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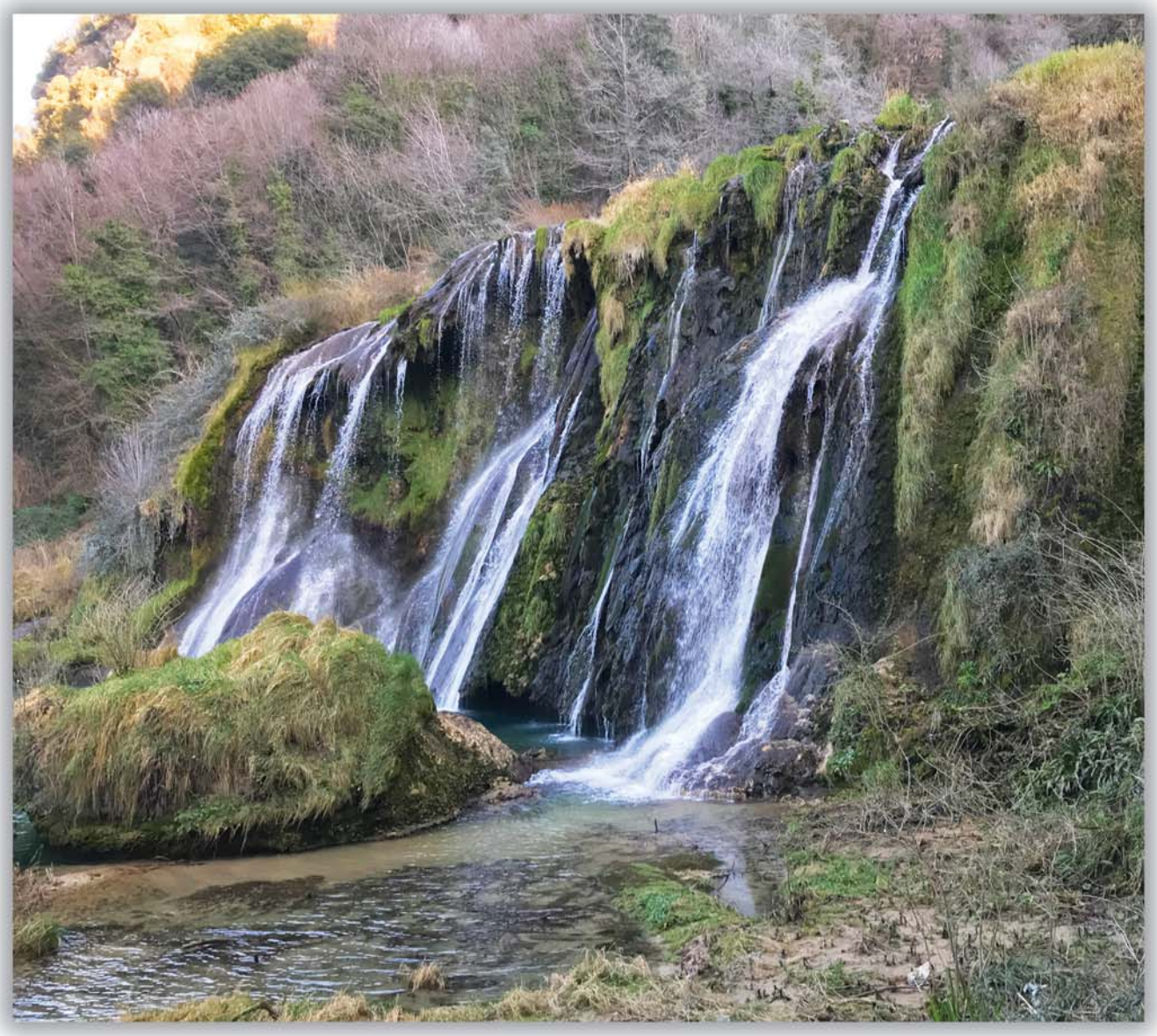

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A phytosociological analysis of the *Brachypodium rupestre* (Host) Roem. & Schult. communities of Sicily

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Abstract
A phytosociological study on the *Brachypodium rupestre* grasslands in Sicily is presented. These grasslands form discontinuous secondary stands dynamically linked to the deciduous oak woods, which are widespread within the upper-colline, submontane and lower montane belts (800-1400 m) of the Tyrrhenian side of the northern Sicily and in the Sicani mountains. In the study area *B. rupestre* grasslands were mainly found in colluvial plains or drainage lines where relatively deep and mesic soils occur. In this paper 42 phytosociological relevés were performed and statistically analysed. Two new associations were described and classified in the alliance *Polygalo mediterraneae-Bromion erecti* (*Brometalia erecti*, *Festuco-Brometea*): *Lolio pluriflori-Brachypodietum rupestris* and *Tanaceto siculi-Brachypodietum rupestris*. The *Lolio pluriflori-Brachypodietum* is typical of the limestone substrates of Nebrodi, Madonie and Sicani mountains and of the mounts surrounding Palermo and Trapani. Two subassociations (*typicum* and *violetosum ucrianae*) and an impoverished variant rich in therophytes have also been identified. The *Tanaceto siculi-Brachypodietum* is restricted to the metamorphic substrates of the Peloritani mountains on the north-eastern side of the island. Finally the association *Polygalo mediterraneae-Brachypodietum rupestris*, which was only provisionally described in 2014 for the Lucanian Apennines (Peninsular Italy), has been validated here.

Key words: *Festuco-Brometea*, grasslands, land abandonment, post-cultivated environments, Sicily, syntaxonomy.

Introduction

The genus *Brachypodium* (*Poaceae*) cover a wide geographical range comprising Europe, Asia, Africa and South-America. It is characterized by annual or perennial species. *Brachypodium rupestre* is a well-known Euro-Mediterranean grass which gives rise to secondary grasslands, especially in post-cultivated environments. In fact, it takes advantage of the abandonment of land-use practices such as terraced cultivations and extensive cattle grazing (Di Pietro & Blasi, 2002; Bonanomi & Allegrezza, 2004; Köhler *et al*., 2005; Catorci *et al*., 2011; Allegrezza *et al*., 2016). The *B. rupestre* communities tend to rapidly colonize and dominate the abandoned cultivations thanks to the extensive lateral clonal spreads of *B. rupestre*, the high cover degree of the aboveground phytomass, and the development of a thick upper litter layer which limits the availability of nutrients and light for the other species (Al-Mufti *et al*., 1977; Grubb *et al*., 1982; Bobbink *et al*., 1988; Wedin & Tilman, 1990; Campbell *et al*., 1992; Wedin & Pastore, 1993; Vinton & Burke, 1995; Catorci *et al*., 2011, 2014). The silica-rich and hairy leaves make this species unappetizing for the herbivorous palate, favouring its proliferation and invasiveness in the territory. In Italy *Brachypodium rupestre* acts as guide-species for several semi-natural and post-coltural grassland associations. In the Apennines *B. rupestre* is widespread throughout the whole colline, sub-montane and lower montane belts. It is substituted by the Italian endemic *B. genuense* (DC.) Roem. & Schult. in the upper montane and subalpine belts (see Pignatti, 1976; Pedrotti, 1982; Biondi *et al*., 1999; Di Pietro *et al*., 2005, 2017a) where *B. genuense* tends to form typical acidic or subacidic grasslands together with *Nardus stricta* L. and/or *Patzkea paniculata* (L.) G.H. Loos. Besides being the guide species of post-cultivated grasslands, *B. rupestre* often plays the role of high-frequency companion species in the *Bromopsis erecta* or in the *Lolium-Cynosurus-Poa* communities, especially where the substrate is characterized by a significant clay content (Lucchese, 1987; Ubaldi, 1988; Biondi, 1994; Biondi *et al*., 1995; Lucchese *et al*., 1995; Di Pietro & Blasi, 2002; Di Pietro *et al*., 2015; Allegrezza *et al*., 2016). In the central Apennines the phytosociological role of *B. rupestre* is detectable from the description of a high number of associations and subassociations (Ubaldi, 1988; Biondi *et al*., 1995; Lucchese *et al*., 1995; Di Pietro & Blasi, 2002; Foggi *et al*., 2014; Allegrezza *et al*., 2016). The majority of these associations were assigned to the *Festuco-Brometea* and a minor part to the *Trifolio-Geranietea*. Very few data are currently available on the *Brachypodium rupestre* communities of southern Italy, where the only association described at present

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is the *Polygalo mediterraneae-Brachypodietum* which was proposed (only as provisional) for the Lucanian Apennines (Di Pietro *et al*., 2014). No phytosociological data were available as regards the *B. rupestre* communities of Sicily, even if they are known to occur in the submontane and lower montane belts of the northern sector of the island (Fig. 1). In order to fill this gap a phytosociological research on the *Brachypodium rupestre* communities of Sicily was carried out. Moreover, an in-depth discussion concerning their marginal phytogeographical position and their consequent critical syntaxonomical classification at the rank of class is also provided.

Study area

The study area includes the mountains and high hills of the northern Sicily which are known as "Siculo Apennines" being these ranges in structural and geographical continuity with the Apennine backbone of the Italian Peninsula (Fig. 2). The following mountainous massifs are identifiable moving along a E-W transect: Peloritani, Nebrodi, Madonie, Palermo and Trapani mountains and, moving inland from these latters, the Sicani mountains. The Peloritani Mountains are a ring of metamorphic hills with isolated carbonated rocky outcrops and represent the southernmost sector of the Calabrian-Peloritanian Arc. On the question concerning the precise delimitation of the area of the Peloritani mountains, we refer to what was published in Sciandrello *et al*. (2015). Following a geographical criterium the Peloritani mountains extend for about 70 km along the Tyrrhenian side of Sicily from Capo Peloro, to the Nebrodi mountains (Valle del Timeto) extending south up to the Alcantara valley and the footslopes of the Etna Volcano. The highest peaks are Montagna Grande (m 1374), Pizzo di Vernà (m 1287), Monte Poverello (m 1279) and Rocca di Novara (m 1340), but the average height of the peaks are between 800 m and 1000 m, and these are intermingled with ridges, ravines and deep gorges. The Nebrodi mountains represent the central sector of the Sicilian northern belt (Appennino Siculo), that faces the Tyrrhenian Sea. They extend westwards for 80 km, up to the valley of the Pollina river and exhibits in Mount Soro (m 1847) their highest peak. The Nebrodi are geologically characterized by the prevalence of tertiary arenaceous rocks and flaky clays with isolated limestone outcrops, such as the Rocche of the Crasto (m 1315) (Giunta *et al*., 1992; Lentini *et al*., 2000). The Madonie mountains consist of rocky limestone ridges that rise in altitude to over 1900 m (Pizzo Carbonara) and are characterized by large karst and siliceous-clastics plateaus and isolated chalky and saline outcrops.

The mountains of Palermo are a limestone system of high hills typically shaped by the karst erosion (Abate *et al*., 1978, 1988), which have in the Mount Pizzuta (m 1333) their higher culmination. Inland these mountains are in contact with the isolated limestone massif of Rocca Busambra (m 1613) and with the wide limestone range of the Sicani mountains which has in Pizzo Cangialoso (m 1420), Mount delle Rose (m 1436) and Mount Cammarata (m 1578) the highest peaks. Moving towards the western coast of Sicily there are the mountains of Trapani that do not exceed 1200 m (for more detailed information see Guarino & Pasta, 2017).

From a bioclimatic point of view (umbro-thermic diagrams in Fig. 3) the *Brachypodium rupestre* grasslands are mainly widespread within the Mesomediterranean and Supramediterranean belts, with subhumid-humid umbrotype (Bazan *et al*., 2015), where the potential vegetation is composed of mesophilous evergreen and deciduous woods (Gianguzzi *et al*., 2016). According to Rivas-Martínez *et al*. (2004), the study area is comprised in the W-Mediterranean subregion, and in the Italian-Tyrrhenian province. At a lower biogeographical rank (Brullo *et al*., 1995), it is included in the Sicilian sector and in the following districts: Peloritano, Nebrodense, Madonita (eastern sub-sector) and Drepano-Panormitano (western sub-sector).

Fig. 1 - *Brachypodium rupestre* communities on the Mountains of Palermo: a) Portella S. Agata plain; b) Mount Signora.

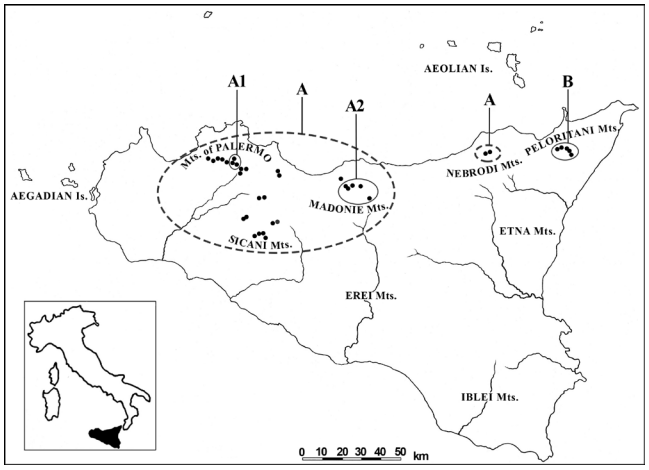

Fig. 2 - Study area.

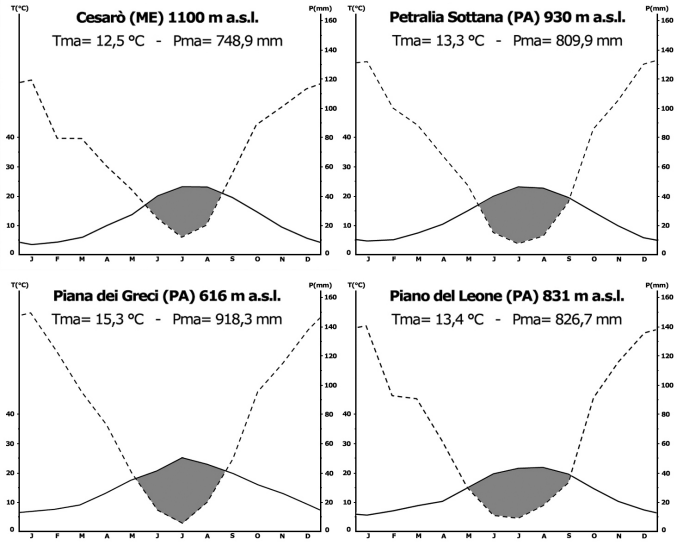

Fig. 3 - Umbrothermic diagrams of four thermopluviometric stations included in the study area.

Data and methods

The vegetation was studied following the phytosociological method of the Zurich-Montpellier school (Braun-Blanquet, 1964), as modified by Géhu & Rivas-Martínez (1981). Forty-two unpublished phytosociological relevés of *Brachypodium rupestre* communities were carried out between 2015-2017 in different localities of the study area. On the basis of the total set of phytosociological relevés a 42 relevés × 174 species matrix was obtained, in turn subjected to cluster analysis (UPGMA based on chord distance measures) and NMDS ordination, both performed using the software Syntax 2000 (Podani, 2007). In order to make a coenological comparison between the Sicilian *B. rupestre* associations and similar associations described for the Italian Peninsula, and to evaluate the role of the different classes in the new associations described in this paper, a synoptic table (Tab. 5) was arranged. This synoptic table included: a) the two original associations classified by Brullo & Grillo (1978) in the C*irsietalia vallis-demoni* (*Molinio-Arrhenatheretea*); b) the two *Brachypodium rupestre* associations originally classified by Allegrezza *et al*. (2016) in the suborder *Dorycnio-Brachypodienalia* (*Trifolio-Geranietea*); c) the synoptic columns of the Sicilian *B. rupestre* communities together with those of *Galio lucidi-Brachypodietum* of the Lazio Region and *Polygalo mediterraneae-Brachypodietum* of the Basilicata Region. The latter two associations were both originally classified in the *Festuco-Brometea* (Di Pietro & Blasi, 2002; Di Pietro *et al*., 2014) and are the only ones exhibiting a certain degree of floristic similarity with the Sicilian communities among all the *B. rupestre* associations described in Italy. The synoptic table was subjected to hierarchical clustering (UPGMA based on chord distance measures). Each species occurring in the synoptic table was assigned to a phytosociological class on the basis of the Appendix S6 provided in Mucina *et al*. (2016). This datum was used to establish how the communities included in the synoptic table were floristically related to the phytosociological classes which, on the basis of the available phytosociological literature, are those currently considered as the most appropriate for use as reference for the *B. rupestre* communities. Moreover the floristic and coenological percenteges of the classes showing the highest number of diagnostic species in the Sicilian *B. rupestre* communities (*Festuco-Brometea*, *Molinio-Arrhenatheretea*, *Poetea bulbosae*, *Lygeo-Stipetea*, *Helianthemetea guttati* + *Stipo-Trachynetea*, *Trifolio-Geranietea*, *Artemisietea* and *Chenopodietea*) were also calculated (Fig. 7).

Syntaxonomic nomenclature followed Weber *et al*. (2000). The high-rank syntaxonomic framework followed Mucina *et al*., (2016) while the nomenclature of taxa followed Bartolucci *et al*. (2018). Some species with taxonomic or identification issues were merged into species aggregates and reported as "*s.l.*" after the name of the *taxon*. The identification of the species was made through Pignatti (1982). Life forms and chorotypes follows Pignatti *et al*. (2005) and Raimondo *et al*. (2010). Both the life form and the chorological tables (Tabs. 2 and 3) were carried out considering for each species: whether or not a given chorotype or life form occurred in the phytosociological tables (Flora), their frequency (Frequency), and their cover degree (Cover) in the phytosociological table. The cover degree of a single species in each grassland community was investigated by calculating its specific cover index (I.R.S.) (Braun-Blanquet, 1964). This latter was calculated for each species occurring in a given phytosociological table summing the central value of cover percentage corresponding of each dominance-abundance Braun-Blanquet's cover index (5 = 87.5; 4= 62.5; 3= 37.5…..) and multiplying this sum for the ratio between 100 and

the number of relevés included in the phytosociological table. In order to present a synchorological scheme as close as possible to the real biogeographical situation of the study areas, the I.RS. values of *Brachypodium rupestre* (as Euro-Mediterranean element) was not considered in the chorological cover spectrum, these values being largely higher than those shown by the other species, and for this reason tending to flatten the contribution of the other chorological components.

Results

Cluster analysis and ordination of the Sicilian communities

The dendrogram resulting from the hierarchical classification (Fig. 4) highlighted two main clusters: "A" and "B", which make reference to two new associations; Cluster "A" *Lolio pluriflori-Barchypodietum rupestris* ass. nov. includes the relevés regarding the *Brachypodium rupestre* communities developed on calcareous substrates, while Cluster "B", *Tanaceto siculi-Brachypodietum rupestris*, includes the relevés of the sub-acidophilous communities developed on metamorphic substrates. Cluster "A" is divided into two main subclusters, A1 and A2, which make reference to two subassociations: *typicum* and *violetosum ucrianae*. The subassociation "*violetosum ucrianae*" is, in fact, restricted to the subcluster A2b. The two relevés of subcluster A2a are linked to those of cluster A2b, probably because of the shared occurrence of the exclusive species *Prangos ferulacea*. Cluster A1b represents an impoverished variant of the *Lolio pluriflori-Brachypodietum*. It is characterized by the exclusive occurrence of *Phleum hirsutum* subsp. *ambiguum* and by a high percentage of therophytes, due to the disturbance caused by heavy cattle grazing. Cluster B is divided into two subclusters, of which only the one labelled with B2 is composed of relevés performed on acidic metamorphic substrates, and is therefore to be classified as *Tanaceto-Brachypodietum*. In contrast, subcluster B1 includes relevés coming from the isolated limestone outcrop known as "Le Rocche del Crasto" in the Nebrodi Mountains. These relevés are characterized by high cover values of species such as *Carlina gummifera*, *Kundmannia sicula*, *Foeniculum vulgare*, *Pulicaria odora* and *Rubus ulmifolius*.

The result obtained from the cluster analysis was confirmed in the NMDS ordination diagram (Fig. 5), where the main groups expressed by the dendrogram are easily distinguishable. No direct coenological gradients, however, are identifiable along either the first, or the second axis.

Vegetation

LOLIO PLURIFLORI-BRACHYPODIETUM RUPESTRIS ass. nova *hoc loco* (*holotypus* rel. 2, Tab. 1) subass. *TYPICUM*

Table – 1, rels. 1-26.

Characteristic/ species – *Brachypodium rupestre* (dom.), *Lolium pluriflorum*, *Anemone hortensis*, *Medicago lupulina*, *Picris hieracioides*, *Thalictrum calabricum*.

Dominant species – *Brachypodium rupestre*, *Origanum vulgare* subsp. *viridulum*, *Opopanax chironium*, *Thalictrum calabricum*, *Eryngium crinitum*, *Anthoxanthum odoratum*, *Achillea ligustica*, *Carlina gummifera*.

High-frequency species – *Brachypodium rupestre*, *Dactylis glomerata*, *Eryngium campestre*, *Trifolium campestre*, *Daucus carota*, *Origanum vulgare* subsp. *viridulum*, *Galium lucidum*, *Picris hieracioides*, *Opopanax chironium*, *Anemone hortensis*, *Anthoxanthum odoratum*.

Structure and ecology – Grassland type dominated by *Brachypodium rupestre* with a close and homogeneous structure with an average cover degree of about

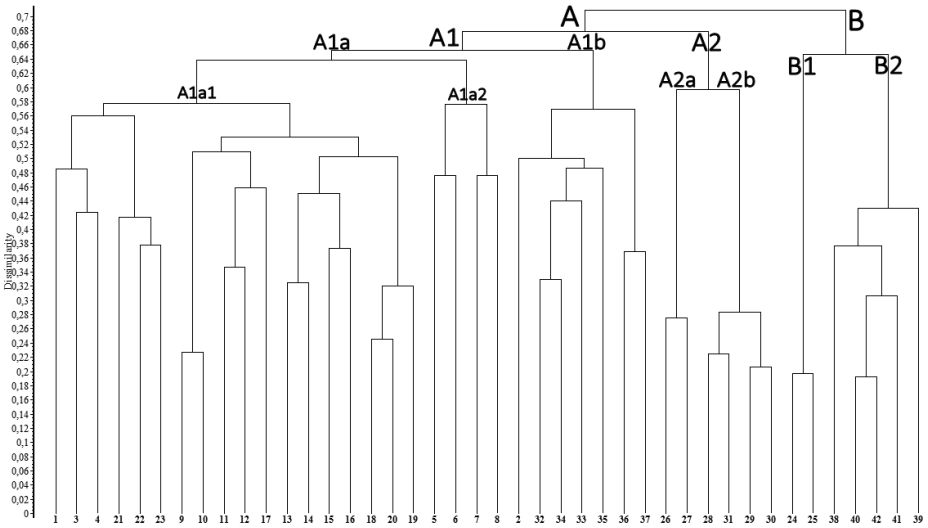

Fig. 4 - Cluster analysis of the *Brachypodium rupestre* communities of Sicily.

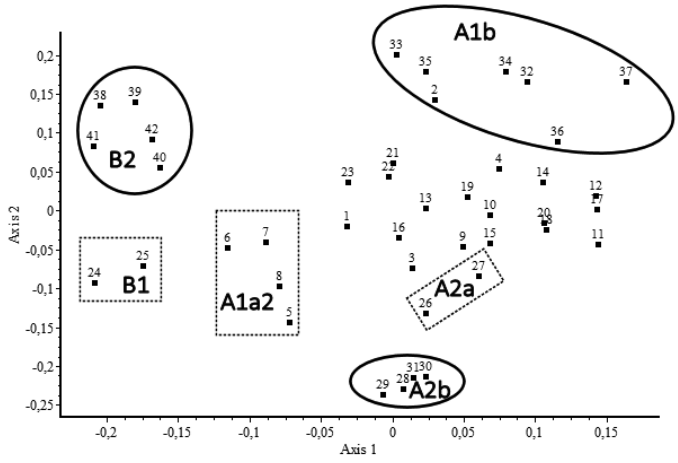

Fig. 5 - NMDS Ordination of the *Brachypodium rupestre* communities of Sicily.

100% and an average number of species per relevé of 30. The occurrence of *Eryngium campestre*, *Galium lucidum*, *Anemone hortensis*, *Trifolium ochroleucon*, *Achillea ligustica*, *Carex flacca* subsp. *erythrostachys*, *Trifolium pratense*, *Trifolium incarnatum* subsp. *molinerii*, etc. makes the Sicilian communities comparable with those of the Italian Peninsula Significant is the contribution of *Medicago lupulina*, *Ranunculus bulbosus*, *Asphodeline lutea*, *Poterium sanguisorba* subsp. *balearicum*, *Polygala preslii*, *Prangos ferulacea*, *Festuca circummediterranea*, *Centaurea parlatoris*, etc. which belong to *Festuco-Brometea*. The *Lolio pluriflori-Brachypodietum* is mainly found on relatively deep soils. This community is advantaged by the abandonment of the traditional cultivations included in the mixed agro-forestry systems, which is a common feauture in the montane landscape of Sicily. In the area of the Mountains of Palermo the *Lolio pluriflori-Brachypodietum* was found in localities that have experienced unsuccessful reforestation attempts, especially where the substrate had previously been prepared through the terracing of the slopes. At the same time this association is particularly common in areas which have been affected by fire in recent times. In terms of dynamical successions the *Lolio pluriflori-Brachypodietum* tends to occupy the ground very rapidly and, just as quickly, to leave space for shrubland communities. Only in the intensively pastured areas does *Lolio-Brachypodietum* remain for longer durations, *B. rupestre* being notoriously unappetising to livestock (see observations reported in Cavallero *et al*., 2007; Roggero *et al*., 2002).

Substrate – The *Lolio pluriflori-Brachypodietum* occurs within the drainage lines on relatively steep slopes. It can also be found on deep and well-drained limestone soils having a high clay content.

Bioclimate – Mesomediterranean and Supramediterranean thermotype; Sub-humid/humid umbrotype.

Syndinamism – It is dynamically linked to the vegetation series of the mesophilous deciduous woods *Oleo-Quercetum virgilianae*, *Sorbo torminalis-Quercetum virgilianae* and *Quercetum leptobalani* (Bazan *et al*., 2010).

Distribution – Mountains of Trapani [Monte Inici], Mountains of Palermo [Piana degli Albanesi (C.da S. Agata Franzisi, Cozzo S. Agata), Monreale (M. Signora, M. Matassaro Renda)], Rocca Busambra, Sicani Mountains [Palazzo Adriano (M.te Rose, M.te Pernice, P.lla di Gebbia), Prizzi (Serra di Pietre Cadute, P.lla dell'Olmo), Bisacquino (C.da Barracù, C.da Gibilcanna)], Mountains of Trabia [Altavilla Milicia (Pizzo Finocchiaro)], Termini Imerese [M.te S. Calogero], Madonie mountains [Gratteri (M.te Macabubbo)], Nebrodi mountains [Rocche del Crasto (Frazzanò at the Passo della Zita, and surrounding areas)].

LOLIO PLURIFLORI-BRACHYPODIETUM RUPESTRIS VIOLETOSUM UCRIANAE subass. nova *hoc loco* (*holotypus* rel. 27, Tab. 1)

Table – 1, rels. 27-30.

Differential species of subassociation – Viola ucriana, *Helleborus viridis* subsp. *bocconei*, *Clinopodium alpinum* subsp. *meridionale*, *Eryngium crinitum*, *Allium subhirsutum*.

Structure and ecology – Grassland type dominated by *Brachypodium rupestre* with a close and homogeneous structure with a average cover degree about 100% and an average number of species per relevé of 35. Four out of the five differential species are endemic of the southern Italy.

Substrate – This association is developed within the north facing slopes, on deep and well-drained soils on limestone.

Bioclimate – Mesomediterranean and Supramediterranean thermotype; humid umbrotype.

Syndinamism – It is dynamically linked to the vegetation series of the mesophilous deciduous woods.

Distribution – Montains of Palermo [Monte Pizzuta (Costa di Fratantoni, Serra del Frassino)].

LOLIO PLURIFLORI-BRACHYPODIETUM IMPOVERISHED VARIANT WITH *PHLEUM HIRSUTUM* SUBSP. *AMBIGUUM* AND THEROPHYTES

Table – 1, rels. 32-37.

Differential species of variant – Phleum hirsutum subsp. *ambiguum*, *Medicago minima*, *Medicago orbicularis*, *Cerastium glomeratum*, *Trifolium stellatum*, *Sherardia arvensis*, *Triticum neglectum*, *Trifolium leucanthum*.

Structure and ecology – Grassland type dominated by *Brachypodium rupestre* with a non-homogeneous structure and an average cover degree of about 90% and average number of species per relevé of 28. This impoverished variant of the *Lolio pluriflori-Brachypodietum* is found at altitudes ranging between 1000 m

Tab. 1 -Phytosociological table of the *Brachypodium rupestre* communities occurring in Sicily.

Relevè n.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
relevès number for statistical analysis	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2	32	33	34	35	36	37	38	39	40	41	42
Altitude (dam s.l.m.)	106	90	89	100	98	95	104	97	98	115	116	95	93	101	106	92	141	140	126	85	95	98	62	61	111	112	109	110	115	118	80	146	146	138	103	127	126	88	102	110	95	100
Slope (%)	40	40	40	35	20	15	20	30	25	45	25	40	40	50	50	35	50	20	20	10	20	15	25	30	50	40	45	45	50	50	25	25	20	20	30	25	20	10	15	10	20	15
Aspect	N	N	N	N	N	SE	W	NW	W	NE	W	SE	NW	NW	NW	SW	NE	NE	N	SW	W	NW	NE	E	NE	N	N	NW	N	N	E	NE	SE	SE	W	NW	NW	E	SE	S	SW	S
Area (m^2)	90	80	70	80	80	100	100	80	80	100	100	80	80	70	80	75	80	80	100	70	70	80	80	80	100	100	100	100	100	100	80	70	75	80	80	80	80	70	70	80	70	70
total cover (%)	100	100	100	100	100	100	100	100	100	100	100	95	100	90	100	85	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	100	100	90	100	100	100	100	100	100	100
Average heigth of the dominant grass layer (cm)	35	40	50	35	40	40	45	40	40	40	60	50	50	35	35	35	35	35	35	45	40	50	35	35	40	35	35	35	35	40	35	40	35	45	30	45	40	35	40	35	40	35
Species per relevé	42	36	20	46	50	34	33	29	27	25	20	15	17	22	23	20	42	27	31	22	22	18	33	39	37	33	35	37	35	35	35	41	30	38	32	21	21	57	18	29	27	29
Lolio pluriflori-Brachypodietum rupestris ass. nov.		Tp																									*											Tp				
Lolium pluriflorum (Schult.) Banfi, Galasso, Foggi, Kopecký & Ardenghi	1	+	+	1	.	+	+	1	1	1	.	.	.	.	.	.	.	.	.	+	+	2	.	.	1	+	1	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Origanum vulgare L. subsp. viridulum (Martrin-Donos) Nyman (local charact.)	2	2	.	.	1	1	+	+	+	.	.	1	.	1	2	.	1	+	1	.	1	.	2	2	2	2	3	3	2	2	.	1	.	.	.	.	.	.	1	1	+	1	1
Anemone hortensis L. subsp. hortensis	.	+	.	2	1	.	1	+	+	+	+	.	+	.	.	+	+	+	+	+	.	.	.	.	.	.	+	+	.	1	+	+	.	+	.	1	+	.	.	.	.	.
Medicago lupulina L.	.	+	1	1	.	.	.	+	+	+	+	.	+	.	.	1	.	.	+	.	.	.	.	.	.	1	+	.	+	.	1	1	.	+	2	.	.	.	.	.	.	.	.
Picris hieracioides L. subsp. hieracioides	1	+	+	+	+	+	2	1	.	1	1	+	+	.	.	1	.	1	.	+	+	1	1	1	1	+	1	+	+	1	+	.	.	.	.	+	+	.	.	.	.	.	.
Thalictrum calabricum Spreng.	3	3	.	.	.	2	.	.	.	.	.	1	.	1	1	.	.	.	.	.	.	.	1	1	1	1	3	2	1	3	.	.	.	.	.	.	.	.	+	1	1	+
subass. violetosum ucrianae subass. nov.																																										
Viola ucriana Erben & Raimondo	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Helleborus viridis L. subsp. bocconei (Ten.) Peruzzi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.
Clinopodium alpinum (L.) Merino subsp. meridionale (Nyman) Govaerts	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.
Eryngium crinitum C.Presl	.	+	.	.	+	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	3	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.
Allium subhirsutum L. subsp. subhirsutum	.	+	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	3	2	3	2	+	.	.	.	.	.	.	.	.	.	.	.
impoverished variant with *Phleum ambiguum* and therophytes																																									
Phleum hirsutum Honck. subsp. ambiguum (Ten.) Cif. & Giacom.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	+	2	1	+	+	+	.	.	.	.	.
Medicago minima (L.) L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	+	.	.	.	.	.
Medicago orbicularis (L.) Bartal.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	+	1	.	+	.	.	.	.
Cerastium glomeratum Thuill.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	+	.	.	.	.	.
Trifolium stellatum L.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	1	.	.	+	.	.	.	.	.
Sherardia arvensis L.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	+	+	.	.	.	.
Triticum neglectum (Req. ex Bertol.) Greuter	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	+	.	.	.	.
Trifolium leucanthum M.Bieb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	+	.	.	.	.	.	.	.	.
Tanaceto siculi-Brachypodietum rupestris ass. nov.																																									
Tanacetum vulgare L. subsp. siculum (Guss.) Raimondo & Spadaro	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	+	+	1	1
Teucrium siculum (Raf.) Guss. subsp. siculum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	2	1
Micromeria graeca (L.) Benth. ex Rchb. subsp. consentina (Ten.) Guinea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	1	+
Carlina hispanica Lam. subsp. globosa (Arcang.) Meusel & Kästner	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	+	.	+
Thymus longicaulis C.Presl subsp. longicaulis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	+	1
Polygalo mediterraneae-Bromion erecti																																									
Brachypodium rupestre (Host) Roem. & Schult.	5	5	4	5	5	5	5	5	5	5	5	5	5	4	4	4	5	4	5	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	4	5	4	5	5	5	5	5
Helianthemum nummularium (L.) Mill. subsp. obscurum (Čelak.) Holub	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	.	+
Blackstonia perfoliata (L.) Huds.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium ochroleucon Huds.	.	+	.	2	2	+	.	1	1	.	.	+	.	1	.	.	1	+	1	.	+	.	.	.	.	.	.	.	.	.	.	+	.	1	.	+	+	.	.	.	.	.
Carex flacca Schreb. subsp. erythrostachys (Hoppe) Holub	.	.	.	+	.	.	.	.	+	+	+	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	1	2	2	+	+	.	.	.	.	+	+	.	.	.	.	.	.
Trifolium incarnatum L. subsp. molinerii (Balb. ex Hornem.) Ces.	.	1	.	.	.	.	.	+	1	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Stachys germanica L. subsp. dasyanthes (Raf.) Arcang.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	1	.	.	+	.
Loncomelos narbonensis (L.) Raf.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agrimonia eupatoria L. subsp. eupatoria	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brometalia erecti and *Festuco-Brometea*																																									
Eryngium campestre L.	+	.	.	+	1	.	.	+	1	+	+	+	1	1	1	1	1	1	1	1	+	.	1	2	1	+	.	.	.	.	1	1	2	1	1	1	2	1	.	+	2	1
Galium lucidum All.	+	+	1	.	+	.	+	.	+	+	1	.	.	1	+	1	1	+	1	.	+	1	2	1	2	1	.	2	2	2	.	+	.	+	+	1	.	.	.	.	.	.
Hypericum perfoliatum L.		1	.	+	1	+	1	+	+	.	.	.	.	.	+	.	.	1	.	.	.	.	1	+	1	1	+	+	+	1	.	.	.	.	.	.	.	.	.	.	1	.	+
Asphodeline lutea (L.) Rchb.	.	.	.	.	+	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	1
Allium sphaerocephalon L. subsp. sphaerocephalon	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	+	.	.
Poterium sanguisorba L. subsp. balearicum (Bourg. ex Nyman) Stace	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	+	.	+	.	.	.	.	.
Prangos ferulacea (L.) Lindl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	1	2	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaurea parlatoris Heldr. subsp. parlatoris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	+
Festuca circummediterranea Patzke	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	+	+	.	1	1
Anacamptis pyramidalis (L.) Rich.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthyllis vulneraria L. subsp. maura (Beck) Maire	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Anthyllis vulneraria L. subsp. busambarensis (Lojac.) Pignatti	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	+	.	.	.	.	.	.	.	.
Arabis collina Ten.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Carlina sicula Ten. subsp. sicula	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.
Dianthus siculus C.Presl	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erysimum bonannianum C.Presl	.	.	.	.	.	.	.	.	.	+	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scorzonera hirsuta (Gouan) L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola aethnensis (DC.) Strobl subsp. messanensis (W.Becker) Merxm. & Lippert	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	1	.
Allium roseum L. subsp. roseum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Festuca sicula C.Presl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Linum usitatissimum L. subsp. angustifolium (Huds.) Thell.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus millefoliatus Vahl	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Convolvulus cantabrica L.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus nutans L. subsp. siculus (Franco) Greuter	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+
Other species																																										
Dactylis glomerata L. s.l.	1	1	+	+	2	1	1	+	+	1	+	1	+	1	1	2	1	2	+	1	1	+	3	2	2	1	1	1	+	1	+	+	+	+	+	+	.	2	.	+	1	1
Trifolium campestre Schreb.	1	.	1	+	1	+	+	1	+	.	1	1	+	.	1	.	+	+	.	+	+	+	1	+	1	1	.	.	.	.	1	1	1	1	+	.	.	1	+	+	1	1
Daucus carota L. subsp. carota	1	+	1	+	+	+	.	+	+	+	.	1	+	+	+	+	+	+	+	+	1	+	.	+	.	.	.	+	1	.	2	.	+	.	+	.	.	1	+	+	.	.
Silene italica (L.) Pers. subsp. sicula (Ucria) Jeanm.	1	1	+	+	.	.	.	+	.	.	.	.	.	1	.	+	+	.	+	.	.	+	2	1	1	+	1	2	+	2	1	1	+	.	.	.	+	.	+	1	.	+
Anthoxanthum odoratum L. subsp. odoratum	.	2	1	1	3	.	.	.	.	.	.	.	.	+	.	.	1	+	+	1	.	1	.	.	.	.	1	3	3	3	.	.	.	+	.	+	.	1	1	1	1	1
Opopanax chironium (L.) W.D.J.Koch	1	1	2	+	.	.	.	1	+	1	1	1	1	2	1	1	2	+	+	.	.	.	.	.	1	1	3	2	1	3	.	.	.	.	.	.	.	.	.	.	.	.
Cynosurus cristatus L.	+	.	.	1	+	.	.	+	+	.	.	.	.	.	.	.	+	.	+	+	.	.	1	1	.	.	.	.	.	.	.	.	.	.	+	+	+	1	.	+	1	.
Hypochaeris radicata L.	+	.	.	+	.	+	+	.	.	+	.	.	+	.	+	.	.	+	.	+	+	+	.	.	.	.	.	.	.	.	+	+	+	.	+	.	.	1	.	.	.	.
Cynosurus echinatus L.	+	+	+	.	+	+	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	+	+	+	+	+	.	+	.	.	.	.	.
Achillea ligustica All.	+	.	.	.	+	.	2	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	3	1	.	.	+	+	+	.	.	.	+	.	1	.	.	+	.	1	+	1
Vicia sativa L. subsp. nigra (L.) Ehrh.	+	+	.	+	1	+	.	+	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	+	+	.	.	.	.
Poa trivialis L.	2	+	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	.	1	+	1	1	+	1	.	.	.	.	.	+	.	.	.	.	.	.
Asphodelus ramosus L. subsp. ramosus	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	2	1	.	.	.	.	.	.	.	.	1	.	+	.	.	.	1	1	1	1
Trifolium pratense L.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	1	1	1	1	1	2	1	.	+	.	+
Bonannia graeca (L.) Halácsy	.	.	.	.	.	.	.	.	.	.	1	.	.	1	+	.	1	2	+	.	.	+	.	.	1	+	.	.	.	.	.	1	2	1	.	.	.	.	.	.	.	.
Lolium perenne L.	.	.	.	+	.	+	+	.	.	.	.	.	.	+	.	+	+	1	1	.	.	.	.	.	2	+	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.
Ranunculus bulbosus L.	+	+	+	.	+	1	.	.	.	.	+	.	.	.	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	+	.	.	.	.	.
Arrhenatherum elatius subsp. bulbosum (Willd.) Schübl. & G.Martens	1	.	.	.	+	.	.	+	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	+	1	+	.	+	.	.	.	.	.	.	.	.	.	.
Hordeum bulbosum L.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	1	+	.	.	.	.	.	+	.	+	.	1	+	.	.	.	.	.
Helictochloa cincinnata (Ten.) Romero Zarco	.	.	.	+	.	+	+	+	1	+	.	.	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca rubra L. subsp. rubra	.	.	.	.	.	.	.	.	.	.	.	1	1	1	1	.	3	2	2	.	.	.	.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Silene vulgaris (Moench) Garcke subsp. vulgaris	.	+	.	.	.	+	+	.	.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.
Lathyrus aphaca L. subsp. aphaca	2	.	1	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Clinopodium nepeta (L.) Kuntze subsp. nepeta	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	+	.	.	+	1	.	.	2	+	.	+	.
Pteridium aquilinum (L.) Kuhn subsp. aquilinum	1	.	.	+	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	1	+
Dasypyrum villosum (L.) P.Candargy	+	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.
Trifolium physodes M.Bieb.	.	.	.	.	+	.	.	1	+	+	.	.	.	+	.	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Urospermum dalechampii (L.) F.W.Schmidt	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	.	.	.	.	.	+	.	.	.	+	.	.	1	.	+	1	+
Oenanthe pimpinelloides L.	.	.	.	1	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	+
Sixalix atropurpurea (L.) Greuter & Burdet	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	1	.	.	.	.	.	1	1	.	+	.	.	.	+	.	.	.	.
Polygala preslii Spreng.	.	.	.	+	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus pratensis C.Presl	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ampelodesmos mauritanicus (Poir.) T.Durand & Schinz	.	.	.	1	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Briza maxima L.	.	.	.	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Thapsia meoides (Desf.) Guss.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	1	.	+	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypochaeris laevigata (L.) Ces., Pass. & Gibelli	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium angustifolium L. subsp. angustifolium	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.
Hypochaeris cretensis (L.) Bory & Chaub.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	1	.	.	.	.	.
Scolymus grandiflorus Desf.	.	.	.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Smyrnium perfoliatum L. subsp. rotundifolium (Mill.) Bonnier & Layens	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.
Phleum echinatum Host	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium aparine L.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Reichardia picroides (L.) Roth	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	1	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Plantago lanceolata L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.
Asperula laevigata L.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	1	.	.	.	.
Sinapis pubescens L. subsp. pubescens	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.
Eudianthe coeli-rosa (L.) Endl.	.	+	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus canescens DC.	.	.	.	+	2	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina gummifera (L.) Less.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium bivonae Guss.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.
Nigella damascena L.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pulicaria odora (L.) Rchb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.

Kundmannia sicula (L.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helictotrichon convolutum (C.Presl) Henrard	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.
Fedia graciliflora Fisch. & C.A.Mey.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.
Festuca rubra L. subsp. microphylla St.-Yves	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	+	1
Potentilla reptans L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	1	+
Vicia bithynica (L.) L.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.
Avena barbata Pott ex Link	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Pimpinella anisoides V.Brig.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pimpinella peregrina L.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunella vulgaris L. subsp. vulgaris	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.
Hypochaeris achyrophorus L.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Avena fatua L.	.	.	.	+	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lolium arundinaceum (Schreb.) Darbysh. subsp. arundinaceum	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium scabrum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.
Linaria purpurea (L.) Mill.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium grandiflorum Schreb.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Trifolium glomeratum L.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Elymus repens (L.) Gould subsp. repens	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Medicago polymorpha L.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carthamus caeruleus L.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anisantha rubens (L.) Nevski	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia villosa Roth subsp. varia (Host) Corb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus hirsutus L.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Clinopodium vulgare L. subsp. arundanum (Boiss.) Nyman	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Anisantha sterilis (L.) Nevski	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus pycnocephalus L. subsp. pycnocephalus	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Linum corymbulosum Rchb.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia ochroleuca Ten. subsp. ochroleuca	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus clymenum L.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex thyrsoides Desf.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hippocrepis biflora Spreng.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Trifolium lappaceum L.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Inula montana L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus sylvestris L. subsp. sylvestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus ulmifolius Schott	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina involucrata Poir.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spartium junceum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Foeniculum vulgare Mill.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phlomis herba-venti L. subsp. herba-venti	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asperula aristata L. subsp. scabra Nyman	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Isatis tinctoria L. subsp. canescens (DC.) Arcang.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leontodon siculus (Guss.) Nyman	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chondrilla juncea L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Paeonia mascula (L.) Mill.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Cota triumfettii (L.) J.Gay	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Narcissus tazetta L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium striatum L. subsp. striatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
Crepis vesicaria L. subsp. vesicaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
Bromus hordeaceus L. subsp. hordeaceus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.
Odontites vernus (Bellardi) Dumort. subsp. siculus (Guss.) P.D.Sell	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.+	.	1
Hypericum perforatum L. subsp. perforatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+
Sporadic species	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	9	0	0	0	0

and 1500 m, where it gives rise to grass patches of relatively small size, especially at the base of rocky limestone slopes. It is favored by the activity of wild boars, which repeatedly dig into the ground and thus providing opportunity for the maintenance of *Brachypodium rupestre* and the entrance of various therophytes.

Substrate – This variant is developed on deep soils on limestone in spatial contact with Flysch substrates where a high content in clay occurs.

Bioclimate – Supramediterranean thermotype; humid umbrotype.

Syndinamism – It is likely that these grasslands are dynamically linked to the mesophilous deciduous woods of the *Quercetum leptobalani* or the *Ilici-Quercetum leptobalani* which are the only two associations of deciduous oaks described for this area (see Brullo, 1984; Maniscalco & Raimondo, 2009).

Distribution – Madonie Montains (Cozzo Piombino, Pizzo Carbonara, Portella Colla).

TANACETO SICULI-BRACHYPODIETUM RUPESTRIS ass. nova *hoc loco* (*holotypus* rel. 38, Tab. 1)

Table – 1, rels. 38-42.

Characteristic/Differential species – *Brachypodium rupestre* (dom.), *Teucrium siculum*, *Tanacetum vulgare* subsp. *siculum*, *Helianthemum nummularium* subsp. *obscurum*, *Carlina hispanica* subsp. *globosa*, *Micromeria graeca* subsp. *consentina*, *Thymus longicaulis*.

Structure and ecology – Grassland type dominated by *Brachypodium rupestre* with a quite tight and homogeneous structure with an average cover degree about 90% and an average number of species per relevé of 32. It substitutes the *Lolio pluriflori-Brachypodietum rupestris* on the subacidic soils rich in clay of the Peloritani mountains and the eastern part of the Nebrodi mountainous range, at altitudes ranging between 800 and 1200 m. The *Tanaceto siculi-Brachypodietum* preferential habitats are those occurring at the margins of the drainage lines, the small-size terraces on which wheat was once grown and the pastures obtained by the cutting of the submontane deciduous oak woods.

Substrate – This association is developed within the north facing slopes, on metamorphic substrates.

Bioclimate – Meso-mediterranean thermotype; upper humid umbrotype.

Syndinamism – It is dynamically linked to the subnitrophilous *Pteridium aquilinum* communities (e.g. *Pteridio-Tanacetum siculi* Brullo & Marcenò 1985) and to the mesophilous deciduous woods of the *Conopodio-Quercetum congestae* Maniscalco & Raimondo 2009 and *Arrhenathero-Quercetum cerridis* Brullo *et al*. 1996.

Distribution – Western side of the Peloritani mountains and eastern side of the Nebrodi mountains, namely in the proximity of Mandanici village and Rocca di Novara di Sicilia and near the village of Floresta.

Life forms and Chorology

The *Lolio pluriflori-Brachypodietum* and the *Tanaceto siculi-Brachypodietum* exhibit a similar structure. In both the associations there is the dominance of the Hemicryptophytes which represents the 57% and the 56% of the flora respectively (Tab. 2). The extremely high percentages for the Hemycryptophytes observable in the spectrum weighted on the cover values (about 80% of the total coverage) is strictly linked to the high cover-abundance indexes of *Brachypodium rupestre*. Significantly high is also the contribute of the Therophytes in both associations. From the chorological viewpoint (Tab. 3) there is a complessive dominance of the Mediterranean species with the Euro-Mediterraneans playing the leading role. In the *Lolio pluriflori-Brachypodietum* there is a higher percentage for the East-Mediterranean and East-European species than in the *Tanaceto siculi-Brachypodietum*. This is due to the different substrate on which these associations are developed where the limestone substrates are characterized by a higher concentration of eastern-European species as happens also in the montane grasslands of the limestone sectors of the central and southern Apennines (Di Pietro, 2010, 2011). Very interesting are the high percentages of endemic species which arrive to totalize 13% (*Lolio pluriflori-Brachypodietum*) and 20.5% (*Tanaceto siculi-Brachypodietum*) of the total flora and 15% and 25% of the total coverage summing the Italian endemics and the Sicily endemics. This is

Tab. 2 - Life form table of the *Brachypodium rupestre* communities of Sicily.

	Lolio-Brach.			*Tanaceto-Brach.*		
	Flora	Frq.	Cover	Flora	Frq.	Cover
CH	4.4	1.4	0.7	4.6	8.8	3.8
G	10.1	9.5	6.2	7.6	10.1	5.7
H bienn	*5.1*	*4.6*	*1.5*	*7.6*	*5.6*	*2.1*
H caesp	*10.8*	*19.2*	*52.1*	*12.3*	*17.0*	*54.4*
H ros	*3.8*	*5.0*	*3.8*	*7.6*	*6.9*	*3.1*
H scap	*37.3*	*38.4*	*27.7*	*29.2*	*36.7*	*24.2*
H total	57.0	67.2	85.0	56.7	66.2	83.8
P	1.9	0.8	1.3	0.0	0.0	0.0
T	26.6	21.1	6.8	30.7	14.5	6.4

Tab. 3 - Chorological table of the *Brachypodium rupestre* communities of Sicily.

	Lolio-Brach.			*Tanaceto-Brach.*		
	Flora	Frq.	Cover	Flora	Frq.	Cover
Circumbor.	3.2	5.5	5.5	-	-	-
Endem. Italy	8.4	8.7	12.5	11.4	14.2	15.7
Endem. Sicily	4.5	3.7	3.1	9.1	9.0	9.6
Eurasian	9.7	16.2	16.6	15.9	17.2	17.3
C-Europ + Europ.-Caucas.	4.5	4.7	2.9	6.8	8.2	6.2
Medit.-Mont. + Oroph.-S-Europ.	9.0	5.4	2.5	2.3	2.2	3.8
E-Medit + Medit.-Turan.	11.6	12.4	13.8	6.8	6.7	6.6
Euro-Medit.	27.1	24.9	20.1	20.5	19.4	21.9
Steno-Medit.	13.5	12.3	17.3	15.9	11.2	10.2
W-Medit. + Subatlantic	5.8	4.2	3.0	4.5	5.2	3.8
Subcosmop.	2.6	1.8	2.6	6.8	6.7	5.0

a very high value for semi-mesophilous grasslands if we consider that in similar sub-Mediterranean *B. rupestre* associations (e.g. *Galio lucidi-Brachypodietum*) the endemic component ranges between 3.0 and 4.4 %. The role of the cosmopolitan species, which is sometimes considered an indirect index of the influence of the anthropogenic component, is very low. This scarce role of the cosmopolitans is emphasized by the fact that three (*Trifolium pratense*, *Agrimonia eupatoria* and *Bromus hordeaceus*) out of the five species reported as "cosmopolitan" in Pignatti *et al*. (2005) are normally not considered as anthropogenic species. Only *Pteridium aquilinum* is related to the increase in the nitrogen content in the soil due to grazing livestock. *Isatis tinctoria* L. is the only alien species (naturalized archeophyte) we have found in the sampled communities although its occurrence is absolutely sporadic.

Floristic remarks

Stachys germanica L. subsp. *dasyanthes* (Raf.) Arcang. This subspecies is endemic of Sicily and acts as geographical vicariant of *S. germanica* L. subsp. *germanica* and *S. germanica* L. subsp. *salviifolia* (Ten.) Gams these latter growing in the Italian Peninsula in similar environments. In Sicily subsp. *dasyanthes* is restricted to the pastures of the submontane and montane belts. It was also designated as characteristic species of the *Cachryetum ferulaceae* in Raimondo (1980).

Viola ucriana Erben & Raimondo. This rare *taxon* is endemic of a very restricted zone of the Monti di Palermo range (Mount Pizzuta) at altitudes ranging between 950 and 1300 m (Erben & Raimondo, 1995). It was recently assessed as Critically Endangered (Gianguzzi & La Mantia, 2005; Gianguzzi *et al*., 2017) being constantly subjected to serious threats including fires the effects of which can be devastating especially during the period of flowering and dissemination. From a phytosociological viewpoint it is strictly linked to the *Lolio pluriflori-Brachypodietum*.

Tanacetum vulgare L. subsp. *siculum* (Guss.) Raimondo & Spadaro. It is endemic of the north-eastern part of Sicily (Etna, Madonie, Nebrodi and Peloritani), where it prefers acidic substrates such as flysch, sandstons and volcanic rocks (Schicchi, 2004; Giardina *et al*., 2007). Brullo *et al*. (2005) considered it as a characteristic species of the *Rumici-Astragaletalia siculi* Pignatti & Nimis in Pignatti *et al*. 1980 (cl. *Rumici-Astragaletea siculi*). It was also considered (Brullo & Marcenò, 1985) a characteristic and guide species of the *Pteridio-Tanacetum siculi*, a meso-nitrophlous community classified in the alliance *Onopordion illyrici* Oberdorfer 1954 in the class *Onopordetea acanthii* Br.-Bl. & Tüxen ex Klika & Hadac 1944.

Lolium pluriflorum (Schult.) Banfi, Galasso, Foggi, Kopecký & Ardenghi. This *taxon*, identified for Sicily by C. Presl. as *Festuca multiflora* (*nom. illeg.*) in 1820 and subsequently validly described by Shultes as *Festuca pluriflora*, was reported in the taxonomic literature under a multitude of names (see Ardenghi & Foggi, 2015; Banfi *et al*., 2017). According to Bartolucci *et al*. (2018) this *taxon* is endemic to Sicily, where it is almost exclusively associated to the *B. rupestre* grasslands.

Syntaxonomic discussion

The syntaxonomical classification of the *Brachypodium rupestre* communities in Italy have long been a critical issue. The phytosociological role of this species has been neglected because of its alleged tendency to take advantage of agricultural, forestry and pastural land-use patterns. The new associations described during the last two decades for the central Apennines allowed the *B. rupestre* communities to be included in the Italian syntaxonomical frameworks and a true coenological role as guide-species to be hypothesized for *Brachypodium rupestre*. The diag-

Fig. 6 - a) *Lolium pluriflorum* (Schult.) Banfi, Galasso, Foggi, Kopecký & Ardenghi; b) *Viola ucriana* Erben & Raimondo c) S*tachys germanica* L. subsp. *dasyanthes* (Raf.) Arcang. d) *Tanacetum vulgare* L. subsp. *siculum* (Guss.) Raimondo & Spadaro.

nosis of the two new alliances of *B. rupestre* grasslands which have been recently proposed by Di Pietro *et al*. (2015) and Allegrezza *et al*. (2016) depict this species as having a double coenological optimum. In the *Polygalo-Bromion* it acts as the guide species of the semi-mesophilous grasslands developed on clayey substrates, whereas in the *Dorycnio-Brachypodion* it is the guide-species for the heliophilous edge of the oak and mixed woods. The two Sicilian *B. rupestre* associations described in this paper could be assigned to both the afore-mentioned habitats. Among the edge species that exhibit high-frequency and cover in the Sicilian communities are *Silene italica* subsp. *sicula*, *Picris hieracioides*, *Opopanax chironium*, *Helleborus viridis* subsp. *bocconei* and *Teucrium siculum*. However, the cover values totaled by these edge-species remains far below of the frequency and cover values totaled by the grassland species occurring in these same communities (see Fig. 7).

The *Lolio pluriflori-Brachypodietum* is by far the most widespread *Brachypodium rupestre* community in Sicily, where it is linked to various types of substrate all of which have a neutral-alkaline pH reaction. Observing its phytosociological table it emerges how varied the floristic composition of this association is. Except for *Brachypodium rupestre*, which obviously occurs in all the relevés, no other species exhibits frequency values exceeding 90%. This relatively low rate of high-frequency species is likely to be due, firstly, to the wide geographical amplitude occupied by this association - which longitudinally extends over almost all the mountainous massifs of nortern Sicily - and, secondly, to the many types of land use to which it has been subjected. From a syntaxonomical viewpoint the *Lolio pluriflori-Brachypodietum* exhibits its major similarities with the *Galio lucidi-Brachypodietum* described by Di Pietro & Blasi (2002) for the Tyrrhenian side of central Italy. This similarity is also evidenced in the dendrogram of Fig. 8. In fact, four out of the seven species originally indicated as characteristic species of the *Galio-Brachypodietum* (*Galium lucidum*, *Trifolium ochroleucon*, *Lathyrus sylvestris*, *Loncomelos narbonensis*), also occur in the *Lolio pluriflori-Brachypodietum* together with other more common grassland *taxa* such as *Daucus carota*, *Dactylis glomerata*, *Thymus longicaulis* and *Trifolium pratense*. Nonetheless, there is no possibility that *Lolio pluriflori-Brachypodietum* and *Galio lucidi-Brachypodietum* could be in the foreseeable future considered as syntaxonomical synonyms. In fact, the *Lolio pluriflori-Brachypodietum* is characterized by many high-frequency species which do not occur in the *Galio-Brachypodietum*, starting with *Origanum vulgare* subsp. *viridulum*, and then continuing with other *taxa* endemic of Sicily or southern Italy, such as *Silene italica* subsp. *sicula*, *Thalictrum calabricum*, *Viola ucriana*, *Helleborus vi-*

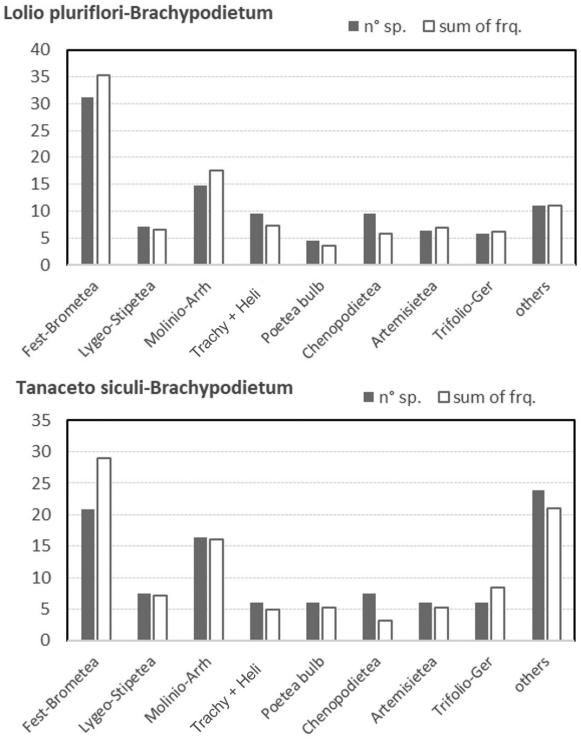

Fig. 7 - Coenological role of the main phytosociological classes in the *Lolio-Brachypodietum* and *Tanaceto-Brachypodietum*. The black columns represent the percentage of species belonging to a given class. The white columns represent the sum of the frequency values of the species belonging to the different classes calculated in its percentage weight in the two associations.

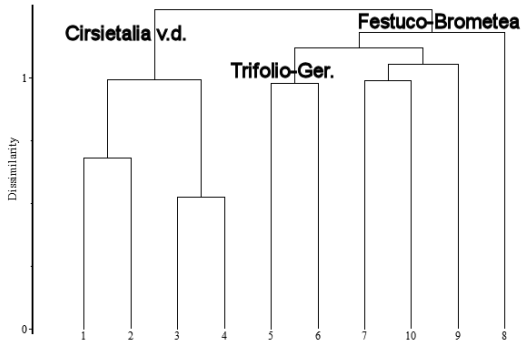

Fig. 8 - Cluster analysis of the communities included in the synoptic table (Tab. 5): 1) *Genisto-Potentilletum calabrae typicum* Brullo & Grillo 1978; 2) *Genisto-Potentilletum calabrae airetosum cupanianae* Brullo & Grillo 1978; 3) *Cynosuro-Leontodontetum siculi typicum* Brullo & Grillo 1978; 4) *Cynosuro-Leontodontetum siculi helianthemetosum* Brullo & Grillo 1978; 5) *Bituminario-Brachypodietum* Allegrezza *et al*. 2016; 6) *Galio erecti-Brachypodietum* Allegrezza *et al*. 2016; 7) *Lolio pluriflori-Brachypodietum* ass.nov.; 8) *Tanaceto siculi-Brachypodietum* ass. nov.; 9) *Polygalo mediterraneae-Brachypodietum* ass. nov.; 10) *Galio lucidi-Brachypodietum* Di Pietro & Blasi 2002.

ridis subsp. *bocconei*, *Carlina hispanica* subsp. *globosa*, *Helictochloa cincinnata*, *Helictotrichon convolutum*, *Hypochaeris laevigata*, *Polygala preslii*, *Viola aethnensis* subsp. *messanensis*, *Centaurea parlatoris*, *Bonannia graeca*, *Trifolium physoides,* etc. The altitudinal location of the *Lolio pluriflori-Brachypodietum* within the lower montane belt and its relationship with the southern Italy phytogeographical sector suggest this community is similar to the *Polygalo mediterraneae-Brachypodietum* described (provisionally) for the Lucanian Apennine in Di Pietro *et al*. (2014) and here validated (Appendix I). Although both these associations are mainly developed on clayey substrates on limestone or marly bedrocks, they have significant differences from the floristic and coenological point of view. The *Polygalo mediterraneae-Brachypodietum* (Tab. 4) exhibits a higher occurrence of *taxa* typical of the semi-mesophilous grasslands developed on clayey soils, such as *Polygala nicaeensis* subsp. *mediterranea*, *Ononis spinosa*, *Lotus herbaceus*, *Lomelosia crenata* subsp. *pseudisetensis*, *Centaurea jacea* subsp. *gaudinii* and *Astragalus monspessulanus*. Moreover the incidence of the anthropogenic flora is significantly lower in the *Polygalo mediterraneae-Brachypodietum*, which more clearly shows those coenological traits typical of grassland communities influenced only slightly by the anthropic activities.

In addition to its typical aspect the *Lolio pluriflori-Brachypodietum* exhibits a mesophilous aspect (subass. *violetosum ucrianae*) typical of the northern slopes of a small area of the Palermo mountains, characterized by the exclusive occurrence of *Viola ucriana* and *Helleborus viridis* subsp. *bocconei* and by the highest frequency and cover values for *Carex flacca* subsp. *erythrostachys*, *Prangos ferulacea*, *Fedia graciliflora*, *Allium subhirsutum*, *Smyrnium perfoliatum* subsp. *rotundifolium* and *Hypochaeris laevigata*.

Finally, an impoverished aspect (var. with *Phleum hirsutum* subsp. *ambiguum*) typical of the heavily disturbed sites characterized by the occurrence of the xerophilous perennial *Phleum hirsutum* subsp. *ambiguum* and *Hypochaeris cretensis* and by the highest frequency values for the sub-anthropogenic annuals *Cynosurus echinatus*, *Cerastium glomeratum*, *Sherardia arvensis*, *Triticum neglectum*, *Medicago orbicularis*, *Trifolium stellatum* and *Medicago minima*.

The *Brachypodium rupestre* community of the sub-acidic metamorphic substrates of the Peloritani mountains has been here assigned to the new association *Tanaceto siculi-Brachypodietum rupestris*. This community share a large portion of the species composition of the *Lolio pluriflori-Brachypodietum*, but differ in respect of a group of exclusive species, namely *Tanacetum vulgare* subsp. *siculum*, *Teucrium siculum*, *Micromeria graeca* subsp. *cosentina*, *Helianthemum nummularium* subsp. *obscurum*, *Carlina hispanica* subsp. *globosa* and *Thymus longicaulis*. For this reason, and because of the different bedrock type, we have opted for proposing a new association separate from the *Lolio pluriflori-Brachypodietum*. The high frequency of *Tanacetum siculum* in the *Tanaceto siculi-Brachypodietum* suggests a possible link, as geographical vicariant, to the *Tanaceto corymbosi-Brachypodietum* described by Allegrezza *et al*. (2016) for the heliophilous edge communities of the lower montane belt of the Umbrian Apennines. This similarity, however, is limited to the simultaneous occurrence of *Helianthemum nummularium* subsp. *obscurum*. In fact, the *Tanaceto corymbosi-Brachypodietum* is characterized by a lower specific richness compared to the *Tanaceto siculi-Brachypodietum* and a higher coenological role of the species typical of edge environments such as *Rumex acetosa*, *Fragaria vesca*, *Cruciata glabra*, *Geranium sanguineum*, *Geum urbanum*, *Helleborus viridis* subsp. *bocconei*, *Campanula micrantha*, etc.

Both the *Lolio pluriflori-Brachypodietum* and the *Tanaceto siculi-Brachypodietum* are here classified in the alliance *Polygalo mediterraneae-Bromion erecti* (*Festuco-Brometea*). The dominance of *Brachypodium rupestre* and the occurrence of some diagnostic species of this alliance, such as *Trifolium ochroleucon*, *T. incarnatum* subsp. *molinerii*, *Carex flacca* subsp. *erythrostachys*, *Loncomelos narbonensis*, etc., support this choice. In fact, these two associations (especially the *Lolio-Brachypodietum*) exhibit a greater occurrence of species belonging to *Festuco-Brometea* compared to *Trifolio-Geranietea* and, using a broader ecological scale, they exhibit the dominance of the species typical of grasslands and open environments in general, over those typical of ecotonal fringes and wood undergrowth. This dominance is clear from the floristic-syntaxonomical histograms of Fig. 7, where it can be seen that the percentage of species of *Festuco-Brometea* and, to a lesser extent,that of *Molinio-Arrhenatheretea*, exceed the percentage of classes typical of edge habitats or more anthropogenic contexts. Only in the subass. *Lolio-Brachypodietum violetosum ucrianae* are the grasslands more significantly colonized by the edge species (e.g. *Helleborus viridis* subsp. *bocconei* and *Opopanax chironium*). Despite this, we exclude for the moment any possible reference to the alliance *Dorycnio herbacei-Brachypodion rupestris* (*Asphodeletalia macrocarpi*), whose diagnosis (Allegrezza *et al*., 2016) is much more appropriate for edge habitats (*Trifolio-Geranietea*). Apostolova *et al*. (2014) have already highlighted on the difficulties in drawing the boundaries between the various dry grassland classes and on how this problem was particularly prominent in the *Festuco-Brometea*. Our classification of the Sicilian *Brachypodium rupestre* communities in the *Festuco-Brometea*, however, is simply the same as the way *B. rupestre*

Tab. 4 - Phytosociological table of *Polygalo mediterraneae-Brachypodietum rupestris*.

Relevé nr.	1	2	3*	4	5	6	7	8	9
Altitude (dam s.l.m.)	107	63	95	97	97	63	95	105	125
Slope (%)	NE	NNE	NE	NE	NE	ENE	NNE	E	NE
Aspect	2	10	7	3	10	15	20	20	45
Area (m^2)	90	120	120	120	100	120	100	80	100
Total cover (%)	70	50	60	60	85	95	70	85	60
Species per relevé	55	37	64	73	51	27	26	48	35
Polygalo mediterraneae-Brachypodietum rupestris									
Polygala nicaeensis Risso ex W.D.J.Koch subsp. mediterranea Chodat	+	2	3	3	3	2	1	2	+
Carex flacca Schreb. subsp. erythrostachys (Hoppe) Holub	+	2	+	1	2	2	2	1	.
Stachys germanica L. subsp. salviifolia (Ten.) Gams	.	1	+	+	1	.	1	+	.
Ophrys lucana P.Delforge, Devillers-Tersch. & Devillers	+	.	1	+	+	.	.	+	.
Ophrys incubacea Bianca	+	.	1	+	+	+	.	+	.
Polygalo mediterraneae-Bromion erecti & Brometalia erecti									
Brachypodium rupestre (Host) Roem. & Schult.	4	5	4	3	4	5	4	3	5
Centaurea jacea L. subsp. gaudinii (Boiss. & Reut.) Gremli	.	+	+	+	+	+	1	2	.
Ononis spinosa L. subsp. spinosa	+	.	1	2	1	.	2	2	.
Scabiosa columbaria L. subsp. columbaria	.	.	+	+	.	.	1	.	2
Blackstonia perfoliata (L.) Huds.	.	.	.	+	.	.	1	+	.
Trifolium incarnatum L. subsp. molinerii (Balb. ex Hornem.) Ces.	+	.	.	.	.	.	.	2	.
Agrimonia eupatoria L. subsp. eupatoria	.	+	.	.	.	2	.	.	.
Helianthemum nummularium (L.) Mill. subsp. obscurum (Čelak.) Holub	.	1	.	.	.	+	.	.	.
Galium verum L.	.	.	.	.	.	.	2	1	.
Brometalia erecti and *Festuco-Brometea*									
Poterium sanguisorba L. subsp. balearicum (Bourg. ex Nyman) Stace	+	1	1	1	1	+	1	1	1
Eryngium campestre L.	1	1	1	1	1	1	2	2	.
Thymus longicaulis C.Presl subsp. longicaulis	+	+	2	1	1	+	.	+	.
Bromopsis erecta (Huds.) Fourr.	2	.	1	3	2	.	.	2	3
Galium lucidum All.	+	1	2	2	1	+	.	.	.
Anthyllis vulneraria L. subsp. rubriflora (DC.) Arcang.	+	.	+	+	+	.	.	.	2
Teucrium chamaedrys L. subsp. chamaedrys	.	.	1	1	1	.	1	.	1
Ophrys pseudoatrata S.Hertel & Presser	+	.	1	+	+	.	.	+	.
Koeleria splendens C.Presl	+	.	1	+	.	.	.	.	1
Anacamptis papilionacea (L.) R.M.Bateman, Pridgeon & M.W.Chase	+	.	2	+	1	.	.	.	.
Helictochloa praetutiana (Parl. ex Arcang.) Bartolucci, F.Conti, Peruzzi & Banfi	.	.	1	1	.	.	.	1	2
Viola aethnensis (DC.) Strobl subsp. splendida (W.Becker) Merxm. & Lippert	+	.	2	1	.	.	.	.	1
Carlina vulgaris L.	+	+	.	.	.	+	.	.	.
Orchis anthropophora (L.) All.	.	1	.	1	+	.	.	.	.
Anacamptis morio (L.) R.M.Bateman, Pridgeon & M.W.Chase	.	.	1	1	1	.	.	.	.
Briza media L.	.	.	.	.	1	.	1	1	.
Muscari comosum (L.) Mill.	.	.	+	+	1	.	.	.	.
Orchis quadripunctata Cirillo ex Ten.	.	.	+	1	.	.	.	.	+
Eryngium amethystinum L.	.	.	.	1	.	.	+	.	+
Astragalus monspessulanus L. subsp. monspessulanus	.	.	1	2	.	.	.	.	.
Carex caryophyllea Latourr.	.	.	2	2	.	.	.	.	.
Leontodon hispidus L. subsp. hispidus	.	.	.	.	1	.	.	.	1
Ophrys apifera Huds.	+	.	.	.	1	.	.	.	.
Prunella laciniata (L.) L.	+	.	.	.	.	.	.	1	.
Pilosella piloselloides (Vill.) Soják	+	.	.	.	.	.	.	+	.
Anacamptis coriophora (L.) R.M.Bateman, Pridgeon & M.W.Chase	+	.	.	.	.	.	.	1	.
Linum usitatissimum L. subsp. angustifolium (Huds.) Thell.	+	.	.	.	.	.	.	+	.
Ophrys lacaitae Lojac.	+	.	.	.	.	.	.	+	.
Thymus oenipontanus Heinr.Braun ex Borbás	.	+	.	.	.	+	.	.	.
Phleum hirsutum Honck. subsp. ambiguum (Ten.) Cif. & Giacom.	.	.	+	+	.	.	.	.	.
Ononis pusilla L. subsp. pusilla	.	.	+	+	.	.	.	.	.
Potentilla pedata Willd. ex Hornem.	.	.	1	+	.	.	.	.	.
Saxifraga granulata L. subsp. granulata	.	.	1	1	.	.	.	.	.
Ophrys passionis Sennen ex Devillers-Tersch. & Devillers subsp. passionis	.	.	1	1	.	.	.	.	.
Ophrys bertolonii Moretti subsp. bertolonii	.	.	+	.	1	.	.	.	.

Carlina acaulis L. subsp. caulescens (Lam.) Schübl. & G.Martens	.	.	.	+	.	.	.	.	1
Trifolium montanum L. subsp. rupestre (Ten.) Nyman	.	.	.	.	.	.	+	.	+
Anacamptis pyramidalis (L.) Rich.	+	.	.	.	.	.	.	.	.
Orchis mascula (L.) L. subsp. mascula	+	.	.	.	.	.	.	.	.
Arabis hirsuta (L.) Scop.	.	+	.	.	.	.	.	.	.
Arabis collina Ten. subsp. collina	.	.	+	.	.	.	.	.	.
Neotinea tridentata (Scop.) R.M.Bateman, Pridgeon & M.W.Chase	.	.	+	.	.	.	.	.	.
Crepis lacera Ten. subsp. lacera	.	.	.	+	.	.	.	.	.
Carduus nutans L. subsp. nutans	.	.	.	+	.	.	.	.	.
Orchis provincialis Balb. ex Lam. & DC.	.	.	.	1	.	.	.	.	.
Achillea setacea Waldst. & Kit.	.	.	.	.	.	.	.	.	1
Linum catharticum L.	.	.	.	.	.	.	.	.	+
Centaurea deusta Ten.	.	.	.	.	.	.	.	.	1
Festuca circummediterranea Patzke	.	.	.	.	.	.	.	.	1
Jurinea mollis (L.) Rchb. subsp. mollis	.	.	.	.	.	.	.	.	2
Pimpinella tragium Vill.	.	.	.	.	.	.	.	.	2
Stachys italica Mill.	.	.	.	.	.	.	.	.	+
Seseli montanum L. subsp. montanum	.	.	.	.	.	.	.	.	+
Other species									
Dactylis glomerata L. subsp. glomerata	+	2	1	+	2	2	2	1	1
Anthoxanthum odoratum L. subsp. odoratum	1	1	2	+	.	1	.	1	+
Poa pratensis L. subsp. pratensis	.	1	2	1	1	1	.	1	.
Ranunculus bulbosus L.	+	.	+	+	+	+	.	+	.
Bellis perennis L.	+	1	1	2	.	1	.	.	.
Lotus corniculatus L. subsp. corniculatus	2	.	1	2	2	+	1	.	.
Lotus herbaceus (Vill.) Jauzein	+	2	.	.	.	1	3	2	.
Plantago lanceolata L.	.	1	1	1	1	.	.	1	.
Crepis vesicaria L. subsp. vesicaria	.	+	1	+	1	+	.	.	.
Trifolium pratense L.	1	.	1	.	.	+	.	2	.
Daucus carota L. subsp. carota	.	2	+	.	1	2	.	.	.
Triticum neglectum (Req. ex Bertol.) Greuter	+	.	.	.	2	.	1	2	.
Serapias vomeracea (Burm.f.) Briq.	+	.	+	.	1	.	.	1	.
Prunella vulgaris L. subsp. vulgaris	+	2	.	.	2	1	.	.	.
Trifolium stellatum L.	+	.	+	+	.	.	.	.	.
Carlina corymbosa L.	+	.	+	.	+	.	.	.	.
Cynosurus cristatus L.	3	.	.	+	.	.	.	3	.
Rhinanthus minor L.	+	.	.	2	.	.	.	1	.
Poa bulbosa L. subsp. bulbosa	+	.	.	.	+	.	.	+	.
Trifolium campestre Schreb.	+	.	.	.	.	.	1	1	.
Achillea millefolium L. subsp. millefolium	+	.	3	1	.	.	.	.	.
Centaurium erythraea Rafn subsp. erythraea	+	.	1	.	.	.	1	.	.
Sherardia arvensis L.	.	+	+	+	.	.	.	.	.
Leontodon tuberosus L.	.	.	2	2	+	.	.	.	.
Trifolium repens L.	.	.	+	1	+	.	.	.	.
Bromus hordeaceus L. subsp. hordeaceus	.	.	+	+	.	.	.	1	.
Luzula multiflora (Ehrh.) Lej. subsp. multiflora	.	.	1	+	1	.	.	.	.
Coronilla scorpioides (L.) W.D.J.Koch	+	.	.	+	.	.	.	.	.
Trifolium striatum L. subsp. striatum	1	+	.	.	.	.	.	.	.
Carex distans L.	+	.	.	.	.	.	.	+	.
Rosa pulverulenta M.Bieb.	+	.	.	.	.	.	.	+	.
Hypericum perfoliatum L.	.	+	+	.	.	.	.	.	.
Echium italicum L. subsp. italicum	.	+	.	+	.	.	.	.	.
Lathyrus aphaca L. subsp. aphaca	.	+	.	.	.	1	.	.	.
Poa sylvicola Guss.	.	+	.	.	.	+	.	.	.
Ervum gracile DC.	.	+	.	.	.	1	.	.	.
Cichorium intybus L.	.	1	.	.	.	.	1	.	.
Trifolium micranthum Viv.	.	.	1	+	.	.	.	.	.
Festuca rubra L. subsp. rubra	.	.	2	2	.	.	.	.	.
Ajuga reptans L.	.	.	+	+	.	.	.	.	.
Medicago lupulina L.	.	1	.	.	1	.	.	.	.
Onobrychis viciifolia Scop.	.	.	.	2	+	.	.	.	.
Orchis purpurea Huds.	.	.	.	+	1	.	.	.	.

Scorzoneroides cichoriacea (Ten.) Greuter	.	.	.	1	.	+	.	.	.
Ophrys tenthredinifera Willd. subsp. neglecta (Parl.) E.G.Camus	.	.	1	1	.	.	.	.	.
Cerastium ligusticum Viv.	.	.	+	+	.	.	.	.	.
Leucanthemum vulgare (Vaill.) Lam. subsp. vulgare	.	.	.	1	.	.	.	+	.
Himantoglossum hircinum (L.) Spreng.	.	.	.	+	+	.	.	.	.
Mentha pulegium L. subsp. pulegium	.	.	.	.	1	.	1	.	.
Crepis neglecta L. subsp. neglecta	.	.	.	.	+	.	.	1	.
Cirsium tenoreanum Petr.	.	.	.	.	.	.	.	+	1
Sporadic species	7	6	6	8	7	0	3	6	9

grasslands have tended to be classified in the rest of Europe. However, it would be interesting to investigate more in-depth the coenological dualism *Festuco-Brometea*/*Trifolio-Geranietea*, in particular using a greater amount of phytosociological data at both national and European level. Owing to wide ecological amplitude of *B. rupestre*, its communities can be open to different syntaxonomic interpretations. Moreover, there is the intermediate syntaxonomic position of the class *Trifolio-Geranietea*, which due to the ecotonal spatial arrangement of its communities, exhibits a highly variegated floristic composition. It is not by chance that in Chytrý (2007) the *Trifolio-Geranietea* was not considered at the class level, but redistributed with its alliances in other classes, such in particular the *Festuco-Brometea* (see also the comment on the class *Trifolio-Geranietea* reported in Mucina *et al*., 2016, Eurovegchecklist). According to Biondi *et al*. (1995, 2014) the *B. rupestre* communities belonging to the *Festuco-Brometea* are to be classified in the order *Phleo-Brometalia erecti*, whereas in Mucina *et al*. (2016) these are classified in the *Brachypodietalia pinnati* (the *Brometalia erecti* being considered as *nomen ambiguum*). Terzi *et al*. (2016) demonstrated that the name *Brometalia erecti* Koch 1926 is not a *nomen ambiguum* and therefore it would have nomenclatural priority over the name *Brachypodietalia pinnati*. Accordingly, in this paper we have opted for using *Brometalia erecti* as reference order and *Bromenalia erecti* Terzi *et al*. 2016 as suborder, this latter substituting *Leucanthemo-Bromenalia* Biondi *et al*. 1995 (inval. Art. 2b).

The decision to make reference to the class *Festuco-Brometea* in Sicily is an important biogeographical choice and deserves an adequate comment. In fact, according to Brullo *et al*. (2002; 2004) the southernmost limit of the distributional range of the *Festuco-Brometea* in the Italian Peninsula is located within the Pollino-Oromarso massif at the boundary between the Calabria and Basilicata administrative regions, where the calcareous rocks of the Apennine limestone platforms come into contact with the metamorphic subtrates of the Calabrian Catena Costiera and Sila massifs. Previously, however, Biondi *et al*. (1995) had already considered the *Festuco-Brometea* as occurring in Sicily, on the basis of their classification of the Madonie's dry grassland *Lino-Seslerietum* in the *Phleo ambigui-Bromion* (this latter alliance being included in the *Festuco-Brometea*). In fact, however, this association was originally classified in the *Rumici-Astragaletea* (Pignatti *et al*. 1980) and *Cerastio-Carlinetea* (Brullo 1984; Brullo *et al*. 2005). The Biondi *et al*. (1995) classification was presumably based on two considerations. First, the Madonie mountains are composed of calcareous rocks as are the majority of the central and southern Apennines (*locus classicus* of *Phleo-Bromion*). Second, the dry montane grasslands of the Madonie are characterized by many diagnostic species of the *Phleo-Bromion*, such as *Koeleria splendens*, *Festuca circummediterranea*, *Phleum ambiguum*, *Sesleria nitida*, *Cerstium tomentosum*. This syntaxonomical classification was also reiterated later by the same authors (Biondi *et al*., 2009) and was changed only in the recent Prodrome of the Italian vegetation (Biondi *et al*., 2014), where the *Lino punctati-Seslerietum nitidae* was moved to the alliance *Cerastio-Astragalion*, which was then included in the *Rosmarinetea officinalis*. In contrast, Mucina *et al*. (2016) included the *Cerastio-Astragalion* (together with the C-S Apennines *Cytiso-Bromion* and *Seslerio nitidae-Caricion macrolepidis*) in the *Festuco-Ononideta*, in order to classify in the same class all the montane dry grasslands mixed with chamaephytes, ranging across the Iberian Peninsula, to the Western Alps the Apennines and Sicily. By doing this Mucina *et al*. effectively excluded the *Festuco-Brometea* not only from Sicily, but also from most of the calcareous mountainous sectors of the central and southern Apennines. This syntaxonomical position will deserve further studies and analyses (which are already underway) that, however, are beyond the scope of this contribution. The *Brachypodium rupestre* grasslands are well-known in the European phytosociological literature as typical *Festuco-Brometea* semi-mesophilous grasslands developed on relatively deep soils with a highly variable floristic composition. This is precisely what is found in Sicily and therefore our hypothesis of classifying them in the *Festuco-Brometea* seems not be inappropriate. In fact, both the *Lolio-Brachypodietum* and the *Tanaceto-Brachypodietum* described in this paper exhibit a very different ecological situation compared to those experienced by the *Lino punctati-Seslerietum* on the litho-soils of the Madonie moun-

tains, and therefore it would be reasonable to designate for them a different syntaxonomic reference from *Festuco-Ononidetea* or *Rosmarinetea*. Our study being the first phytosociological work strictly concerning the *B. rupestre* vegetation in Sicily, and having already established that the two new associations here identified cannot be classified, either in *Trifolio-Geranietea*, or in *Festuco-Ononidetea*, or *Rosmarinetea*, the further options for their classification are substantially reduced to the following three grassland classes: *Festuco-Brometea*, *Molinio-Arrhenateretea* and *Poetea bulbosae*. Observing what has already been proposed in other countries concerning similar vegetation types, we have found that almost all the authors that investigated the *Brachypodium rupestre/pinnatum* grasslands in central and southern Europe (Rivas-Martínez *et al*., 2001, Chytrý, 2007; Janišová *et al*., 2007; Dengler *et al*., 2012, Mucina *et al*., 2016) included them in the *Festuco-Brometea*. For central and eastern Europe reference was always made to *Brachypodietalia pinnati* and to *Cirsio-Brachypodion* (*Festuco-Brometea*). For the Iberian peninsula reference was made to the *Potentillo-Brachypodion* (*Festuco-Brometea*). For Italy Ubaldi (1988) initially included the *Dorycnio-Brachypodietum* described for the sub-appennine sector of the northern Marche Region in the *Agropyretea intermedio-repentis*, but subsequently (Ubaldi 2011) he moved it into the *Bromion erecti* (*Festuco-Brometea*). In the revisions of Biondi *et al*. (1995; 2005) the only *B. rupestre* association considered (*Polygalo flavescentis-Brachypodietum* Lucchese *et al*. 1995) was included in the *Phleo-Bromion* (*Festuco-Brometea*). This alliance was classified in the *Festuco-Brometea* and has been recently confirmed in this class also in the Italian Prodrome of Vegetation (Biondi *et al*., 2014).

The inclusion of the Sicilian *B. rupestre* communities in *Molinio-Arrhenatheretea* or *Poetea bulbosae* would be largely based on their possible classification in the Sicilian endemic alliance and order *Plantaginion cupani* and *Cirsietalia vallis-demoni*. These two *syntaxa* were originally proposed (Brullo & Grillo, 1978) for classifying the mesophilous and sub-acidophilous grasslands developed on the siliceous substrates of the Nebrodi mountains in northern Sicily. On the syntaxonomically critical position of the *Cirsietalia vallis-demoni* and on its peculiar floristic diagnostic composition, a brief comment was already published in Di Pietro *et al*. (2017a). However, it emerges that a very low floristic similarity is identifiable comparing the communities normally included in the *Plantaginion cupanii* and the *Brachypodium rupestre* ones. The result of the cluster analysis (Fig. 8) performed on the synoptic table (Tab. 5) shows a clear separation between the *Plantaginion cupanii* (*Cirsietalia vallis-demoni*) communities and the *Brachypodium rupestre* ones from both Sicily and the Italian Peninsula. In the

Tab. 5 - Synoptic table of selected sub-mesophilous grasslands associations of Sicily and Peninsular Italy.

Column's number	1	2	3	4	5	6	7	8	9	10
Association's acronym	GE-PO typ	GE-PO air	CY-LE typ	CY-LE hel	BITU-BRA	GAer-BRA	LOL-BRA	TANsi-BRA	POme-BRA	GAlu-BRA
Total number of relevés	13	19	36	14	6	23	39	5	9	19
Average altitude x 10	180	155	128	150	22	53	106	99	94	42
Genisto Potentilletum	.	.	.	.	.	.	.	.	.	.
Lepidium hirtum subsp. nebrodense	100	47	10	50	.	.	.	.	.	.
Genista aristata	54	68	.	50	.	.	.	.	.	.
Polycarpon tetraphyllum subsp. alsinifolium	23	63	.	10	.	.	.	.	.	.
Petrorhagia illyrica subsp. haynaldiana	92	58	.	.	.	.	.	.	.	.
Potentilla calabra	100	100	.	.	.	.	.	.	.	.
Scleranthus polycarpos subsp. collinus	100	68	.	.	.	.	.	.	.	.
Herniaria glabra subsp. nebrodensis	46	.	.	.	.	.	.	.	.	.
Scorzoneroides cichoriacea	23	74	.	.	.	.	.	.	11	.
Cynosuro-Leontodonttum										
Leontodon siculus	.	.	30	50	.	.	5	.	.	.
Centaurium erythraea	.	.	70	70	16	21	.	.	33	26
Polygala preslii	8	11	30	50	.	.	18	.	.	.
Trifolium striatum	.	63	90	70	.	.	5	.	11	5
Crepis leontodontoides	.	47	70	50	.	.	.	.	.	.
Trifolium phleoides	.	.	30	50	.	.	.	.	.	.
Trifolium squarrosum	.	.	30	50	.	.	.	.	.	.
Psoraleo-Brachypodietum rupestris										
Sixalix atropurpurea	.	.	70	30	83	.	18	20	.	.
Pallenis spinosa	.	.	.	.	83	.	.	20	.	5
Bituminaria bituminosa	.	.	.	.	100	.	.	.	.	.
Dittrichia viscosa	.	.	.	.	83	4	.	.	.	.
Galio erecti-Brachypodietum rupestris										
Helianthemum nummularium subsp. obscurum	38	26	.	.	.	21	2	80	22	16
Hypericum perforatum	23	5	30	10	83	30	.	40	.	36
Lotus herbaceus	.	.	.	.	33	82	.	.	55	21
Galium album	.	.	.	.	50	65	.	.	.	.
Lolio pluriflori-Brachypodietum rupestris										
Lolium pluriflorum	.	.	.	.	.	.	45	.	.	.
Origanum vulgare subsp. viridulum	.	.	.	.	.	.	62	100	.	.
Anemone hortensis	.	.	.	.	.	.	59	.	.	.
Thalictrum calabricum	.	.	.	.	.	.	37	80	.	.
Medicago lupulina	.	.	50	30	.	17	46	.	22	5
Picris hieracioides	.	.	.	.	33	30	76	.	11	26
Opopanax chironium	.	.	.	.	.	.	59	.	.	.
Eryngium crinitum	.	.	.	.	.	.	29	.	.	.
Viola ucriana	.	.	.	.	.	.	10	.	.	.
Tanaceto siculi-Brachypodietum rupestris										
Teucrium siculum	.	.	.	.	.	.	.	100	.	5
Tanacetum vulgare subsp. siculum	.	.	.	.	.	.	.	100	.	.
Carlina hispanica subsp. globosa	.	.	.	.	.	.	.	80	.	.
Micromeria graeca subsp. consentina	.	.	.	.	.	.	.	80	.	.
Thymus longicaulis	.	.	.	.	.	.	.	100	78	.
Polygalo mediterraneae-Brachypodietum rupestris										
Carex flacca subsp. serrulata	.	.	.	.	.	.	.	.	88	16
Polygala nicaeensis subsp. mediterranea	.	.	.	.	.	17	.	.	100	.
Stachys germanica subsp. salviifolia	.	.	.	.	.	.	.	.	66	5
Ophrys incubacea	.	.	.	.	.	.	.	.	66	.
Ophrys lucana	.	.	.	.	.	.	.	.	55	.
Galio lucidi-Brachypodietum rupestris										
Galium lucidum	.	.	.	.	.	.	72	.	67	63
Trifolium ochroleucon	8	26	30	30	.	8	43	.	.	31
Lathyrus sylvestris	.	.	.	.	16	21	5	.	.	36
Loncomelos narbonensis	.	.	.	.	.	4	5	.	.	42
Scabiosa columbaria	.	.	.	.	.	13	.	.	44	36
Melica transsilvanica	.	.	.	.	.	.	.	.	.	36
Festuco-Brometea										
Brachypodium rupestre	23	53	.	.	100	100	100	100	100	100
Festuca circummediterranea	77	74	10	10	.	.	2	80	11	.
Prunella laciniata	.	32	50	70	.	13	2	.	22	21
Linum usitatissimum subsp. angustifolium	.	5	30	30	.	4	5	.	22	.
Hypericum perfoliatum	.	.	30	30	.	.	45	40	22	.
Muscari comosum	8	5	10	.	.	.	.	.	33	5
Anacamptis pyramidalis	.	.	.	.	.	8	11	.	11	5
Bromopsis erecta	.	.	.	.	66	17	.	.	66	42
Phleum hirsutum subsp. ambiguum	.	.	.	.	.	.	21	20	22	47
Poterium sanguisorba subsp. balearicum	.	.	.	.	.	13	18	.	100	63
Teucrium chamaedrys	.	.	.	.	16	43	.	.	55	21
Festuca sicula	8	58	.	.	.	.	5	.	.	.
Carex flacca	.	.	.	.	33	47	35	.	.	.
Convolvulus cantabrica	.	.	.	.	16	.	5	.	.	11
Eryngium amethystinum	.	.	.	.	.	4	.	.	33	21

Column's number	1	2	3	4	5	6	7	8	9	10
Eryngium campestre	.	.	.	.	.	.	75	80	89	.
Galium verum	54	37	.	.	.	30	.	.	.	.
Anthyllis vulneraria subsp. maura	.	.	50	10	.	.	10	.	.	.
Carduus nutans	8	5	.	.	.	.	.	.	11	.
Thymus spinulosus	8	5	.	.	.	.	2	.	.	.
Trifolium leucanthum	.	.	90	50	.	.	10	.	.	.
Neotinea tridentata	.	5	.	.	.	.	.	.	11	.
Parentucellia latifolia	.	.	50	30	.	.	.	.	.	.
Odontites luteus	.	.	.	.	33	4	.	.	.	.
Anacamptis morio	.	.	.	.	.	4	.	.	33	.
Arabis collina	.	.	.	.	.	.	8	.	11	.
Asphodeline lutea	.	.	.	.	.	.	16	60	.	.
Briza media	.	.	.	.	.	4	.	.	33	.
Bunium bulbocastanum	.	.	.	.	.	8	.	.	.	5
Carlina vulgaris	.	.	.	.	.	17	.	.	33	.
Centaurea deusta	.	.	.	.	.	.	.	.	11	11
Centaurea jacea subsp. gaudinii	.	.	.	.	.	56	.	.	77	.
Ononis spinosa	.	.	.	.	.	.	.	.	66	5
Potentilla pedata	.	.	.	.	.	.	.	.	22	5
Ranunculus millefoliatus	.	.	.	.	.	.	5	.	.	5
Stachys italica	.	.	.	.	.	.	2	.	11	.
Tragopogon pratensis	.	.	.	.	.	4	.	.	.	26
Allium vineale	.	.	.	.	.	.	.	.	11	5
Allium roseum	.	.	.	.	.	.	5	20	.	.
Allium sphaerocephalon	.	.	.	.	.	.	13	60	.	.
Asperula aristata	.	.	.	.	.	.	5	.	11	.
Ornithogalum gussonei	.	16	.	.	.	.	.	.	.	.
Centaurea scabiosa	.	.	.	.	.	4	.	.	.	.
Cruciata glabra	.	.	.	.	.	30	.	.	.	.
Cytisus hirsutus	.	.	.	.	.	4	.	.	.	.
Gymnadenia conopsea	.	.	.	.	.	8	.	.	.	.
Inula salicina	.	.	.	.	.	17	.	.	.	.
Linum viscosum	.	.	.	.	.	8	.	.	.	.
Polygala flavescens	.	.	.	.	.	4	.	.	.	.
Silene otites	.	.	.	.	.	4	.	.	.	.
Anthyllis vulneraria subsp. busambarensis	.	.	.	.	.	.	8	.	.	.
Carlina sicula	.	.	.	.	.	.	8	.	.	.
Dianthus siculus	.	.	.	.	.	.	8	.	.	.
Erysimum bonannianum	.	.	.	.	.	.	8	.	.	.
Lactuca viminea	.	.	.	.	.	.	2	.	.	.
Ornithogalum montanum	.	.	.	.	.	.	2	.	.	.
Phlomis herba-venti	.	.	.	.	.	.	5	.	.	.
Pimpinella peregrina	.	.	.	.	.	.	8	.	.	.
Prangos ferulacea	.	.	.	.	.	.	16	.	.	.
Scorzonera hirsuta	.	.	.	.	.	.	8	.	.	.
Carduus nutans subsp. siculus	.	.	.	.	.	.	.	40	.	.
Teucrium montanum	.	.	.	.	.	.	2	.	.	.
Viola aethnensis subsp. messanensis	.	.	.	.	.	.	.	60	.	.
Achillea setacea	.	.	.	.	.	.	.	.	11	.
Anacamptis coriophora	.	.	.	.	.	.	.	.	22	.
Anacamptis papilionacea	.	.	.	.	.	.	.	.	44	.
Crepis lacera	.	.	.	.	.	.	.	.	11	.
Cuscuta epithymum	.	.	.	.	.	.	.	.	11	.
Helictochloa praetutiana	.	.	.	.	.	.	.	.	44	.
Himantoglossum hircinum	.	.	.	.	.	.	.	.	22	.
Jurinea mollis	.	.	.	.	.	.	.	.	11	.
Koeleria splendens	.	.	.	.	.	.	.	.	44	.
Leontodon hispidus	.	.	.	.	.	.	.	.	22	.
Linum catharticum	.	.	.	.	.	.	.	.	11	.
Lomelosia crenata subsp. pseudisetensis	.	.	.	.	.	.	.	.	11	.
Ononis pusilla	.	.	.	.	.	.	.	.	22	.
Ophrys apifera	.	.	.	.	.	.	.	.	22	.
Ophrys bertolonii	.	.	.	.	.	.	.	.	22	.
Ophrys lacaitae	.	.	.	.	.	.	.	.	22	.
Ophrys passionis	.	.	.	.	.	.	.	.	22	.
Ophrys passionis subsp. garganica	.	.	.	.	.	.	.	.	11	.
Ophrys passionis subsp. pseudoatrata	.	.	.	.	.	.	.	.	44	.
Ophrys sphegodes	.	.	.	.	.	.	.	.	11	.
Orchis anthropophora	.	.	.	.	.	.	.	.	33	.
Orchis mascula	.	.	.	.	.	.	.	.	11	.
Orchis quadripunctata	.	.	.	.	.	.	.	.	33	.
Phleum nodosum	.	.	.	.	.	.	.	.	11	.
Pilosella piloselloides	.	.	.	.	.	.	.	.	22	.
Pimpinella tragium	.	.	.	.	.	.	.	.	11	.
Saxifraga granulata	.	.	.	.	.	.	.	.	22	.
Serapias vomeracea	.	.	.	.	.	.	.	.	44	.
Seseli montanum	.	.	.	.	.	.	.	.	11	.
Thymus oenipontanus	.	.	.	.	.	.	.	.	22	.
Anthyllis vulneraria subsp. rubriflora	.	.	.	.	.	.	.	.	55	.
Arabis hirsuta	.	.	.	.	.	.	.	.	11	.
Carex caryophyllea	.	.	.	.	.	.	.	.	22	.
Carlina acaulis subsp. caulescens	.	.	.	.	.	.	.	.	22	.
Luzula campestris	.	.	.	.	.	.	.	.	11	.
Bupleurum baldense	.	.	.	.	.	.	.	.	.	5
Cerastium arvense	.	.	.	.	.	.	.	.	.	16
Dianthus carthusianorum	.	.	.	.	.	.	.	.	.	5

Column's number	1	2	3	4	5	6	7	8	9	10
Dianthus sylvestris	.	.	.	.	.	.	.	.	.	5
Erysimum pseudorhaeticum	.	.	.	.	.	.	.	.	.	5
Lilium bulbiferum subsp. croceum	.	.	.	.	.	.	.	.	.	5
Melica minuta subsp. latifolia	.	.	.	.	.	.	.	.	.	5
Potentilla recta	.	.	.	.	.	.	.	.	.	16
Allium tenuiflorum	.	.	.	.	.	.	.	.	.	11
Trifolio-Geranietea										
Agrimonia eupatoria	.	.	.	.	50	47	2	.	22	11
Silene italica subsp. sicula	15	5	.	10	.	.	59	60	.	.
Clinopodium nepeta	.	.	.	.	66	21	18	60	.	.
Clinopodium vulgare subsp. arundanum	.	.	.	.	.	21	5	.	11	.
Campanula rapunculus	.	.	.	.	.	4	.	.	.	42
Securigera securidaca	.	.	.	.	33	.	.	.	.	26
Origanum vulgare	.	.	.	.	33	.	.	.	.	.
Campanula persicifolia	.	.	.	.	.	8	.	.	.	.
Inula conyzae	.	.	.	.	.	13	.	.	.	.
Securigera varia	.	.	.	.	.	8	.	.	.	.
Silene italica	.	.	.	.	.	8	.	.	.	.
Cota triumfettii	.	.	.	.	.	.	5	.	.	.
Pimpinella anisoides	.	.	.	.	.	.	8	.	.	.
Vicia ochroleuca	.	.	.	.	.	.	5	.	.	.
Hypericum montanum	.	.	.	.	.	.	.	.	11	.
Trifolium alpestre	.	.	.	.	.	.	.	.	11	.
Galium mollugo	.	.	.	.	.	.	.	.	.	11
Geranium sanguineum	.	.	.	.	.	.	.	.	.	5
Poetea bulbosae										
Anthoxanthum odoratum	8	89	50	70	.	4	43	100	78	.
Poa bulbosa	92	79	30	.	.	.	.	.	33	11
Anthemis arvensis subsp. sphacelata	100	100	95	100	.	.	.	.	.	.
Logfia heterantha	23	63	10	50	.	.	.	.	.	.
Trifolium glomeratum	.	5	10	10	.	.	5	.	.	.
Hypochaeris cretensis	31	42	.	.	.	.	13	.	.	.
Tolpis virgata	.	.	55	8	.	.	2	.	.	.
Trifolium strictum	.	74	70	50	.	.	.	.	.	.
Trifolium bivonae	.	.	33	11	.	.	10	.	.	.
Plantago cupanii	31	89	.	.	.	.	.	.	.	.
Trifolium subterraneum	.	.	10	.	.	.	.	20	.	.
Trifolium tomentosum	8	5	.	.	.	.	.	.	.	.
Trifolium suffocatum	.	.	10	.	.	.	.	.	.	.
Plantago serraria	.	.	.	.	.	.	.	20	.	.
Trifolium nigrescens	.	.	.	.	.	.	.	20	.	.
Leontodon tuberosus	.	.	.	.	.	.	.	.	33	.
Molinio-Arrhenatheretea										
Cynosurus cristatus	15	89	95	85	.	.	35	60	33	5
Lolium perenne	100	100	100	85	16	.	29	20	.	21
Prunella vulgaris	.	5	10	10	.	21	5	20	44	11
Phleum pratense	8	5	30	.	.	4	.	20	11	5
Hypochaeris radicata	46	26	90	88	.	.	40	20	.	.
Poa trivialis	.	.	30	30	66	26	37	.	.	21
Trifolium repens	62	32	30	30	.	.	.	.	33	11
Bellis perennis	85	47	30	50	.	.	.	.	55	.
Rumex acetosa	8	5	10	10	.	4	.	.	.	.
Trifolium lappaceum	8	.	10	30	.	.	5	.	.	5
Oenanthe pimpinelloides	.	.	10	10	.	.	13	60	.	5
Holcus lanatus	.	.	10	10	.	17	.	.	.	5
Carex divisa	8	74	10	50	.	.	.	.	.	.
Mentha pulegium	.	5	50	1	.	.	.	.	22	.
Lolium arundinaceum	.	.	.	.	.	30	8	.	.	21
Ranunculus bulbosus	.	.	.	.	.	.	29	.	67	36
Oenanthe lachenalii	.	11	50	50	.	.	.	.	.	.
Poa sylvicola	.	.	.	.	.	.	3	.	22	21
Sagina alexandrae	8	16	.	.	.	.	.	.	.	.
Veronica serpyllifolia	15	21	.	.	.	.	.	.	.	.
Lathyrus pratensis	.	.	.	10	.	34	.	.	.	.
Elymus repens	.	.	.	.	50	.	5	.	.	.
Leucanthemum vulgare	.	.	.	.	.	13	.	.	22	.
Poa pratensis	.	.	.	.	.	.	.	.	66	16
Achillea millefolium	.	.	.	.	.	30	.	.	33	.
Hordeum bulbosum	.	.	.	.	.	.	29	.	.	5
Ajuga reptans	.	.	.	.	.	4	.	.	22	.
Anacamptis laxiflora	.	.	10	10	.	.	.	.	.	.
Arrhenatherum elatius subsp. bulbosum	.	.	.	10	.	.	29	.	.	.
Pulicaria dysenterica	.	.	.	.	.	26	.	20	.	.
Oenanthe globulosa	.	5	.	.	.	.	.	.	.	.
Trifolium fragiferum	.	5	.	.	.	.	.	.	.	.
Trifolium micranthum	.	5	.	.	.	.	.	.	.	.
Verbena officinalis	.	5	.	.	.	.	.	.	.	.
Trifolium resupinatum	.	.	10	.	.	.	.	.	.	.
Centaurea nigrescens	.	.	.	.	16	.	.	.	.	.
Glycyrrhiza glabra	.	.	.	.	16	.	.	.	.	.
Bellevalia romana	.	.	.	.	.	13	.	.	.	.
Galega officinalis	.	.	.	.	.	8	.	.	.	.
Pastinaca sativa	.	.	.	.	.	13	.	.	.	.
Narcissus tazetta	.	.	.	.	.	.	5	.	.	.
Ranunculus pratensis	.	.	.	.	.	.	18	.	.	.

Column's number	1	2	3	4	5	6	7	8	9	10
Potentilla reptans	.	.	.	.	.	.	.	80	.	.
Agrostis capillaris	.	.	.	.	.	.	.	.	11	.
Carex distans	.	.	.	.	.	.	.	.	22	.
Colchicum lusitanum	.	.	.	.	.	.	.	.	11	.
Onobrychis viciifolia	.	.	.	.	.	.	.	.	11	.
Rhinanthus minor	.	.	.	.	.	.	.	.	33	.
Scirpoides holoschoenus	.	.	.	.	.	.	.	.	11	.
Gaudinia fragilis	.	.	.	.	.	.	.	.	.	16
Mentha suaveolens	.	.	.	.	.	.	.	.	.	26
Phalaris aquatica	.	.	.	.	.	.	.	.	.	16
Rumex obtusifolius	.	.	.	.	.	.	.	.	.	5
wide-ecology grassland species										
Plantago lanceolata	100	100	70	90	16	.	8	40	56	26
Daucus carota	.	26	30	10	33	43	70	60	44	58
Trifolium pratense s.l.	69	58	86	93	.	21	24	60	44	31
Trifolium campestre	.	26	85	50	16	4	70	100	33	366
Dactylis glomerata s.l.	.	21	70	30	83	91	97	80	100	95
Bromus hordeaceus	46	47	50	30	.	.	.	40	33	16
Festuca rubra	8	5	10	.	.	4	27	.	22	.
Lotus corniculatus	.	16	.	.	50	26	.	.	66	21
Blackstonia perfoliata					16	21	14	.	33	36
Trifolium incarnatum subsp. molinerii	.	.	70	50	.	.	16	.	22	.

Plantaginion cupanii communities (*Cynosuro-Leontodontetum siculi*, *Genisto-Potentilletum calabrae*) *B. rupestre* exhibits just a sporadic occurrence and only in the *Genisto-Potentilletum* (see Tab. 5). The dominant species of the *Plantaginion cupanii*, besides *Plantago cupanii* itself, are *Molinio-Arrhenatheretea* species. In particular, on the basis of the cover/abundance values, the *Cynosuro-Leontodontetum* (type-association of *Plantaginion cupanii*) could be easily defined as a sort of S-Mediterranean-montane variant of the European *Lolio-Cynosurietum*. Instead, in the *Brachypodium rupestre* communities, *Cynosurus cristatus* and *Lolium perenne* exhibit very low frequency and cover values and the role of the other *Molinio-Arrhenatheretea* species is always secondary if compared to that played by the *Festuco-Brometea* species (Fig. 7). The reference to the *Poetea bulbosae* derives simply from the fact that Mucina *et al*. (2016) moved into this class the order *Cirsietalia vallis-demoni*, that had originally been classified in the *Molinio-Arrhenatheretea*. However, again in this case, the species of the *Poetea bulbosae* are few in number in the *B. rupestre* communities and always show very low frequency and cover values (see Tab. 5). In the light of all these arguments, we think that our choice of classifying the Sicilian *B. rupestre* communities in the *Festuco-Brometea* seems to be not only the most coenologically appropriate, but also the most closely in line with the recent Italian and European syntaxonomic frameworks. From a syndynamical viewpoint, the Sicilian *Brachypodium rupestre* communities exhibit a substantial similarity with those occurring in central Italy. Indeed, in both areas the oak forests are the most usual reference as potential vegetation. However, in Sicily these potential oak woods are generally dominated by *taxa* (as proposed in Brullo *et al.*, 1999), such as *Quercus virgiliana*, *Quercus leptobalana* and *Q. congesta*, which although belonging to the complex of *Q. pubescens s.l.* are considered as microthermic species and therefore restricted to the montane belt of the island. Instead, especially on the Tyrrhenian side of central Italy, the wide occurrence of *Brachypodium rupestre* stands within the whole colline bioclimatic belt allows many thermophilous oak forests (e.g. *Pistacio terebinthi-Quercetum pubescentis*, *Rubio-Quercetum cerridis*, etc.) and deciduous-evergreen microwoods (e.g. *Lonicero-Carpinetum orientalis*) to act as potential vegetation types (Blasi & Di Pietro, 1998; Blasi *et al*., 2000, 2001).

Conclusions

In this paper the *Brachypodium rupestre* communities of the whole Tyrrhenian side of Sicily and of the inner areas of the Sicani mountains were investigated from a phytosociological and syntaxonomic point of view. It emerged that the *Brachypodium rupestre* communities are found exclusively within a bioclimatic belt ranging between 800 and 1400 m. This range is significantly narrower than that covered by the *B. rupestre* communities in the rest of the Italian Peninsula, where they occur from sea level up to about 1500 m. From a syntaxonomical viewpoint two new associations, *Lolio pluriflori-Brachypodietum* and *Tanaceto siculi-Brachypodietum* were identified. These associations are linked to different bedrock types: limestone for the *Lolio pluriflori-Brachypodietum* and metamorphic substrates for the *Tanaceto siculi-Brachypodietum*. The description of two new associations for Sicily and the validation of the *Polygalo mediterraneae-Brachypodietum rupestris* for the Lucanian Apennines enable a large gap in the syntaxonomical knowledge of the *Brachypodium rupestre* grasslands in the southern Italy to be filled. The fact that almost all the stands of these two associations have been subjected to disturbances linked to the traditional agricultural, silvicultural and pastoral human activities make the Sicilian *Brachypodium rupestre* communities open to the ingression of edge-habitat species. Nevertheless, the high number of species per relevé, and the fact that the role of the *Festuco-Brometea* and *Molinio-Arrhenatheretea* species always prevailed over that of *Trifolio-Geranietea* led us to classify these communities in the *Festuco-Brometea*. The decision to propose the *Festuco-Brometea* as occurring in Sicily represents a big syntaxonomic novelty, especially considering what is currently reported in the Prodrome of the Italian vegetation and in the Eurovegchecklist. In fact, the arguments presented in this work on the basis of the results obtained confirm that the classification of the Sicilian *Brachypodium rupestre* grasslands in the *Festuco-Brometea* is the most obvious choice and is perfectly in the line with what has been proposed in the majority of the European countries. A possible classification within the Sicilian endemic order *Cirsietalia vallis-demoni*, which would lead to a reference, at the

rank of class, to *Molinio-Arrhenatheretea* or *Poetea bulbosae*, is not justified from either a floristic or coenological viewpoint. It is true that in the last decade, especially in the Italian Peninsula, the classic floristic and coenological concepts at the base of the diagnosis of the *Molinio-Arrhenatheretea* have been reviewed under a Mediterranean perspective (see Blasi *et al*., 2010, 2012; Rodríguez-Rojo & Fernández-González, 2014; Di Pietro *et al*., 2017b). However, the possibility of considering the *Brachypodium rupestre* semi-mesophilous grasslands as suitable to be moved into the *Molinio-Arrhenatheretea* would be, in our opinion, an over-hasty and binding decision without first having the support of a general analysis of these grasslands at a European level. On the other hand, the classification of the *Brachypodium rupestre* communities in Mediterranean grassland or garrigue classes different from the *Festuco-Brometea*, such as *Poetea bulbosae*, *Rosmarinetea*, *Rumici-Astragaletea*, *Lygeo-Stipetea* or *Helianthemetea guttati*, even if justified in phytogeographical terms, is not feasible from a floristic, coenological and structural point of view.

Syntaxonomic scheme

FESTUCO-BROMETEA Br.-Bl. & Tuxen ex Br.-Bl. 1949
BROMETALIA ERECTI W. Koch 1926
BROMENALIA ERECTI Terzi, Di Pietro & Theurillat 2016
[*Leucanthemo-Bromenalia* Biondi *et al*. 1995 inval. Art. 2b]
Polygalo mediterraneae-Bromion erecti (Biondi, Allegrezza & Zuccarello 2005) Di Pietro in Di Pietro *et al*. 2015
Lolio pluriflori-Brachypodietum rupestris ass. nova [*holotypus*: Tab. 1, rel. 2]
typicum subass. nova
violetosum ucrianae subass. nova [*holotypus* Table 1 rel. 27]
Tanaceto siculi-Brachypodietum rupestris ass. nova [*holotypus*: Tab. 1, rel. 38]
Polygalo mediterraneae-Brachypodietum rupestris Di Pietro, Conte & Iamonico ex Di Pietro in Gianguzzi, Caldarella & Di Pietro ass. nova.

Other syntaxa quoted in the text

Agropyretea intermedio-repentis Müller & Görs 1969; *Arrhenathero nebrodensis-Quercetum cerridis* Brullo *et al*. 1996; *Artemisietea vulgaris* Lohmeyer *et al*. in Tüxen ex von Rochow 1951; *Bituminario bituminosae-Brachypodietum rupestris* Allegrezza *et al*. 2016; *Brachypodietalia pinnati* Korneck 1974 *nom. conserv. propos*.; *Bromenalia erecti* Terzi *et al*. 2016; *Brometalia erecti* Koch 1926; *Bromion erecti* Koch 1926; *Cachryetum ferulaceae* Raimondo 1980; *Cerastio-Astragalion nebrodensis* Pignatti & Nimis ex S. Brullo 1984; *Cerastio-Carlinetea nebrodensis* Brullo 1984; *Chenopodietea* Br.-Bl. in Br.-Bl. *et al*. 1952; *Cirsietalia vallis-demoni* Brullo & Grillo 1978; *Cirsio-Brachypodion pinnati* Hadač & Klika in Klika et Hadač 1944; *Conopodio capillifolii-Quercetum congestae* Maniscalco & Raimondo 2009; *Cynosuro-Leontodontetum siculi helianthemetosum* Brullo & Grillo 1978; *Cynosuro-Leontodontetum siculi typicum* Brullo & Grillo 1978; *Cytiso spinescentis-Bromion erecti* Bonin 1978; *Dorycnio herbacei-Brachypodienalia rupestris* Allegrezza *et al*. 2016; *Dorycnio herbacei-Brachypodion rupestris* Allegrezza *et al*. 2016; *Dorycnio penthaphylli-Brachypodietum rupestris* Ubaldi 1988; *Festuco hystricis-Ononidetea striatae* Rivas-Mart. *et al*. 2002; *Galio erecti-Brachypodietum rupestris* Allegrezza *et al*. 2016; *Galio lucidi-Brachypodietum rupestris* Di Pietro & Blasi 2002; *Genisto-Potentilletum calabrae airetosum cupanianae* Brullo & Grillo 1978; *Genisto-Potentilletum calabrae typicum* Brullo & Grillo 1978; *Helianthemetea guttati* Rivas Goday & Rivas-Mart. 1963; *Ilici aquifolii-Quercetum leptobalani* Maniscalco & Raimondo 2009; *Leucanthemo vulgaris-Bromenalia erecti* Biondi *et al*. 1995; *Lino punctati-Seslerietum nitidae* Pignatti & Nimis in Pignatti *et al*. 1980; *Lolio-Cynosuretum* (Br.-Bl. & De Leeuw 1936) Tüxen 1937; *Lonicero etruscae-Carpinetum orientalis* Blasi *et al*. 2001; *Lygeo sparti-Stipetea tenacissimae* Rivas-Mart. 1978 nom. conserv. propos.; *Molinio-Arrhenatheretea* Tüxen 1937; *Oleo-Quercetum virgilianae* Brullo 1984; *Onopordetea acanthii* Br.-Bl. & Tüxen ex Klika & Hadac 1944; *Onopordion illyrici* Oberdorfer 1954; *Phleo ambigui-Brometalia erecti* Biondi, Allegrezza, Blasi & Galdenzi in Biondi *et al*. 2014; *Pistacio terebinthi-Quercetum pubescentis* Allegrezza *et al*. 2002; *Plantagionion cupanii* Brullo & Grillo 1978; *Poetea bulbosae* Rivas Goday & Rivas-Mart. in Rivas-Mart. 1978; *Polygalo flavescentis-Brachypodietum* Lucchese *et al*. 1995; *Pteridio-Tanacetum siculi* Brullo & Marcenò 1985; *Ptilostemo stricti-Quercenion cerridis* Bonin & Gamisans 1976; *Quercetum leptobalani* Brullo 1984; *Rosmarinetea officinalis* Rivas-Mart. *et al*. 2002; *Rubio peregrinae-Quercetum cerridis* Di Pietro *et al*. 2010; *Rumici-Astragaletalia siculi* Pignatti & Nimis in Pignatti *et al*. 1980; *Rumici-Astragaletea siculi* Pignatti & Nimis in Pignatti *et al*. 1980; *Seslerio nitidae-Caricion macrolepidis* Ubaldi 1997; *Sorbo torminalis-Quercetum virgilianae* Brullo *et al*. 1996; *Stipo-Trachynietea distachyae* Brullo in Brullo *et al*. 2001; *Tanaceto corymbosi-Brachypodietum rupestris* Allegrezza *et al*. 2016; *Trifolio-Geranietea sanguinei* Müller 1962.

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Appendix I: Validation of the *POLYGALO MEDITERRANEAE-BRACHYPODIETUM RUPESTRIS* Di Pietro, Conte & Iamonico ass. nov.

The *Polygalo mediterraneae-Brachypodietum rupestris* was described by Di Pietro *et al*. (2014) in the explanatory notes of the Vegetation map of the area of San Martino D'Agri in the Lucanian Apennines National Park. A brief description and a type-relevé was provided in the original publication. Accordingly the *Polygalo mediterraeae-Brachypodietum* is to be considered invalid being the proposal of new association expressedly declared as provisional (Art. 3b). In the present paper one of us (R. Di Pietro), validates the *Polygalo mediterraneae-Brachypodietum rupestris* Di Pietro, Conte & Iamonico 2014 presenting a complete phytosociological table (Tab. 4) and designating as *holotypus* the relevé n° 3 of Table 4.

Characteristic species – The characteristic species of the *Polygalo mediterraneae-Brachypodietum rupestris* are: *Brachypodium rupestre* (Host) Roem. & Schult. (physiognomic guide species), *Polygala nicaeensis* W.D.J. Koch subsp. *mediterranea* Chodat, *Carex flacca* Schreb. subsp. *erythrostachys* (Hoppe) Holub, *Stachys germanica* L. subsp. *salviifolia* (Ten.) Gams, *Ophrys fusca* subsp. *lucana* (P. Delforge, Devillers-Terschuren & Devillers) Kreutz, *Ophrys incubacea* Bianca, *Ophrys pseudoatrata* S. Hertel & Presser. The first three species are to be considered as playing the role of transgressive species (see Poldini & Sburlino, 2005) from the alliance *Polygalo-Bromion*.

Structure and ecology – Grassland type dominated by *Brachypodium rupestre* with a relatively close and homogeneous structure and an average cover degree (85-90%). The community is mainly found within the N-facing exposures, especially on gentle slopes, at altitudes ranging between 500 and 1300 m. The *Polygalo mediterraneae-Brachypodietum* exhibits a high floristic diversity that in some cases can even exceed 70 species per relevés, considering a plot-size of about 100 m^2. The average number of species per relevé is 46. The *Polygalo-Brachypodietum* has a relatively variable floristic component depending on the micro-morphology of the substrate. It hosts typically mesophilous species in the small depressions (e.g. *Cynosurus cristatus*, *Phleum pratense*, *Anthoxanthum odoratum*, *Luzula campestris*, etc.) or significantly more xerophilous species on the lines of displuvia (e.g. *Bromopsis erecta*, *Koeleria splendens*, *Phleum hirsutum* subsp. *ambiguum*, *Eryngium amethystinum*, *Lomelosia crenata* subsp. *pseudisetensis*, etc.).

Substrate – This association is developed on pelithic-calcareous or pelithic arenaceous flysch with a high clay component

Bioclimate – Meso-Mediterranean and Meso-Temperate thermotypes; humid umbrotype.

Syndinamism – It is dynamically linked to the *Spartium junceum*, *Prunus spinosa* and *Rosa canina* scrubs, and to the *Quercus cerris* woods of the *Ptilostemo stricti-Quercenion cerridis*.

Distribution – submontane and lower montane belt of the Lucanian Apennines and likely of the Pollino massif. It can be considered a geographical vicariant of the *Polygalo flavescentis-Brachypodietum* of the central Apennines.

Appendix II: Sporadic species

Tab. 1 - *Lolio pluriflori-Brachypodietum* & *Tanaceto siculi-Brachypodietum* - Rel. 4:, Prunella laciniata (L.) L. +; rel. 5: Tolpis virgata (Desf.) Bertol. subsp. virgata +; rel. 7: Ornithogalum montanum Cirillo ex Ten. +; rel. 10: Thymus spinulosus Ten. +; rel. 17: Lactuca viminea (L.) J. Presl & C. Presl subsp. viminea +, Teucrium montanum L. +; rel. 32: Poa sylvicola Guss. +; rel. 33: Xeranthemum inapertum (L.) Mill. +; rel. 34: Stachys italica Mill. +; rel. 38: Trifolium nigrescens Viv. subsp. nigrescens 2, Cynara cardunculus L. 1, Plantago serraria L. +, Pallenis spinosa (L.) Cass. subsp. spinosa +, Echium italicum L. subsp. siculum (Lacaita) Greuter & Burdet +, Galactites tomentosus Moench +, Petrosedum tenuifolium (Sm.) Grulich +, Phleum pratense L. 1, Trifolium subterraneum L. +.

Tab. 4 - *Polygalo mediterraneae-Brachypodietum rupestris* - Rel. 1: Potentilla reptans L. +, Dasypyrum villosum (L.) P.Candargy 1, Vicia bithynica (L.) L. +, Cynara cardunculus L. +, Crataegus monogyna Jacq. +, Cuscuta epithymum (L.) L. +, Medicago sativa L. +; rel. 2: Anisantha madritensis (L.) Nevski subsp. madritensis +, Picris hieracioides L. subsp. hieracioides 1, Sonchus asper (L.) Hill subsp. asper +, Clinopodium vulgare L. subsp. arundanum (Boiss.) Nyman +, Trifolium alpestre L. +; rel. 3: Colchicum lusitanum Brot. +, Salvia verbenaca L. +, Geranium molle L. +, Cirsium arvense (L.) Scop. +, Ononis viscosa L. subsp. breviflora (DC.) Nyman +; rel. 4: Hippocrepis biflora Spreng. +, Reichardia picroides (L.)

Roth +, Teucrium capitatum L. subsp. capitatum +, Clinopodium acinos (L.) Kuntze +, Petrosedum tenuifolium (Sm.) Grulich +, Hippocrepis ciliata Willd. +, Lomelosia crenata (Cirillo) Greuter & Burdet subsp. pseudisetensis (Lacaita) Greuter & Burdet +, Ophrys sphegodes Mill. subsp. sphegodes 1; rel. 5: Phleum pratense L. subsp. pratense 2, Potentilla recta L.1, Trigonella sulcata (Desf.) Coulot & Rabaute 2, Oloptum miliaceum (L.) Röser & H.R.Hamasha 1, Lotus hirsutus L. +, Gladiolus italicus Mill. +, Ophrys lutea Cav. 1; rel. 7: Phleum nodosum L.1, Brachypodium distachyon (L.) P.Beauv. +, Petrorhagia saxifraga (L.) Link subsp. gasparrinii (Guss.) Greuter & Burdet 1; rel. 8: Luzula campestris (L.) DC. subsp. campestris +, Festuca rubra L. subsp. microphylla St.-Yves 1, Cynosurus echinatus L. 1, Allium vineale L. +, Ophrys passionis subsp. garganica E. Nelson ex H. Baumann & R. Lorenz +, Scirpoides holoschoenus (L.) Soják +; rel. 9: Agrostis capillaris L. subsp. capillaris +, Asperula aristata L.f. subsp. aristata 1, Aremonia agrimonoides (L.) DC. subsp. agrimonoides +, Emerus major Mill. subsp. emeroides (Boiss. & Spruner) Soldano & F.Conti +, Genista tinctoria L. 1, Hypericum montanum L. 2, Primula vulgaris Huds. subsp. vulgaris +, Tussilago farfara L. +, Vicia incana Gouan +.

Appendix III: Place and date of the phytosociological relevés

Tab. 1 - Rel. 1: Gratteri, Monte Macabubbo (04.06.2009); rels. 2, 3: Casteldaccia, Pizzo Finocchiaro (21.05.2003); rels. 4, 5: Monreale, Portella della Cannavera (08.06.2007); rels. 6, 7: Monreale, Monte Signora (08.06.2007); rels. 8, 9: Monreale, Monte Matassaro Renda (12.06.2007); rels. 10, 11: Corleone, C.da Barracù (15.05.2008); rel. 12: Bisacquino, C.da Gibilcanna (15.05.2008); rel. 13: Palazzo Adriano, Portella di Gebbia (15.05.2008); rels. 14, 15: Lercara Friddi, Serra di Pietre Cadute (05.06.2008); rel. 16: Prizzi, Demanio Cozzo della Fieravecchia (05.06.2008); rels. 17, 18: Palazzo Adriano, Monte Rose (06.06.2008); rel. 19: Palazzo Adriano, Monte Pernice (06.06.2008); rel. 20: Piana degli Albanesi, C.da S. Agata Franzisi (24.05.2008); rels. 21, 22: Piana degli Albanesi, Cozzo S. Agata (28.05.2008); rels. 23, 24: Frazzanò, Passo della Zita (28.05.2016); rels. 25, 26: Godrano, Rocca Busambra alle Coste Cerasa (03.06.2016); rels. 27-30: Monreale, Serra del Frassino (30.05.2016); rel. 31: Gangi, Monte S. Calogero (30.05.2007); rels. 32-34: Madonie, Cozzo Piombino (29.05.2007); rel. 35: Petralia Sottana, P.lla Arena (11.06.2007); rels. 36, 37: Petralia Sottana, Portella di Colla (30.05.2007); rel. 38: Fondachelli Fantina, versante Nord-est di Monte Castello d'Orlando (10.07.2017); rels. 39, 40: Mandanici, lungo la dorsale (10.07.2017); rels. 41, 42: Mandanici, presso Portella Fossa Lupo (10.07.2017).

Tab. 4 - Rel 1: Masseria Piccinninno M. Raparello (08.06.2012); rel. 2: Ponte Gaddone i' Mannar (20.05.2011); rels. 3, 4, 5: Sorva - M. Raparello (20.05.2011); rel. 6: Ponte Gaddone i' Mannar (20.05.2011); rel. 7: M. Raparello (08.07.2011); rel. 8: Strada per M. Raparello (08.06.2012); rel. 9: Vetta Raparello (10.07.2011).