main clusters: cluster »A« which includes the *S. juncifolia* communities of the subalpine and the alpine belt of the Apennines and cluster »B« which includes the associations of the hilly and the montane belt of both the Apennines and the western Balkans. Cluster B exhibits a further division in sub-cluster B1, which includes most of the Apennine and Balkan associations, and sub-cluster B2, which is restricted to two associations (the Apulian *Stipo-Seslerietum* and the Dalmatian *Salvio-Seslerietum*). A further subdivision of the subcluster B1 separates the Apennine (B1a) from the Balkan communities (B1b).

Discussion

Most of the phytosociological literature concerning the Gargano grasslands has discussed the steppe-like vegetation (especially dominated by *Stipa austroitalica*) of the limestone plateaus (FORTE et al. 2005, TERZI et al. 2010) or the chasmophytic communities rich

Tab. 2. Chorological spectrum of the *Sesleria juncifolia* s.l. associations included in the synoptic table.

	Leont-Sesl	Scab-Sesl.	Sesl. apenninae	Sesl-Dryadetum	Anth-Sesl. cal.	Carici hum.-Sesl.	Carici macr.-Sesl.	Sesl.-Stipetum	Jurineo-Sesl. cal.	Sesl.-Drabetum	Genisto-Sesl. jun	Sesl-Caricetum hum	Sesl. juncif.	Sesl. kalnik.	Salvio-Sesl.	Genisto-Sesl. kaln	Stipo aus-Sesl.	Bro-Sesl. interr.
AMPHI-ADRIAT.	16.8	15.7	16.9	28.9	20.3	10.8	7.7	5.6	13.6	9.8	9.6	4.3	3.0	2.8	15.7	4.2	8.8	10.3
BALKAN ENDEM.	.	.	.	.	.	.	.	.	.	.	5.3	.	.	1.1	8.2	5.0	.	9.0
BOREAL	19.4	10.1	18.3	7.8	5.3	4.2	.	.	0.6	1.5	.	6.7	7.3	3.4	0.9	6.1	.	1.4
CENTR.-EUROP.	10.3	5.6	5.6	3.3	1.5	8.4	7.7	5.1	1.9	3.0	8.5	3.7	14.0	11.3	2.7	10.3	0.2	6.9
SUBCOSMOP.	.	.	.	.	.	.	.	.	0.6	.	.	.	.	.	.	1.1	0.8	.
EURASIAT	7.1	5.1	5.6	4.4	6.0	15.0	11.6	14.4	9.3	4.5	13.8	21.3	13.4	20.3	9.1	17.2	6.5	11.0
EURIMEDIT.	.	3.9	2.8	2.2	9.8	7.2	11.6	15.3	13.6	6.0	7.4	6.1	3.7	5.6	26.4	6.1	25.6	13.8
EUROP-CAUCAS.	2.6	5.6	4.9	8.9	5.3	7.8	9.4	6.5	5.6	3.8	2.1	14.6	15.2	10.7	2.7	8.0	1.0	2.8
ITAL ENDEMICS	13.5	15.2	12.0	8.9	20.3	13.8	12.2	13.5	15.4	24.1	.	0.6	.	.	.	.	19.5	.
MEDIT-MONT.	4.5	5.6	2.8	2.2	2.3	3.6	8.8	4.2	5.6	9.8	20.2	12.2	1.2	4.0	4.5	8.4	7.3	6.2
OROPH S-EUROP.	25.8	29.2	30.3	31.1	26.3	13.2	12.2	12.6	7.4	31.6	7.4	16.5	18.3	15.8	8.2	17.6	3.2	13.1
SE-EUROP	.	3.9	0.7	2.2	2.3	13.8	16.6	17.2	14.8	5.3	16.0	10.4	20.1	20.9	10.9	12.6	10.8	20.7
STENOMEDIT.	.	.	.	.	0.8	.	.	2.3	9.9	.	5.3	.	.	.	10.9	1.5	13.5	3.4
SUB-ATLANTIC	.	.	.	.	.	2.4	2.2	3.3	2.5	0.8	4.3	3.7	3.7	4.0	.	1.9	2.8	1.4

in endemic and rare species (BIANCO et al. 1988, DI PIETRO and WAGENSOMMER 2008, TERZI and D' AMICO 2008). By contrast, the grassland types developed in other habitats such as rocky slopes, stable talus slopes or mountain ridges (which are those in which *S. juncifolia* dominates more frequently) have been overlooked. This is why *Sesleria juncifolia* is known only for its role of »companion« species, as in some *Centaureo-Campanuletalia* chasmophitic communities, while it has never been associated with the role of guide species in a grassland community. It is not easy, however, to provide an unequivocal syntaxonomical framework for these Apulian *Sesleria juncifolia* communities. Although their ecological features are similar to those of the other *S. juncifolia* communities of the rest of the Apennines, their floristic composition is quite different. The low average altitude of the Apulian relief and the high incidence of the Mediterranean climate result in *Stipo-Seslerietum* being characterized by higher percentages of therophytes and a lower percentages of Boreals and south-European orophytes when compared to the *Sesleria* communities occurring within the true Apennines (Tabs. 2 and 3). Furthermore *Stipo-Seslerietum* hosts several species (e.g. *Lomelosia crenata* subsp. *dallaportae, Centaurea subtilis, Genista michelii, Satureja cuneifolia, Inula verbascifolia, Aubrieta columnae* subsp. *italica* etc.) which exhibit an Italian distribution more or less restricted to the Apulian region. These chorological features are due to the past and present geographical isolation of the Gargano and Murge ranges. The phytosociological literature reports that the majority of the Italian primary and secondary *Sesleria juncifolia* s.l. associations have been described for the montane and subalpine belts of the Apennines and are to be included in the *Seslerion apenninae* alliance and in the *Elyno-Seslerietea* class (BRUNO and FURNARI 1966; BIONDI et al. 1988; PETRICCIONE and PERSIA 1995; BIONDI et al. 1999, 2004; BLASI et al. 2003, 2005). The *Jurineo mollis--Seslerietum calabricae* of the Pollino-Orsomarso massif (DI PIETRO 2010) and *Seslerio--Stipetum appenninicolae* of the Sibillini mountains (CATORCI et al. 2007) have alone been included in the *Cytiso-Bromion erecti* alliance (ex *Phleo ambigui-Bromion erecti*) and in *Festuco-Brometea* class. The complete lack of the subalpine endemic and southeastern European orophitic components does not allow *Seslerion apenninae* to be used as a good reference for the Apulian *Stipo-Seslerietum*. The strong occurrence of the steno-Mediterranean therophytic component mixed with a significant percentage of amphi-Adriatic hemycryptophytic and chamaephytic components suggests that other syntaxonomical references could be hypothesised (e.g.*Cytiso-Bromion erecti* and *Hippocrepido-Stipion austroitalicae*,

Tab. 3. Life form spectrum of the *Sesleria juncifolia* s.l. associations included in the synoptic table.

	Leont-Sesl	Scab-Sesl.	Sesl. apenninae	Sesl-Dryadetum	Anth-Sesl. cal.	Carici hum.-Sesl.	Carici macr.-Sesl.	Sesl.-Stipetum	Jurineo-Sesl. cal.	Sesl.-Drabetum	Genisto-Sesl. jun	Sesl-Caricetum hum	Sesl. juncif.	Sesl. kalnik.	Salvio-Sesl.	Genisto-Sesl. kaln	Stipo aus-Sesl.	Bro-Sesl. interr.
CH	28.4	27.0	28.9	37.8	37.6	27.5	22.1	26.0	30.7	34.6	30.9	28.7	17.1	18.1	30.9	20.6	25.5	31.2
G	1.9	3.4	6.3	3.3	0.8	6.6	7.2	6.0	5.5	.	13.8	5.5	5.5	10.2	10.0	6.1	4.2	4.2
H	67.7	61.8	60.6	54.4	55.6	62.9	63.5	63.7	52.1	65.4	53.2	61.6	76.8	70.6	57.3	64.1	41.5	61.8
PH	0.6	1.7	1.4	.	2.3	.	0.6	.	9.2	.	2.1	3.7	.	.	.	8.1	3.2	1.4
T	1.3	6.2	2.8	4.4	3.8	3.0	6.6	4.2	2.5	.	.	0.6	0.6	1.1	1.8	1.0	25.6	1.4

which are typical alliances of the lower altitudinal belts). The possible choice of *Cytiso--Bromion* (endemic alliance of the central and southern Italy) would be supported by the presence of the two Apennine endemics *Sideritis italica* and *Crepis lacera* and by a group of southeastern-European species (*Centaurea deusta, Onobrychis alba* subsp. *alba* and *Cytisus spinescens*), which various authors considered in the role of differentials for this alliance in their syntaxonomical synthesis. These same species, however, are frequently found also in the communities of the alliance *Hippocrepido-Stipion austroitalicae*, this latter including the steppe-like vegetation of the easternmost side of the Italian Peninsula (Apulia, eastern Basilicata and eastern Molise regions). *Hippocrepido-Stipion* is represented in *Stipo-Seslerietum* by the majority of its characteristic component (*Stipa austroitalica*, *Thymus spinulosus, Hippocrepis glauca,* and *Scorzonera villosa* subsp. *columnae*). For this reason we have preferred to include *Stipo-Seslerietum* in the alliance *Hippocrepido-Stipion austroitalicae* rather than in *Cytiso-Bromion*. At a higher syntaxonomical rank, the choice of *Hippocrepido-Stipion* would result in *Stipo-Seslerietum* being included in the order *Scorzonero-Chrysopogonetalia* the presence of which in the Italian peninsula was known for the karst territories of NE Italy (Feoli-Chiapella and Poldini 1993) and has been subsequently recorded for the Apulia and Molise regions in southern Italy (Fanelli et al. 2001, Forte et al. 2005, Di Pietro and Wagensommer 2008, Terzi et al. 2010). Precisely in the sub-Mediterranean zones of Friuli Venezia-Giulia Karst, Poldini (1980) described the association *Genisto sericeae-Seslerietum juncifoliae* which exhibits ecological and structural features very similar to those of the Apulian *Stipo-Seslerietum*. Both communities are developed at relatively low altitudes, where there is a greater influence of the Mediterranean climate, and are characterized by a group of species which behave as geographical vicariants (*Genista michelii / G. sylvestris*, *Satureja montana / S. variegata; Satureja cuneifolia / S. subspicata; Athamanta sicula / A. turbith; Centaurea subtilis / C. rupestris; Stipa austroitalica / S. eriocaulis*). Dry grasslands dominated by the *Stipa-Sesleria* taxa association are not a novelty for the Italian Peninsula since they are known also for the central Apennines (montane belt of the Sibillini mountains in Marches region) with the community *Seslerio juncifoliae--Stipetum appenninicolae* (Catorci et al. 2007). Notwithstanding their physiognomical similarities, the Apulian *Stipo-Seslerietum* and the Marches *Seslerio-Stipetum* are easily distinguishable from a floristic point of view due to the presence of a significantly higher Mediterranean component in the Apulian association (Tab. 2). The cluster analysis of the synoptic table (Fig. 8) including most of the *Sesleria juncifolia* s.l. associations described for both sides of the Adriatic Sea (Fig. 1c) reports the geographical location of these associations) – shows that *Stipo austroitalicae-Seslerietum* is clearly separated from the *Sesleria juncifolia* s.l. associations described for the subalpine and upper montane belts of the Italian Peninsula (*Seslerion apenninae*; cluster A) whereas it is included in the cluster which encompasses the central and southern Apennine *Sesleria juncifolia* associations belonging to the *Festuco-Brometea* class (cluster B). The thermophilous *Sesleria juncifolia* associations described for the western Balkans form a clearly-distinguishable eastern-Adriatic sub--cluster (B1b) in the *Festuco-Brometea* cluster, except for *Salvio-Seslerietum juncifoliae* of coastal Croatia which segregates together with *Stipo-Seslerietum* in the dendrogram. This amphi-Adriatic link between *Stipo-Seslerietum* and *Salvio-Seslerietum*, which could suggest a possible inclusion of *Stipo-Seslerietum* in *Scorzonero-Chrysopogonetalia*, is only due to the sharing of a group of thermophilous species (*Cephalaria leucantha, Teucrium capitatum*, *Convolvulus elegantissimum,, Brachypodium retusum, Helichrysum italicum* etc.) that do not occur in the *Sesleria juncifolia* communities of the high altitude zones. By

contrast, there are some other typical amphi-Adriatic species which can be expected on both the sides of the Adriatic Sea (e.g. *Helianthemum oelandicum* subsp. *incanum*, *Festuca circummediterranea, Onosma echioides, Jurinea mollis,* etc.) which curiously occur only in the Italian *Sesleria juncifolia* grasslands tables. The only taxon which testifies to an amphi-Adriatic connection between *Stipo-Seslerietum* and *Salvio-Seslerietum* is the chasmophitic *Inula verbascifolia,* which occurs in both these associations with the role of »companion«.

As mentioned before, one of the most distinctive characters of *Stipo-Seslerietum* is that of exhibiting a percentage of therophytes which is significantly higher than those found in the other *Sesleria juncifolia* associations (Tab. 3). The presence of a strong Mediterranean therophytic component, however, is also a diagnostic character of the alliance *Hippocrepido-Stipion austroitalicae* in comparison with other similar alliances (*Cytiso-Bromion, Satureion subspicatae, Scorzonerion villosae*), and this supports our decision to choose it as syntaxonomical reference. It is more complicated to identify a proper reference at the rank of order. *Koeleretalia splendentis* which was proposed by HORVATIĆ (1973) for separating Mediterranean from the temperate steppe-like grasslands (*Scorzoneretalia villosae*) would be suitable both in physiognomical and bioclimatic terms but it was subsequently reported to *Scorzonero-Chrysopogonetalia,* and, for a minor part, to *Cymbopogono-Brachypodietalia*. Owing to the impossibility of including *Stipo-Seslerietum* in *Cymbopogono-Brachypodietalia*, or in any other *Thero-Brachypodietea* syntaxon (as reported in figure 7) the presence of a high number of therophytes in *Stipo-Seslerietum* is not accompanied by an equally important role in terms of cover percentages), the choice necessarily falls upon *Scorzonero-Chrysopogonetalia,* although there still are many unsolved questions concerning the coenological and syntaxonomical features of this order and many doubts on the possibility that its distribution area could be extended to the southern Italy. Several of the species identified as characteristic of *Scorzonero-Chrysopogonetalia* by the various authors (e.g. HORVATIĆ 1973, 1975; HORVAT et al. 1974; FEOLI-CHIAPELLA and POLDINI 1993; REDŽIĆ 1999) such as *Potentilla zimmeteri, Leucanthemum atratum* subsp. *platylepis, Knautia illyrica, Knautia resmannii, Salvia pratensis* subsp. *saccardiana, Pseudolisymachion barrelieri* subsp. *nitens, Centaurea scabiosa* subsp. *fritschii, Scorzonera villosa* subsp. *villosa* exhibit a prevailing northern Adriatic distribution and do not occur in southern Italy. At the same time other species often associated to *Scorzonero-Chrysopogonetalia* dry grasslands (*Plantago holosteum, Polygala nicaeensis* subsp. *mediterranea, Cyanus triumfetti, Koeleria*

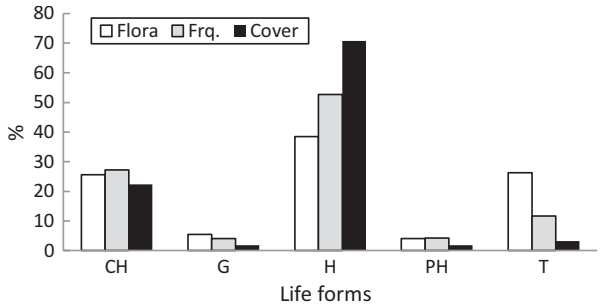

Fig. 7. Life form spectrum of *Stipo austroitalicae-Seslerietum juncifoliae* calculated on the presence (Flora), frequency (Frq.), cover of a given life form in the phytosociological table.

splendens s.l., *Eryngium amethystinum, Leontodon crispus, Thlaspi praecox, Thymus longicaulis, Sanguisorba minor* etc.) are considered characteristic of *Artemisio-Brometalia* or closely related syntaxa by other authors (ROYER 1991, BIONDI et al. 1995, MUCINA et al. 2009, DI PIETRO 2011). On the one hand the high presence of Italian endemic species (Fig. 6), most of which are endemic to the central-southern Apennine range, would clearly suggest the inclusion of *Stipo-Seslerietum* and *Hippocrepido-Stipion* in the suborder *Festuco--Seslerienalia nitidae* which has been recently proposed in the coenological range of *Artemisio-Brometalia* for central and southern Italy (DI PIETRO 2011). On the other hand the presence of several species which are endemic to the Apulian limestone platform (*Centaurea subtilis*, *Lomelosia crenata* subsp. *dallaportae*, *Aubrieta columnae* subsp. *italica*, *Genista michelii*, *Viola merxmullerii*, *Euphorbia nicaeensis* subsp. *japygica* etc.) and of several thermophilous southeastern European species advises against the use of a western and central-European order such as *Artemisio-Brometalia*.

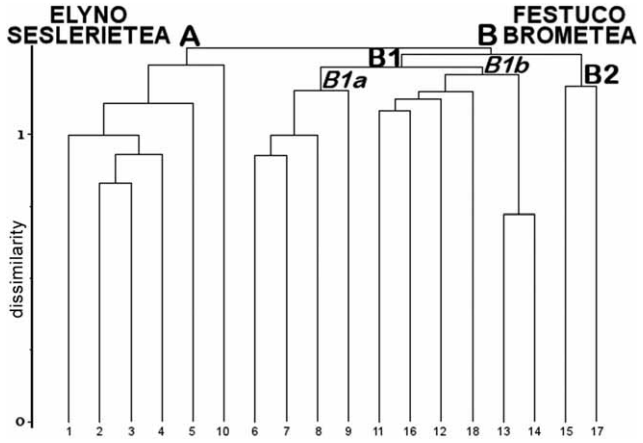

Fig. 8. Cluster analysis of the synoptic columns of the main *Sesleria juncifolia* associations occurring in the Italian and Balkan Peninsula (List of the associations in On-line supplement appendix 4). **A** – Peninsular Italy *Sesleria juncifolia* microthermic associations belonging to *Elyno-Seslerietea* class. **B1a** – »thermophilous« *Sesleria juncifolia* association of the Italian Peninsula; **B1b** – »thermophilous« *Sesleria juncifolia* associations of the Dinaric and Karst territories; **B2** – *Stipo-Seslerietum* + *Salvio-Seslerietum*.

Conclusion

The description of *Stipo austroitalicae-Seslerietum juncifoliae* is a step towards filling a gap in the phytosociological knowledge of the Apulian vegetational pattern and in defining the syntaxonomical and distributional framework of *Sesleria juncifolia* communities in Peninsular Italy. This association is unusual in peninsular Italy in being located at significantly lower altitudes than the other *Sesleria juncifolia* communities and in its Mediterranean bioclimatic context. Although several amphi-Adriatic species occur in this association the floristic similarities with the thermophilous *S. juncifolia* communities occurring in the western coastal side of the Balkan Peninsula are rather low. In syntaxonomical terms *Stipo-Seslerietum* has been included here in the southern Italy endemic alliance *Hippo-*

Tab. 4. Synoptic table of the main *Sesleria juncifolia* s.l. communities of the Italian and Balkan Peninsulas.

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
association name	Leo-S. junc	Sca-S. apenn	Sesl. apenn	Sesl-Drya	Anth-S. cal	C. hum.-S. ape	C. macr.-S. ape	Sesl-Stip app.	Jur-S. cal	Sesl-Drab	Gen-S. junc	Sesl-C. hum	Sesl. juncif.	Sesl. kalnik.	Salv-S. junc.	Gen-S. kaln	Stipo-S. junc	Bro-S. interr.
number of species per column	54	68	65	36	52	57	84	78	81	70	45	66	62	80	49	111	124	77
number of relevés per column	13	10	9	13	21	9	13	11	19	29	9	10	15	11	6	7	24	13
Seslerion apenninae																		
Avenula praetutiana	4	3	2	3	3	2	1	.	.	3	.	.	.	.	.	.	.	.
Dianthus brachycalyx	.	4	2	.	5	3	1	5	3	2	.	.	.	.	.	.	.	.
Trinia dalechampii	5	3	2	1	.	.	5	.	.	2	.	.	.	.	.	.	.	.
Pedicularis elegans (s.l.)	5	2	5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca violacea subsp. *italica*	4	3	3	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa molineri	4	.	.	.	4	.	1	2	.	.	.	.	.	.	.	.	.	.
Cerastium arvense subsp. *suffruticosum*	4	.	.	.	.	5	4	4	.	.	.	.	.	.	.	.	.	.
Carum heldreichii	.	2	1	2	.	4	.	.	.	.	.	.	.	.	.	.	.	.
Leontopodium nivale	5	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus breyninus	5	.	5	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
Arenaria bertoloni	.	2	.	.	3	.	.	.	.	4	.	.	.	.	.	.	.	.
Carduus carlinifolius	.	.	.	.	1	.	1	.	.	2	.	.	.	.	.	.	.	.
Cerastium tomentosum	.	3	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Lomelosia graminifolia	.	.	.	4	.	.	.	.	.	3	.	.	.	.	.	.	.	.
Campanula scheuchzeri subsp. *pollinensis*	.	.	.	.	4	.	.	.	1	.	.	.	.	.	.	.	.	.
Androsace vitaliana subsp. *praetutiana*	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cynoglossum magellense	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Seslerietalia tenuifoliae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sesleria juncifolia s.l. (*junc., apenn., calab., kaln.)*	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Edraianthus graminifolius subsp. *graminifolius*	5	5	4	4	5	5	2	.	1	.	.	2	.	.	.	.	.	.
Carex kitaibeliana	5	5	4	5	5	2	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis montana subsp. *jaquinii*	1	.	3	4	5	4	.	4	.	.	.	.	.	.	.	.	.	4

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Globularia meridionalis	.	3	2	4	.	3	.	1	.	5	.	.	.	.	.	.	.	.
Androsace villosa subsp. *villosa*	3	3	5	5	.	.	.	.	.	2	.	.	.	.	.	.	.	.
Anthyllis vulneraria subsp. *pulchella*	5	.	1	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Gentiana dinarica	.	4	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Paronychia kapela subsp.kapela	.	3	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.	2
Elyno-Seslerietea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Minuartia verna subsp. *verna*	4	5	4	2	4	4	.	.	.	.	.	1	.	.	.	.	.	1
Draba aizoides subsp. *azoides*	5	5	3	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.
Pulsatilla alpina subsp. *alpina*	2	3	3	1	.	.	.	.	.	1	.	1	.	.	.	.	.	.
Phyteuma orbiculare	.	3	3	1	.	.	.	.	.	.	.	2	2	1	.	.	.	.
Saxifraga paniculata subsp. paniculata	5	2	1	.	4	2	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum oelandicum subsp. *alpestre*	5	3	5	2	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Polygonum persicaria	1	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gentiana verna subsp. *verna*	2	1	2	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.
Dryas octopetala	1	3	.	5	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Thymus praecox subsp. *polytrichus*	3	.	5	.	5	.	.	.	.	.	.	4	.	.	.	.	.	.
Pedicularis comosa	.	2	.	.	4	3	2	.	.	.	.	.	.	.	.	.	.	.
Linum alpinum	.	1	.	.	.	.	.	1	.	2	.	1	.	.	.	.	.	.
Silene acaulis s. l.	4	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juncus monanthos	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aster alpinus	5	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Anthyllis montana subsp. *montana*	.	3	.	.	.	.	.	.	.	3	.	4	.	.	.	.	.	.
Festuca laevigata subsp. *laevigata*	.	.	.	.	.	1	.	3	.	3	.	.	.	.	.	.	.	.
Astragalus depressus	.	.	.	.	.	.	1	.	1	1	.	.	.	.	.	.	.	.
Erigeron epiroticus	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oxytropis campestris subsp. *campestris*	5	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla crantzii subsp. *crantzii*	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Elyna myosuroides	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium anisophyllum	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.	1
Gentianella crispata	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Festuca laevigata subsp. *crassifolia*	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga oppositifolia subsp. speciosa	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anemone narcissiflora ssp. *narcissiflora*	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oxytropis neglecta	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pedicularis verticillata	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum atratum	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex firma	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex rupestris	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium alpinum	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Draba aspera	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.
Antennaria dioica	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Allium lusitanicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Cytiso-Bromion erecti, Festuco-Seslerienalia nitidae																		
Carex macrolepis	.	.	.	2	.	5	4	2	5	1	.	.	.	.	.	.	.	.
Brachypodium genuense	.	2	.	2	1	.	2	.	.	1	.	.	.	.	.	.	.	.
Festuca circummediterranea	.	.	.	.	.	.	1	2	1	1	.	.	.	.	.	.	3	.
Centaurea ambigua	.	.	.	.	.	1	2	4	.	1	.	.	.	.	.	.	.	.
Erysimum pseudorhaeticum	.	.	.	.	.	2	3	5	.	2	.	.	.	.	.	.	.	.
Crepis lacera	.	.	.	.	.	.	1	4	1	.	.	.	.	.	.	.	1	.
Linum austriacum subsp. *tommasinii*	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.
Laserpitium siler subsp. *siculum*	.	.	.	.	.	5	2	.	3	.	.	.	.	.	.	.	.	.
Scabiosa holosericea	.	.	.	.	2	.	.	.	.	3	.	.	.	.	.	.	.	.
Stipa dasyvaginata subsp. *appenninicola*	.	.	.	.	.	.	.	4	3	.	.	.	.	.	.	.	.	.
Leontodon cichoraceus	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.
Onobrychis alba subsp. *alba*	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	2	.
Orchis pauciflora	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.
Centaurea deusta	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	2	.
Cytisus spinescens	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	2	.
Ornithogalum gussonei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	2
Asperula calabra	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.
Onobrychis alba subsp. *pentelica*	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Sesleria nitida	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhinantus wettsteinii	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Festuca inops	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.
Potentilla rigoana	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Cachrys ferulacea	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Leontodon rosani	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Phleum hirsutum subsp. *ambiguum*	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.
Euphorbia barrelieri	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.
Cerastium scaranii	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
Crepis rubra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Elaeoselinum asclepium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Sideritis italica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
Satureion subspicatae / Scorzonerion villosae																		.
Oreoselinum nigrum	.	.	.	.	.	.	.	.	1	.	.	.	5	5	.	2	.	.
Satureja montana subsp. *variegata*	.	.	.	.	.	.	.	.	.	.	3	5	.	.	1	3	.	1
Veronica jacquinii	.	.	.	.	.	.	.	.	.	.	.	1	2	4	2	.	.	.
Festuca stricta subsp. *sulcata*	.	.	.	.	.	.	.	1	.	.	.	.	1	1	.	.	.	.
Potentilla zimmeteri	.	.	.	.	.	.	.	.	.	.	1	1	.	.	2	.	.	.
Genista sericea	.	.	.	.	.	.	.	.	.	.	5	2	.	.	.	4	.	1
Globularia cordifolia	.	.	.	.	.	.	.	.	.	.	1	5	.	.	.	3	.	5
Veronica barrelierii	.	.	.	.	.	.	.	.	.	.	1	3	.	.	.	4	.	1
Inula ensifolia	.	.	.	.	.	.	.	.	.	.	3	5	.	.	.	.	.	1
Genista sylvestris	.	.	.	.	.	.	.	.	.	.	3	.	.	.	3	.	.	.
Stipa eriocaulis s.l.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	3	.	.	1
Iris pallida subsp. *illyrica*	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.
Satureja subspicata subsp. *liburnica*	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	3	.	4
Seseli elatum subsp. *gouanii*	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	3	.	.
Lilium carniolicum	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.
Bupthalmum salicifolium	.	.	.	.	.	.	.	.	.	.	.	.	5	5	.	.	.	.
Cirsium pannonicum	.	.	.	.	.	.	.	.	.	.	.	.	2	3	.	.	.	.
Euphorbia brittingeri	.	.	.	.	.	.	.	.	.	.	.	.	4	4	.	.	.	.

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Leontodon incanus	.	.	.	.	.	.	.	.	.	.	.	.	5	5	.	.	.	.
Polygala comosa	.	.	.	.	.	.	.	.	.	.	.	.	4	2	.	.	.	.
Dianthus sylvestris subsp. *tergestinus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	1
Potentilla australis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2
Potentilla tommasiniana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	2
Medicago prostrata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2
Lomelosia crenata subsp. *crenata*	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.
Hypochaeris maculata	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.
Dianthus giganteum	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
Centaurea cristata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Sideritis syriaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Tanacetum cinerarifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.
Centaurea pannonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Centaurea tommasinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Edrajanthus tenuifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Euphorbia fragifera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Euphrasia illyrica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Genista dalmatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Leucanthemum liburnicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Onosma javorkae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Seseli montanum subsp. *tommasinii*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Hippocrepido-Stipion austroitalicae																		.
Convolvulus elegantissimus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	2	.
Carduus micropterus subsp. *perspinosus*	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Alyssum diffusum subsp. *garganicum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Centaurea subtilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Crepis apula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Cytisus decumbens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Dianthus tarentinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
Euphorbia nicaeensis subsp. *japigica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Genista michelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Hippocrepis glauca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
Leontodon apulus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.
Satureja cuneifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Scabiosa taygetea subsp. *garganica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Scorzonera villosa subsp. *columnae*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Stipa austroitalica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.
Thymus spinulosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Viola merxmuelleri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Artemisio-Brometalia + Scorzonero-Chrysopogonetalia																		
Teucrium montanum	.	2	.	2	.	4	2	3	5	1	2	4	.	2	1	4	2	5
Teucrium chamaedrys	.	.	.	.	.	3	3	4	2	.	.	1	3	4	1	2	1	.
Carex humilis	4	.	.	2	.	5	.	5	.	.	4	5	5	4	.	4	.	4
Helianthemum oelandicum subsp. *incanum*	.	3	2	4	5	5	5	5	5	.	.	.	.	.	.	.	2	.
Stachys recta s.l.	.	.	.	.	.	.	1	.	2	1	1	1	2	4	.	4	1	.
Hippocrepis comosa	.	2	.	.	.	2	1	.	1	1	.	1	2	.	.	1	.	1
Galium lucidum	.	.	1	.	.	4	5	.	.	2	2	4	.	3	.	5	.	.
Asperula cynanchica	.	4	3	.	.	5	4	3	.	.	.	.	4	4	.	.	.	.
Koeleria splendens aggr.	.	3	.	.	1	4	5	5	2	.	.	.	.	.	.	.	3	4
Cyanus triumfetti	.	.	1	.	.	2	5	2	.	.	.	5	4	.	.	5	.	.
Anthyllis vulneraria ssp. *weldeniana*	.	.	.	2	.	4	4	.	.	.	.	.	4	2	1	3	.	3
Biscutella laevigata	.	3	2	.	1	.	.	.	1	.	.	1	1	.	.	.	.	.
Dianthus sylvestris subsp. *sylvestris*	.	.	.	.	.	.	5	.	.	2	3	1	.	1	1	.	.	.
Carex caryophyllea	.	.	2	.	.	.	.	.	.	.	.	1	1	.	1	.	1	.
Eryngium amethystinum	.	.	.	.	.	.	3	5	1	.	1	.	.	.	.	.	1	4
Muscari neglectum	.	.	.	.	.	.	2	3	1	.	.	.	.	.	5	.	2	.
Thalictrum minus	.	.	.	.	.	.	.	.	.	.	1	4	3	2	.	2	.	.
Anthyllis vulneraria ssp. *rubriflora*	.	.	.	.	5	.	.	5	3	.	.	.	.	.	.	.	4	.
Allium sphaerocephalon	.	.	.	.	.	2	4	4	.	.	.	.	.	.	.	.	1	.
Trinia glauca s.l.	.	.	.	.	.	4	.	5	.	.	1	5	.	.	.	.	.	.
Asperula purpurea	.	.	.	.	.	.	3	5	.	.	1	.	.	.	.	1	.	2
Plantago holosteum	.	.	.	.	.	.	.	4	1	.	1	.	.	.	.	.	2	5

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Galium corrudifolium	.	.	.	.	.	.	.	4	3	.	.	.	.	.	4	.	5	3
Artemisia alba	.	.	.	.	.	.	.	2	.	.	2	.	.	.	.	5	1	.
Anthericum ramosum	.	.	.	.	.	.	.	.	.	.	4	3	5	5	.	.	.	.
Silene saxifraga	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	2	.	.
Coronilla vaginalis	.	2	.	.	.	.	.	.	.	2	.	4	.	.	.	.	.	.
Leontodon crispus subsp. *crispus*	.	.	.	.	1	.	3	.	3	.	.	.	.	.	.	.	.	2
Knautia purpurea	.	.	.	.	.	2	4	5	.	.	.	.	.	.	.	.	.	.
Polygala major	.	.	.	.	.	3	1	.	1	.	.	.	.	.	.	.	.	.
Thesium linophyllon	.	.	.	.	.	2	.	.	4	.	.	.	4	.	.	.	.	.
Petrorhagia saxifraga	.	.	.	.	.	.	1	2	4	.	.	.	.	.	.	.	.	.
Potentilla incana	.	.	.	.	.	.	2	3	.	.	2	.	.	.	.	.	.	.
Helianthemum apenninum	.	.	.	.	.	.	2	4	.	.	.	.	.	.	.	.	3	.
Globularia bisnagarica	.	.	.	.	.	.	1	.	.	.	.	.	4	4	.	.	.	.
Thesium humifusum	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	2	2
Fumana procumbens	.	.	.	.	.	.	.	.	1	.	2	.	.	.	1	.	.	3
Asperula aristata	.	.	.	.	.	.	.	.	5	.	.	5	.	.	.	.	1	2
Aethionema saxatile	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	1	.
Laserpitium siler subsp. *siler*	.	.	.	.	.	.	.	.	.	.	.	.	5	5	.	4	.	.
Thlaspi praecox	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	1	1
Carlina acaulis subsp. *caulescens*	.	3	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Allium flavum	.	.	.	.	1	.	.	.	3	.	.	.	.	.	.	.	.	.
Thymus striatus	.	.	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	1
Euphrasia stricta	.	.	.	.	.	2	.	.	.	.	.	.	.	1	.	.	.	.
Aira caryophyllea	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.
Bunium bulbocastanum	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	1
Silene otites	.	.	.	.	.	.	1	5	.	.	.	.	.	.	.	.	.	.
Arabis collina	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	1	.
Centaurea rupestris	.	.	.	.	.	.	.	5	.	.	3	.	.	.	.	.	.	2
Inula hirta	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.
Inula montana	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	1	.
Echinops ritro s.l.	.	.	.	.	.	.	.	.	5	.	1	.	.	.	.	.	.	2

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Jurinea mollis	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	1	.
Scabiosa columbaria	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	1	.
Leucanthemum heterophyllum	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.
Pimpinella tragium	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	4	.
Centaurea jacea	.	.	.	.	.	.	.	.	.	.	.	3	.	1	.	.	.	.
Cephalaria leucantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	1	.
Euphorbia spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	2	1
Polygala nicaeensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	1	2
Astragalus monspessulanus	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	1
Anthericum liliago	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	1
Knautia illyrica	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	1
Plantago argentea	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
Koeleria cristata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Seseli montanum subsp. *montanum*	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum diffusum subsp. *calabricum*	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Alyssum diffusum subsp. *diffusum*	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.
Petrorhagia prolifera	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Alyssum campestre	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
Convolvulus cantabrica	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Ranunculus millefoliatus	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Linum tenuifolium	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Ononis pusilla	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Astragalus sempervirens	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Euphorbia nicaeensis	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Potentilla hirta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Carduus nutans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Carex liparocarpos	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Euphorbia myrsinites	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Orchis antropophora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Ranunculus illyricus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Ruta graveolens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Festuco-Brometea																		.
Bromus erectus	.	3	.	.	3	5	4	5	3	1	2	5	3	4	5	5	3	5
Lotus corniculatus	.	.	.	.	.	2	1	.	.	1	1	4	4	2	.	2	.	2
Gymnadenia conopsea	.	.	.	.	.	5	2	.	1	.	.	2	1	1	.	1	.	.
Thymus longicaulis	.	.	.	.	.	3	4	.	2	.	1	.	4	.	2	.	.	1
Brachypodium rupestre	.	.	.	.	.	4	.	1	2	.	.	.	1	1	.	.	1	.
Helianthemum nummularium subsp. *obscurum*	.	.	.	.	.	.	.	2	1	.	.	4	4	5	.	2	.	.
Euphrasia salisburgensis	2	4	2	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Hieracium pilosella	1	.	.	.	.	2	2	.	.	.	.	1	.	.	.	.	1	.
Linum catharticum	.	3	.	2	.	1	.	.	.	.	.	.	1	1	.	.	.	.
Leontodon hispidus ssp. *hispidus*	.	2	.	2	.	.	.	2	1	.	.	1	.	.	.	.	.	1
Sanguisorba minor s.l.	.	.	.	.	.	.	3	.	.	.	2	.	1	.	.	4	1	2
Thymus pulegioides s.l.	.	.	.	.	.	.	.	3	.	3	.	.	.	5	.	3	.	.
Dorycnium penthaphyllum subsp. *germanicum*	.	.	.	.	.	.	.	.	.	.	2	1	2	.	.	2	.	1
Minuartia verna subsp.collina	.	.	1	.	.	.	4	3	.	.	.	.	.	.	.	.	.	.
Campanula glomerata	.	.	.	.	.	.	.	1	.	.	.	2	.	2	.	.	.	.
Pimpinella saxifraga	.	.	.	.	.	.	.	.	.	1	.	3	.	.	.	1	.	.
Koeleria pyramidata	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	2	.	.
Plantago media	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	2	.	.
Festuca rubra	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	.	.
Dactylorhiza sambucina	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.
Anthoxantum odoratum	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.
Scorzonera austriaca	.	.	.	.	.	.	.	3	.	.	3	.	.	.	.	.	.	.
Carlina acaulis subsp. *acaulis*	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.
Filipendula vulgaris	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	1
Festuca valesiaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	1
Centaurea scabiosa	.	.	.	.	.	.	.	.	.	.	.	.	3	3	.	.	.	.
Galium verum	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.
Leucanthemum vulgare	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.
Potentilla recta	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.
Prunella vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Ranunculus bulbosus	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.
Salvia pratensis	.	.	.	.	.	.	.	.	.	.	.	.	4	3	.	.	.	.
Briza media	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.
Festuca rupicola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	3
Orchis mascula	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus carthusianorum	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Narcissus poeticus	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Orchis morio	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Carex flacca	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Dactylis glomerata	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Knautia arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Prunella laciniata	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Orchis provincialis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Dianthus monspessulanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.
Lathyrus pratensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Phleum hirsutum subsp. *hirsutum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.
Trifolium montanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Trifolium pratense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Bromus hordeaceous	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Ononis spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Onobrichis montana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Cisto-Micromerietea + Rosmarinetea																		.
Cytisus hirsutus subsp. *polytrichus*	.	.	.	.	.	.	1	3	2	.	.	.	4	.	.	2	.	.
Genista januensis	.	.	.	.	.	.	.	1	.	.	.	.	5	2	.	.	.	2
Satureja montana subsp. *montana*	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	2	.
Genista radiata	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.
Onosma echioides ssp. *echioides*	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	1	.
Helichrysum italicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.
Teucrium capitatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.
Emerus major subsp. *emeroides*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2	.
Cotoneaster tomentosum	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Matthiola fruticulosa subsp. *fruticulosa*	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
Salvia officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.
Cistus creticus subsp. *eriocephalus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Cistus salvifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Fumana ericifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Fumana thymifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Micromeria graeca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Onosma echioides subsp. *angustifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Rhamnus saxatilis subsp. *infectoria*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
Tuberarietea guttatae																		.
Bupleurum baldense	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.
Crepis sancta	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.
Bombycilaena erecta	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.
Crupina vulgaris	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Asterolinon linum-stellatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Briza maxima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Bromus madritensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Catapodium rigidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Crupina crupinastrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Cynosurus echinatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Euphorbia exigua	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Hypochoeris achyrophorus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Linum strictum subsp. strictum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Ononis ornitopodioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Trachynia distachya	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Urospermum dalechampii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Vulpia ciliata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Xeranthemum inapertum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
chasmophytic species																		.
Sempervivum tectorum	.	.	.	.	4	4	1	5	.	.	3	.	.	.	.	4	.	.
Sedum album	.	.	.	.	2	2	2	1	.	.	.	.	.	1	.	3	.	.

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Saxifraga caesia	.	4	1	2	.	.	.	.	.	2	.	.	.	.	.	.	.	.
Sedum rupestre	.	.	.	.	.	3	2	5	1	.	.	.	.	.	.	.	.	.
Sedum ochroleucum	.	.	.	.	3	.	.	.	.	.	.	.	.	.	5	.	2	.
Potentilla apennina	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sedum dasyphyllum	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1	1
Athamanta turbith	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	3	.	.
Inula verbascifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	1	.
Asplenium trichomanes	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.
Ceterach officinarum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.
Scabiosa silenifolia	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium paleoitalicum	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
Saxifraga callosa	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Asplenium ruta-muraria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Saxifraga crustata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.
Athamanta sicula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
Aubrieta columnae subsp. *italica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Aurinia saxatilis subsp. *megalocarpa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Hellenocarum multiflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Hieracium acanthodontoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Lomelosia crenata subsp. *dallaportae*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
other species																		.
Acinos alpinus	.	.	.	.	1	2	1	.	.	2	.	.	.	.	.	2	2	.
Poa alpina subsp. *alpina*	3	3	4	.	.	3	.	.	.	1	.	.	.	.	.	.	.	.
Tanacetum corymbosum	.	.	.	.	.	1	1	3	1	.	.	.	.	2	.	.	.	.
Silene vulgaris	.	.	.	.	.	.	.	1	.	.	.	.	1	2	3	.	1	.
Thesium parnassi	1	4	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola eugeniae subsp. *eugeniae*	1	2	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Helianthemum nummularium subsp. *grandiflorum*	1	1	.	.	2	.	.	.	.	.	.	.	.	.	2	.	.	.
Juniperus communis subsp. *nana*	.	3	2	.	1	.	.	.	1	.	.	.	.	.	.	.	.	1
Bupleurum falcatum subsp. *cernuum*	.	.	.	.	1	.	.	.	2	.	.	1	.	.	.	5	.	.
Valeriana tuberosa	.	.	.	.	.	.	1	2	.	.	.	.	.	.	2	.	1	.

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Aster bellidiastrum	.	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus thora	.	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arctostaphylos uva-ursi	.	1	1	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.
Cuscuta epithymum	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	1	.
Thymus glabrescens subsp. *decipiens*	.	.	.	.	.	2	2	3	.	.	.	.	.	.	.	.	.	.
Cerastium pumilum	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	1	.
Senecio doronicum	.	.	.	.	.	.	2	.	.	1	.	2	.	.	.	.	.	.
Galium album	.	.	.	.	.	.	1	.	.	.	.	.	1	.	1	.	.	.
Sorbus aria	.	.	.	.	.	.	.	.	3	.	.	1	.	.	.	1	.	.
Inula salicina	.	.	.	.	.	.	.	.	.	.	.	5	2	3	.	.	.	.
Euphorbia cyparissias	.	.	.	.	.	.	.	.	.	.	.	.	3	4	.	4	.	1
Geranium sanguineum	.	.	.	.	.	.	.	.	.	.	.	.	4	3	.	2	.	.
Laserpitium latifolius	.	.	.	.	.	.	.	.	.	.	.	.	3	2	.	1	.	.
Hypericum perforatum	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	1	.
Gentianella columnae	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygala alpestris	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Armeria canescens subsp. *canescens*	3	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
Astrantia pauciflora subsp. *tenorei*	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum capitatum ssp. *serrulatum*	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Primula auricola subsp. *ciliata*	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Carex mucronata	.	.	.	4	.	.	.	.	.	3	.	.	.	.	.	.	.	.
Euphrasia italica	.	.	.	.	3	.	.	.	2	.	.	.	.	.	.	.	.	.
Pinus leucodermis	.	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.
Sedum hispanicum	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.
Arenaria serpyllifolia	.	.	.	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.
Seseli libanotis	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	5	.	.
Ornithogalum comosum	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.
Plantago lanceolata subsp. *sphaerocephala*	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.
Amelanchier ovalis subsp. *cretica*	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	1
Fagus sylvatica	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.
Carlina corymbosa	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	2

Tab. 4. – continued

relevée nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Centaurium erythraea	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2	.
Genista tinctoria	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.
Quercus ilex	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.
Anthyllis vulneraria ssp. *polyphylla*	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.
Erica carnea	.	.	.	.	.	.	.	.	.	1	.	.	.	5	.	.	.	.
Helianthemum oelandicum subsp. *italicum*	.	.	.	.	.	.	.	.	.	4	.	.	.	.	1	.	.	.
Cyclamen purpurascens	.	.	.	.	.	.	.	.	.	.	2	.	.	1	.	.	.	.
Frangula rupestris	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.
Ruta divaricata	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	4	.	.
Stachys officinalis	.	.	.	.	.	.	.	.	.	.	.	3	.	1	.	.	.	.
Vincetoxicum hirundinaria	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.	.	.
Juniperus communis	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	2	.	.
Verbascum chaixii	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	2	.	.
Cirsium acaule	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2
Clematis recta	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.
Daphne cneorum	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.
Hieracium bauhini	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.
Primula vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.
Polygonatum odoratum	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2	.	.
Allium carinatum	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	5	.	.
Fragaria vesca	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.
Mercurialis ovata	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	1	.	.
Trifolium rubens	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.
Brachypodium retusum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	1	.
Carex halleriana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Crepis chondrilloides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Poa bulbosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Podospermum roseum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Klasea radiata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

crepido-Stipion austroitalicae but its placing at higher syntaxonomical ranks remains uncertain. The lack of any pan-European synthesis on this topic makes the inclusion of *Stipo--Seslerietum* in *Scorzonero-Chrysopogonetalia* nothing but provisional. The general revision of south-European dry grasslands is currently in progress will certainly provide new elements for the solution of this syntaxonomical and biogeographical issue.

Syntaxonomical scheme

FESTUCO-BROMETEA Br.-Bl. et Tüxen ex Br.-Bl. 1949
Scorzonero villosae-Chrysopogonetalia grylli Horvatić et Horvat in Horvatić 1963 (prov.)
Festuco circummediterraneae-Seslerienalia nitidae Di Pietro 2011
Hippocrepido glaucae-Stipion austroitalicae Forte et Terzi in Forte, Perrino et Terzi 2005
Stipo austroitaliacae-Seslerietum juncifoliae Di Pietro et Wagensommer ass. nov.
Stipo austroitaliacae-Seslerietum juncifoliae typicum subass. nov.
Stipo austroitaliacae-Seslerietum juncifoliae helianthemetosum apennini subass. nov.
Stipo austroitaliacae-Seslerietum juncifoliae seslerietosum autumnalis subass. nov.

Syntaxa quoted in the text are listed in the Online supplement appendix 5.

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