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The vegetation and the plant landscape of Monte Sassotetto (Sibillini Mountains, Central Apennines)

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Abstract
We present here a detailed phytosociological study of the vegetation and the plant landscape of the north-eastern slopes of Monte Sassotetto (Sibillini Mountains, central Apennines), which is part of an extensive skiing area. The findings have revealed the high vegetational diversity of the study area, as shown by the 11 vegetational typologies identified, which are updated with the latest syntaxonomic and nomenclatural revisions. Nine of these belong to Habitats of Community Interest (SCI). The new associations described here are *Gentiano luteae-Brachypodietum genuensis*, *Luzulo sieberi-Brachypodietum genuensis* and *Dichoropetalo carvifolii-chabraeii-Paeonietum italicae*, as well as the subassociations and the syntaxon variants that have already been described in the literature. The geological and geomorphological variability, the vast areas of pasture land that have been long abandoned by traditional human activities, and the management of the ski slopes make this a territory that is indeed representative for the analysis of the biotic and abiotic ecological factors that can have effects on the phytocoenosis and species diversity. Along with the lithological characteristics, the geomorphology together with the steepness of the slopes and the acidity of the soil are the most significant abiotic factors for the interpretation of the vegetational diversity of this territory. For the grasslands, the study has allowed the indication in particular of *Filipendulo vulgaris-Trifolietum montani* (Habitat 6210*) as grassland communities at risk of disappearing due to the floristic-vegetational changes. Abandonment of the traditional human practices has triggered the natural dynamic processes of the vegetation. In locations where disturbance has been practically absent for a long time, under conditions of deep soil and prolonged snow cover, there has been progression of the natural dynamic processes. This has also been accelerated by the forest coenoses, which has led to the replacement of the grasslands included in the association *Filipendulo vulgaris-Trifolietum montani* (Habitat 6210*), with coenoses that are included in the class *Trifolio-Geranietea*, with the subsequent loss of this Habitat. Finally, the management of the snow cover in the preparation of the ski slopes is one of the ecological factors responsible for the acidification of the slope grasslands of the association *Filipendulo vulgaris-Trifolietum montani*, which is being replaced by the acidophilous microthermal grasslands of the association *Gentiano luteae-Brachypodietum genuensis*.

Key words: land abandonment, geology, geomorphology, phytosociology, Habitat Directive, plant landscape, ski slopes.

Introduction

The presence and the coexistence of the species that constitute the various plant communities are the result of the interactions of multiple ecological factors, both biotic and abiotic. As shown by the numerous studies published over the years (Biondi *et al*., 2012), the most significant abiotic factors, at least at the landscape level, are those that are geological-geomorphological, topographic and bioclimatic. To these characteristics that can be considered as structural to the territory, the effects due to the biotic ecological factors can be added, or rather, integrated. These are mainly related to the human activities that through the traditional forestry and agro-pastoral practices have contributed, in a certain way, to determine, maintain or modify the physiology of the various plant communities that are present. In general, there have been a few investigations into the effects of fungal interactions, as shown by a recent study (Bonanomi *et al*., 2012, 2013) of the secondary grasslands (Habitat 6210*) of the central Apennines. These interactions can have significant effects on the presence and coexistence of the species of the grassland, and thus contribute to the maintenance and conservation of the biodiversity of these coenoses that are at present at risk of disappearing. The Apennine secondary grasslands originated in antiquity, and have been maintained since through traditional practices, such as grazing and cutting. These grasslands have had an important role in the conservation of biodiversity, both in terms of their high floristic richness, and through the presence of species that are rare and/or endemic, and of phytogeographical interest. This has justified the recognition of these grasslands by the Habitats Directive (92/42/EEC) as Habitats of Community Interest (SCI). The progressive abandonment of the traditional human practices that has occurred extensively throughout Europe since the 1950's (Poschlod & WallisDeVries, 2002; Biondi, 2003; Galdenzi *et al*., 2012) has led to the triggering of the dynamic processes of the natural vegetation, first towards the dominance of a few tall-grass species (Bobbink & Willems, 1987), and then to the encroachment of shrubby and woody plants, thus resulting in a loss of biodiversity

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(Tilman, 1988; Köhler *et al*., 2005). As shown from mainly ecological studies that have been published in recent years, among the herbaceous species, the most active in the colonisation of the secondary grasslands in the Apennines are two species in particular of the genus *Brachypodium*. These two species have similar modes of colonisation of the secondary grasslands: *Brachypodium rupestre* in the mesotemperate bioclimatic belt (Bonanomi & Allegrezza, 2004; Bonanomi *et al*., 2006, 2009, 2013), and *Brachypodium genuense* in the supratemperate bioclimatic belt (Catorci *et al*., 2011; Biondi & Galdenzi, 2012; Galiè *et al*., 2013).

The present study provides a detailed phytosociological analysis of the vegetation and the plant landscape of the north-eastern slopes of Monte Sassotetto (in the Sibillini Mountains) in the supratemperate bioclimatic belt at altitudes between 1280 m and 1624 m a.s.l. (the peak of Monte Sassotetto), in terms of the local bioclimatic, geomorphological and lithological characteristics. Most of the study area is part of an extensive skiing area that dates back to the early 1960's. The installation of new ski lifts resulted in a change in the use of the land, with actions that led to the transformation of forest and grazing land into areas that were destined almost exclusively to host the skiing activities. The purpose of the present study was to analyse the effects of the human and natural ecological factors, with a focus on the effects of the geology, the geomorphology, the reduction and/or abandonment of the pastoral activities, and the management of the ski slopes on the phytocoenosis and species diversity in the study area. The geological and geomorphological variability, the long abandonment of the traditional human practices over large areas, and the management of the ski slopes, mean that this territory is highly representative for our goals.

The plant landscape (Fig. 1) is at present characterised by extensive mesophilous, dense secondary grasslands and beech woods, while shrubby vegetation is particularly rare and isolated, and is mainly in the steeper areas, with isolated bushes of *Juniperus communis* subsp. *nana*, *Rhamnus alpina* subsp. *alpina* and *Sorbus aria* subsp. *aria*.

This is a territory of undoubted interest for biodiversity, and it is part of the Sibillini Mountains, and borders on the National Park of the Sibillini Mountains and on two Natura 2000 areas. However, an overall vegetational study for this area is still missing, with the only information available to date coming from three phytosociological relevés carried out on the grasslands of the slopes under investigation, which are included in the tables published in Catorci *et al*. (2008), and from studies of the adjacent territory of the "Prati di Ragnolo" (Francalancia *et al*., 1981; Catorci *et al*., 2007). This lack of knowledge applies in general to the whole area of the Sibillini Mountains, despite the creation of the National Park. The studies on the vegetation remain very few, and they are mostly outdated and have often focused on just a few vegetational aspects within limited areas. A special mention is deserved for the study of Pedrotti (2001), who provided an overview of the vegetation of the Sibillini Mountains with a map of the potential vegetation at a scale of 1:300,000 that was based on previously published studies. The recent phytosociological studies of the Valle dell'Ambro (Catorci *et al*., 2008), the beech woods of the Sibillini Mountains (Catorci *et al*., 2010), and the territory of Piè Vettore (Allegrezza *et al*., 2013) are of particular interest for our knowledge of the biodiversity of this mountain complex.

On the one hand, it should be noted that detailed phytosociological analyses of territories of limited size such as that considered here involve difficulties in the clear syntaxonomic identification through relatively few relevés of coenoses that are naturally formed, in relation to those recognized in the literature. This is a problem that can only be overcome with comparisons between relevés to avoid local effects. However, on the other hand, it should be emphasised that this kind of analysis represents the only way to better understand both the synecology of the vegetal coenoses that are already known in the literature, and the physiological complex of the vegetational system that is present in a specific area, in relation to the ecological factors that are acting there.

Study area

Geography

The study area (coordinates: N 43° 00' 22"; E 13° 14' 10") covers about 100 hectares, and includes the north-eastern slopes of Monte Sassotetto (Fig. 2), at altitudes between 1280 m and 1624 m a.s.l. (the peak of Monte Sassotetto). It is situated in the north-eastern sector of the Sibillini Mountains, which reach their highest altitude with the peak of Monte Vettore (2476 m a.s.l.). The study area is about 60 km from the sea.

From the administrative point of view, the study area includes part of the Macerata Province, and is within the municipality of Sarnano. It borders on the National Park of the Sibillini Mountains and on two Natura 2000 sites: the SAC (IT5330003) area of "Rio Terro", and the SPA (IT5330029) area of "dalla Gola del Fiastrone al Monte Vettore" (from Fiastrone Gorge to Monte Vettore).

Geological and geomorphological characteristics

From the geological-structural point of view, the study area falls within the calcareous domain of the Sibillini Mountains (north-eastern sector), and more precisely, along the north-eastern slopes of Monte Sassotetto. The slopes under study are characterised by

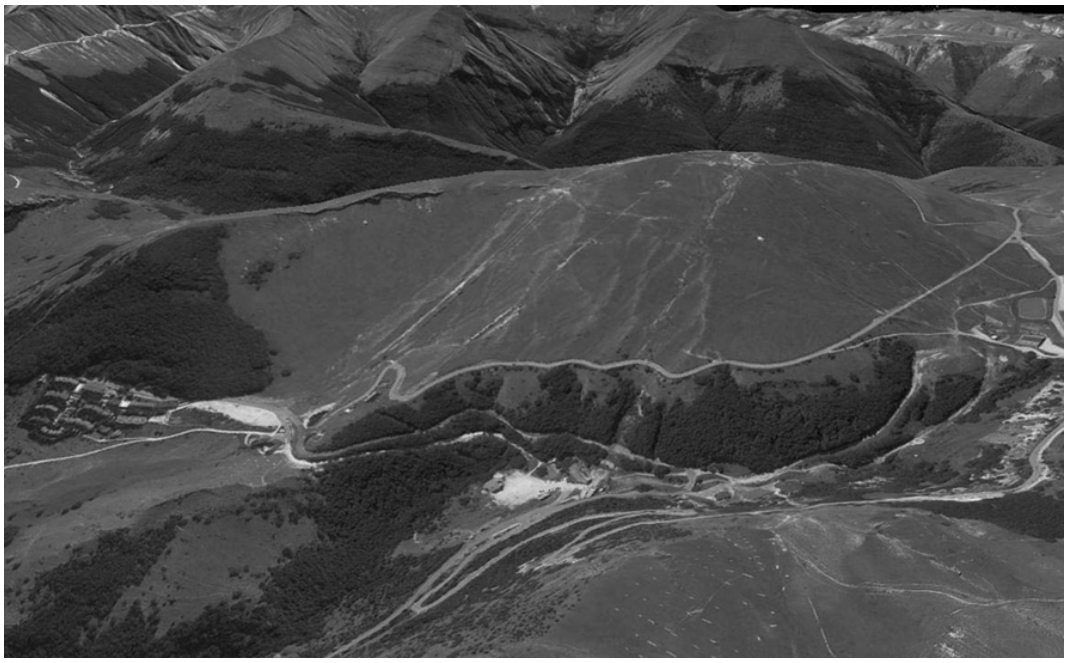

Fig. 1 – The northern estern slope of Monte Sassotetto.

the outcroppings of the stratified limestone lithotypes that belong to the Maiolica Formation from the Jurassic-Cretaceous period, where the abutment is less than the slope, while in a limited portion of the slopes only (south-eastern sector), there are outcroppings of the limestone-flint lithotypes of the Umbria-Marche Diasprini Calcari Formation and of the Calcare Massiccio Formation of the Lower Jurassic period (Chiocchini *et al*., 1976; Regione Marche, 2001). These lithotypes are often covered by a thin (<1.0 m) layer of regolith (residual eluvial material) that is made up of heterometric calcareous gravel in variable amounts of silty-clay matrix. Locally, there is a more substantial layer of slope detritus of a thickness that varies from area to area, which is made up of sandy gravel and pebbles, with mainly sub-angular calcareous elements that are loose to weakly cemented.

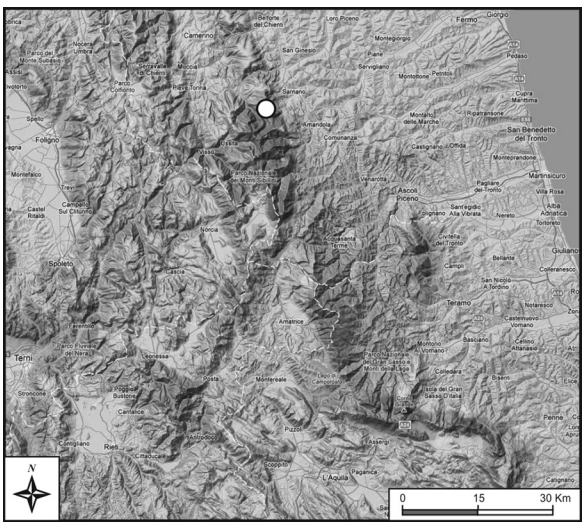

Fig. 2 – The Monte Sassotetto study area.

The study area lies along a slope that dips towards the north-east, and is characterised by outcropping or sub-outcropping substrata, with a steepness of about 25° for the initial portion, and about 15° for the middle and summit sectors. These slopes are characterised by a relatively articulated morphology, with ridges (‘ribs’) that run in a longitudinal direction and with the ridge sides of varying steepness, and that are connected to watersheds, wide valleys and narrow valleys of varying widths and lengths (wider valleys in the southern sectors, that are narrower and longer in the central and northern sections), and are probably set along fractures and lines of weakness. The ridges are characterised by outcropping or sub-outcropping of the limestone substratum that is weathered and fractured (the Maiolica Formation), while in the narrow and wide valleys there is an increase in the thickness of the regolith blanket (Fig. 3).

At the base of the slopes there are small flat-bottomed valleys (which have been partially artificially remodelled for the construction of the ski slopes), and these form the head of the valley that is cut by the Fosso di Fonte Lardina (Ditch of the Lardina Spring). There are also V-shaped valleys, where in the past there was intense linear erosion caused by running water (AA. vv., 1991).

Climatic characteristics

The bioclimatic classification of the study area was carried out using the climatic data collected at the Bolognola thermo-pluvial station (1445 m a.s.l.), which is

1.7 km to the west of the study area. On the basis of the indices of Rivas-Martinez. (2008), this thermo-pluvial station is included in the temperate macroclimate, oceanic bioclimate, with an upper supratemperate thermotype and an upper humid ombrotype (Fig. 4).

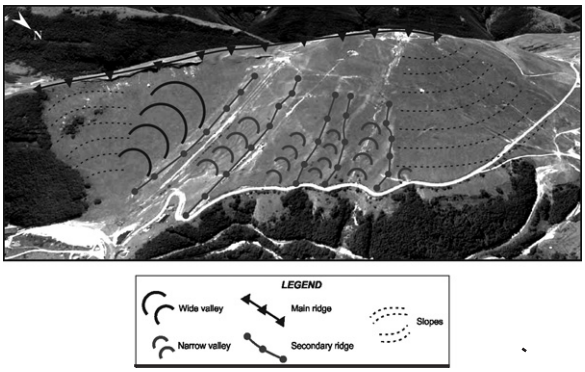

Fig. 3 – The main geomorphological elements of the study area

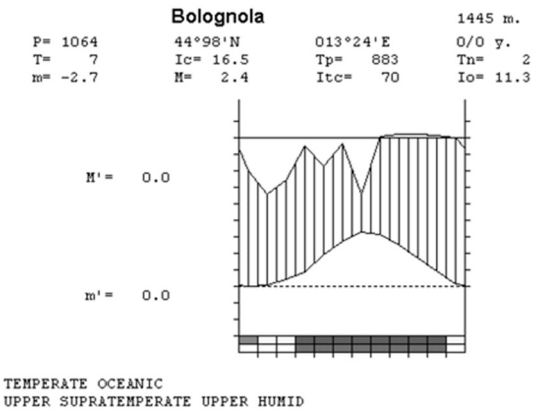

Fig. 4 - Bioclimatic diagram from the Bolognola thermo-pluvial station.

Materials and methods

The study of the plant communities was carried out following the phytosociological method of the Zurich-Montpellier sigmatist school, as successively integrated (Tüxen 1978; Géhu & Rivas-Martinez, 1981; Miyawaki, 1986; Géhu, 1991; Theurillat, 1992; Biondi, Feoli & Zuccarello, 2004a; Allegrezza *et al*., 2008; Rivas-Martìnez, 2005; Géhu, 2006; Biondi, 2011; Blasi & Frondoni, 2011; Pott, 2011; Biondi *et al*., 2012).

Sixty-two relevés with 60 original phytosociological relevés were carried out in study area from the spring 2009 to the summer 2013.

Species nomenclature and chorological and biological characterisation follow Aeschimann *et al*. (2004); moreover, the following studies were also consulted: Tutin *et al*. (1964–80, 1993), Pignatti (1982), Conti *et al*. (2005, 2007), Jalas *et al*. (1972-1994), Castroviejo *et al*. (1986), Ballelli *et al*. (2005).

The phytosociological nomenclature of the higher syntaxonomic levels: order and class, follow Biondi & Blasi (2013), Biondi *et al*. (2014). Publications regarding syntaxonomic review, local phytosociological study were considered in order to define the vegetation types (Bonin, 1972; Francalancia *et al*., 1981; Biondi & Ballelli, 1995; Biondi *et al*., 1995, 1999, 2001, 2002, 2002a, 2004, 2005, 2008; Allegrezza, 2003; Catorci *et al*., 2007, 2008, 2010; Di Pietro, 2007; Lancioni *et al*., 2011, Biondi & Galdenzi, 2012; Allegrezza *et al*., 2013; Di Pietro, 2007, 2011).

For all of the phytosociological relevés, the environmental parameters recorded were altitude, exposure and slope, with the following geomorphological elements: ridges (C), the lateral parts of the ridges (LC), slopes (V), rolling plain areas (BVP), wide valleys (BVC) and narrow valleys (VA). The geomorphological classification was carried out by a specialist geomorphologist. In addition, for 33 samples of soil taken in the field, the pH was measured by potentiometric analysis, using standard suspensions of soil/ water and soil/ saline.

The phytosociological relevés were submitted to multivariate analysis using the Matedit programme (Burba *et al*., 1992) and the VEGAN community ecology package (Oksanen *et al*., 2012) for R (R Core Team, 2012). The numerical classification (cluster analysis) was carried out by applying the average link algorithm (Orloci, 1978) to the (dis)similarity ratio matrix (Westoff & Van der Maarel, 1978) computed on phytosociological relevé values converted according to the Van der Maarel (1979) scale. The ordering of the non-metric multidimensional scaling (NMDS), which is suitable for the analysis of ordinal data such as those of Van der Maarel (Podani, 2007), was used to describe the main trends in the structure of the phytosociological data. For a comparison and the simultaneous display of the results of the cluster analysis and the NMDS, these clusters were superimposed on the two-dimensional plot of the NMDS.

Furthermore, we overlaid the environmental variables (pH, slope and topographic position) onto an ordination diagram (using the envfit and ordisurf function of the VEGAN package) to interpret the ecological gradient of the phytocoenosis.

Results

Forest plant communities

In this territory, the forest vegetation includes woods of *Fagus sylvatica* subsp. *sylvatica* that at present occupy a wide band that extends up to about 1550 m a.s.l., which represents the current limit of the woods of Monte Sassotetto. The dendrogram obtained from the classification of seven phytosociological relevés carried out on the forest vegetation identified two groups of relevés that differ in terms of their geology

(Fig. 5). The first (Cluster I) includes the basophilous and neutrobasophilous beech on the limestone substrate of the Maiolica Formation, while the second combines the acidophilous and subacidophilous beech on the limited outcropping of limestone and flint substrate of the Umbria-Marche Diasprini Limestone Formation, which typically provides an acidic pedogenesis, as has been shown in other studies in the central Apennines (e.g., Allegrezza, 2003). The processing of phytosociological relevés and the comparisons with the literature data allow the beech woods under study to be included in the associations *Cardamino kitaibelii-Fagetum sylvaticae* and *Actaeo spicatae-Fagetum sylvaticae*, of the endemic Apennine suballiance *Cardamino kitaibelii-Fagenion sylvaticae*, of the alliance *Aremonio-Fagion sylvaticae*. It can be noted that the microthermal character of the beech woods in question is not fully expressed, which is testified by the sporadic presence of species from the lower supratemperate bioclimatic belt, such as: *Solidago virgaurea* subsp. *virgaurea, Cyclamen hederifolium* subsp. *hederifolium* and *Hepatica nobilis*, and others.

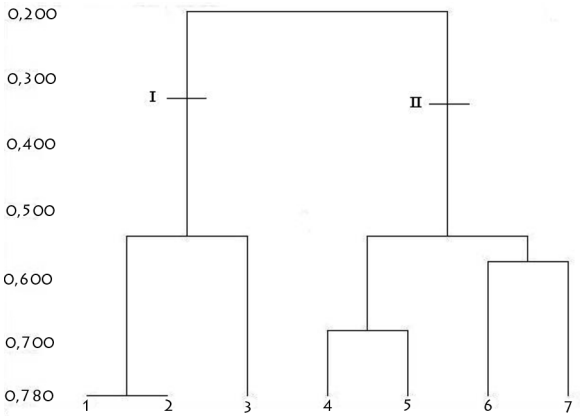

Fig. 5 - Dendrogram of the woods phytosociological relevés.

CARDAMINO KITAIBELII-FAGETUM SYLVATICAE Ubaldi, Zanotti, Puppi, Speranza & Corbetta ex Ubaldi 1995 (Table 1, rels. 1-3; Cluster I of Fig. 5)

This basophilous and neutrobasophilous beech wood is part of the Maiolica Formation, on particularly steep slopes with less-developed soils (pH 6.9) and abundant leaf litter. This is a dense, monoplane and paucispecific coppice of *Fagus sylvatica* subsp. *sylvatica*. The shrub layer is represented by some rare examples of *Rubus caesius*, while the herbaceous layer is characterised by high diversity of nemoral species, such as *Cardamine bulbifera, C. enneaphyllos, Saxifraga rotundifolia* subsp. *rotundifolia, Polystichum aculeatum, Cyclamen hederifolium* subsp. *hederifolium*, *Galium odoratum, Viola reichenbachiana, Brachypodium sylvaticum, Doronicum columnae, Galanthus nivalis, Corydalis cava* subsp. *cava* and *Arum maculatum*, and others.

From the phytosociological point of view, the basophilous beech woods are included in the association *Cardamino kitaibelii-Fagetum sylvaticae* (Table 1, rels. 1-3), which is widespread on the higher calcareous Apennine ridges of the upper supratemperate bioclimatic belt of the central Apennines. The differential and characteristics species are: *Saxifraga rotundifolia* subsp. *rotundifolia, Polystichum aculeatum, Cardamine enneaphyllos* and *Doronicum columnae*.

ACTAEO SPICATAE-FAGETUM SYLVATICAE Biondi *et al*. ex Biondi, Casavecchia, Frattaroli, Pirone, Pesaresi, Di Martino, Galassi, Ventrone, Angelini & Ciaschetti 2013 (Table 1, rels. 4-7; Cluster II of Fig. 5)

This subacidophilous and acidophilous beech wood is on the Umbria-Marche Diasprini Limestone Formations of the eastern sector of the study area, with an average slope of 25°, localised rocky outcrops, an acid soil (pH 4.0), and covered by a thin layer of leaf litter. This is a paucispecific wood, aged, periodically cut coppice of *Fagus sylvatica* subsp. *sylvatica* with a monoplane structure. The morphology of the branches that are always bent down at their base is due to the weight and frequency of the snow cover on the slope. The shrub layer is almost exclusively comprised of *Rubus hirtus*, although with low coverage, also the herbaceous layer is very species poor. It differs from basophilous beech woods by the presence of typically acidophilous plants, such as: *Veronica officinalis, Prenanthes purpurea, Luzula sylvatica* subsp. *sylvatica* and *Galium rotundifolium* ssp. *rotundifolium*. For the northern exposure, the substratum, the dense arboreal layer and the snow spring permanence also favour the development of a dense covering of moss and lichens, both over the ground and on the trunks and lower branches of the trees.

The beech woods under study have similar floristic aspects as those of the acidophilous associations described for the sandstone substrates of Laga Mountains. Considering the absence in the study area of purely acidophilous species (e.g., *Vaccinium myrtillus*), which are the differential associations: *Solidagini-Fagetum sylvaticae* (Longhitano & Ronsisvalle 1974) Ubaldi, Zanotti, Puppi, Speranza & Corbetta 1987 ex Ubaldi 1993 and *Prenantho purpureae-Fagetum sylvaticae* Di Pietro 2007, on the basis of the available data, it is considered more appropriate here to include the beech woods under study in the association *Actaeo spicatae-Fagetum sylvaticae*, as described for the supratemperate belt of the high valley of Vomano (Biondi *et al*., 2008).

The herbaceous vegetation

A large part of the studied territory has predominan-

Tab. 1 - *Aremonio agrimonioidis-Fagion sylvaticae* (rels.1-7), *Cardamino kitaibelii-Fagetum sylvaticae* Ubaldi, Zanotti, Puppi, Speranza & Corbetta ex Ubaldi 1995 (rels.1-3), *Actaeo spicatae-Fagetum sylvaticae* Biondi *et al.* ex Biondi, Casavecchia, Frattaroli, Pirone, Pesaresi, Di Martino, Galassi, Ventrone, Angelini & Ciaschetti 2013 (rels. 4-7). Substratum legend: MA - Maiolica Formation; CD - Marche-Umbria Diasprini Limestone Formation

		Relevè number	1	2	3	4	5	6	7	
		Cluster from the dendrogram fig. 5	I	I	I	II	II	II	II	
		Substratum	MA	MA	MA	CD	CD	CD	CD	
		Altitude (m a.s.l.) x 10	127	134	135	136	138	140	144	
		Aspect	NE	NE	NE	NE	NE	NE	NE	
		Slope (°)	40	40	40	30	20	25	30	
		Coverage (%)	95	95	90	90	95	90	95	Presences
Biotype	Chorotype	Area (m^2)	400	300	150	300	200	400	400	
		Charact. and diff. species of the *Cardamino kitaibelii-Fagetum sylvaticae* ass.								
H scap	S EUROP. MONT.	Saxifraga rotundifolia L. subsp. rotundifolia	1.1	2.2	2.3	+.2	.	.	1.1	5
G rhiz	S EUROP. MONT.	Cardamine enneaphyllos (L.) Crantz	1.2	+.2	+.2	.	.	.	.	3
G rhiz	SE EUROP. MONT.	Doronicum columnae Ten.	+	1.2	1.2	.	.	.	.	3
G rhiz	EUROSIB.	Polystichum aculeatum (L.) Roth	+.2	+	.	.	.	.	.	2
		Charact. and diff. species of the *Actaeo spicatae-Fagetum sylvaticae* ass.								
H scap	EUROP.	Prenanthes purpurea L.	.	.	+	3.3	+.2	3.4	+.3	5
H caesp	SE EUROP. MONT.	Luzula sylvatica (Huds.) Gaudin subsp. sylvatica	.	.	1.2	1.1	1.2	.	1.1	4
H rept	EUROSIB.-N AMER.	Veronica officinalis L.	.	.	.	1.1	+.3	+.2	1.2	4
H scap	EUROP.-SW ASIAT.	Galium rotundifolium L. subsp. rotundifolium	.	.	.	.	+.3	1.2	1.2	3
		Charact. and diff. species of the *Cardamino kitaibelii-Fagenion sylvaticae* suball., *Aremonio-Fagion* all. and the *Fagetalia sylvaticae* ord.								
P scap	EUROP.	Fagus sylvatica L. subsp. sylvatica	4.4	4.5	4.3	4.4	4.4	4.4	4.5	7
H scap	EUROP.	Viola reichenbachiana Jord. *ex* Boreau	1.1	+.2	(+.2)	.	1.1	.	.	4
H scap	EUROP.-W ASIAT.	Sanicula europaea L.	+.2	+.2	+	.	.	.	1.2	4
H caesp	EURASIAT.	Campanula trachelium L. subsp. trachelium	+	+	+	.	.	.	+	4
G rhiz	EUROP.	Cardamine bulbifera (L.) Crantz	1.2	1.2	+	.	.	.	.	3
G bulb	S EUROP.	Cyclamen hederifolium Aiton subsp. hederifolium	1.2	1.1	+	.	.	.	.	3
H scap	EUROSIB.-N AMER.	Solidago virgaurea L. subsp. virgaurea	+	.	1.2	1.1	.	.	.	3
G rhiz	EUROSIB.	Galium odoratum (L.) Scop.	+.3	+.2	.	.	.	.	+	3
P caesp	S EUROP. MONT.	Laburnum alpinum (Mill.) Bercht. *et* J. Presl	.	.	+	.	.	+	+	3
G bulb	EUROP.	Corydalis cava (L.) Schweigg. *et* Körte subsp. cava	1.1	+.2	.	.	.	.	.	2
G bulb	S EUROP.	Galanthus nivalis L.	1.1	+.2	.	.	.	.	.	2
G rhiz	EUROSIB.	Lathyrus vernus (L.) Bernh.	1.2	.	(+)	.	.	.	.	2
H caesp	EUROP.	Melica uniflora Retz.	+.2	.	.	.	.	.	+	2
P caesp	S EUROP. MONT.	Euonymus latifolius (L.) Mill.	+	+.2	.	.	.	.	.	2
H scap	S EUROP. MONT.	Adenostyles glabra (Mill.) DC. subsp. glabra	.	.	.	(+)	.	.	+.3	2
H scap	ENDEM.	Pulmonaria apennina Cristof. *et* Puppi	+	.	.	.	.	.	.	1
G rhiz	S EUROP.	Polystichum setiferum (Forssk.) T. Moore *ex* Woynar	.	+.2	.	.	.	.	.	1
P scap	S EUROP. MONT.	Abies alba Mill.	.	.	+	.	.	.	.	1
P scap	EUROP.-W ASIAT.	Acer platanoides L. (pl.)	.	.	+	.	.	.	.	1
G bulb	EURASIAT.	Dactylorhiza maculata (L.) Soó subsp. fuchsii (Druce) Hyl.	.	.	.	+.2	.	.	.	1
G rhiz	EUROP.-W ASIAT.	Festuca heterophylla Lam.	.	.	.	.	.	+.2	.	1
		Charact. species of the *Querco-Fagetea* class								
H scap	EUROP.-W ASIAT.	Hieracium murorum L. (*s.l.*)	.	.	1.2	2.3	1.2	2.3	3.3	5
H caesp	EURASIAT.-N AMER.	Poa nemoralis L. subsp. nemoralis	+	+	+	.	+.2	.	.	4
H scap	EURASIAT.	Lactuca muralis (L.) Gaertn.	+	+	+	.	.	.	+.2	4
G rhiz	EUROP.	Hepatica nobilis Schreb.	+.2	.	+	.	+.2	.	+	4
H caesp	EURASIAT.	Brachypodium sylvaticum (Huds.) Beauv.	1.1	+.2	+.2	.	.	.	.	3
P caesp	W EUROP.-MEDIT.	Daphne laureola L.	+.2	+	+	.	.	.	.	3
H caesp	S EUROP.	Luzula forsteri (Sm.) DC.	.	.	.	+	+	+	.	3
NP	EUROP.-W ASIAT.	Rubus caesius L.	+	+	.	.	.	.	.	2
P caesp	EURASIAT.	Epipactis helleborine (L.) Crantz subsp. helleborine	.	.	+	.	.	.	+	2
P caesp	EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria	.	.	.	+	.	.	(+.2)	2
G rhiz	EUROP.	Euphorbia dulcis L.	+	.	.	.	.	.	.	1
T scap	EURASIAT.-N AMER.	Geranium robertianum L.	+	.	.	.	.	.	.	1
G rhiz	EUROP.	Arum maculatum L.	.	+.3	.	.	.	.	.	1
G bulb	EURASIAT.	Lilium martagon L.	.	+	.	.	.	.	.	1
P scap	SE EUROP.	Acer opalus Mill. subsp. obtusatum (Waldst. *et* Kit. *ex* Willd.) Gams	.	.	+	.	.	.	.	1
H scap	SE EUROP.	Lathyrus venetus (Mill.) Wohlf.	.	.	.	.	.	.	+.2	1
		Other species								
H scap	ENDEM.	Campanula micrantha Bertol.	.	.	+	+	+	.	+	4
H scap		Heracleum sphondylium L. (*s.l.*)	+	+	+	.	.	.	.	3
T rept	MEDIT.	Stellaria media (L.) Vill. subsp. media	+	+	.	.	.	.	.	2
H scap	EUROP. MONT.	Chaerophyllum hirsutum L. subsp. hirsutum	+	+	.	.	.	.	.	2
NP	C EUROP.	Rubus hirtus Waldst. *et* Kit.	.	.	.	.	+.2	.	+	2
H scap	EUROSIB.	Silene dioica (L.) Clairv.	.	.	+	.	.	.	.	1
H bienn	MEDIT.	Arabis turrita L.	.	.	+	.	.	.	.	1
H rept	EUROP.-W ASIAT.	Ajuga reptans L.	.	.	+	.	.	.	.	1
H scap	EUROP.	Carex flacca Schreb. subsp. flacca	.	.	.	.	.	+	.	1
		Muschi	.	.	.	.	.	4.5	.	1

tly herbaceous vegetation that is related to the secondary grasslands that extend from 1300 m a.s.l. up to 1624 m a.s.l. (the peak of Monte Sassotetto) on the Maiolica Formation. The dendrogram shown in Figure 6 was obtained from the cluster analysis of 53 phytosociological relevés, and it identifies two main clusters that bring together the relevés carried out on the grasslands of the ridges and the lateral parts of the ridges (Cluster I) and those carried out on the slopes, on the rolling plains, and in the wide valleys and nar-

row valleys (Cluster II). At a higher level of similarity, 10 clusters were identified (from 1 to 10) that correspond to the different grassland plant communities described below. These plant communities (of clusters 1 to 10) were well separated in the NMDS ordination (Figure 7) and they show the floristic dissimilarity or the characteristic composition of the association according to the environmental gradients. In Table 2, the correlations between the environmental variable and positions of the relevés in the NMDS diagram are shown. Along the NMDS1 axis the morphological gradient passes from the narrow valleys to the ridges. The arrows indicate the gradient of pH and slope direction. The evolution of the pH is illustrated not only by the arrows, but also with the isolines (obtained from the ordisurf function that is based on the GAM regression methods), which are useful to estimate the pH of the phytosociological relevés where this was not measured in the field.

Tab. 2 - Table correlation coeffiecient R^2 and significances of environmental variables (geomorphology as fatctor) with phytosociological releves position (indirect gradient analysis) in the NMDS1 and NMDS2 axis. Significance thresholds.:P<0.001.

	NMDS1	NMDS2	R^2
pH	0.56	-0.83	0.71***
Slope	0.70	0.71	0.80***
Geomorphology			0.72***

CARICI HUMILIS-SESLERIETUM APENNINAE Biondi, Guitian, Allegrezza & Ballelli 1988 (Table 3; Cluster 10 of Fig. 6 and Fig. 7)
paronychietosum kapelae subass. nova hoc loco (rels. 1-4 of Table 3, holotypus rel. 2)

On the peaks and ridges (the 'ribs' of the slopes) that are subjected to cryoturbation phenomena, on lithosoil (average pH 7.3), there is a durable xerophilous grassland with a discontinuous herbaceous cover of *Sesleria apennina*, which is accompanied by numerous chamaephytes, which include: *Anthyllis montana* subsp. *atropurpurea, Astragalus sempervirens, Teucrium montanum, Globularia meridionalis* and *Potentilla incana*, and others (Table 2). Locally, in topographic positions that are occupied by *Sesleria apennina* grassland, there are isolated nuclei of *Juniperus communis* subsp. *nana*.

From the phytosociological point of view, on the basis of a comparison with the literature data , the vegetation under study can be included in the association *Carici humilis-Seslerietum apenninae* (Biondi *et al*., 1988). This is particularly widespread in the supratemperate belt of the limestone heights of the central Apennines, and it has already been indicated for the Sibillini Mountains (Catorci *et al*., 2008; Lancioni *et al*., 2011), where for the southern slopes of the heights of the Valle dell'Ambro Mountains it can be found up to an altitude of 1900 m a.s.l.. Compared with the subassociation *typicum caricetosum humilis* Catorci Gatti & Ballelli 2007 of the association, the *Sesleria apennina* grassland in the study area are differentiated by the constant presence of a contingent of mountain species, which include: *Paronychia kapela* subsp. *kapela, Astragalus sempervirens, Thymus striatus* and *Rhinanthus wettsteinii*. These are sporadically found in the subassociations already described in literature (Lancioni *et al*., 2011; Biondi & Galdenzi, 2012): *anthyllidetosum pulchellae* Lancioni *et al*. 2011, *hieracietosum cymosi* Lancioni *et al*. 2011 and *astragaletosum sempervirentis* Biondi & Galdenzi 2012. However, in the study area, these are included in a submontane chamaephytic and rupicolous vegetation context that is typical of the peaks. This comprises *Potentilla incana, Teucrium montanum, Allium lusitanicum, Helianthemum oelandicum* subsp. *incanum* and *Globularia meridionalis*, and others, which are similar to those of the subassociation *genistetosum michelii* Allegrezza *et al*. 1997 described for Monte San Vicino (Allegrezza *et al*., 1997). From a comparison of the relevés (Figure 8), the autonomy of the vegetation under study can be seen, which therefore results in the proposal of the new subassociation *paronychietosum kapelae*, for which the differential species can be considered as: *Paronychia kapela* subsp. *kapela, Astragalus sempervirens, Allium lusitanicum, Potentilla incana, Thymus striatus* and *Teucrium montanum*. The new subassociation *paronychietosum kapelae* (holotypus rel. 2 of Table 3) represents the higher-altitude chamaephytic and rupicolous aspects of the association *Carici humilis-Seslerietum apenninae*, and can be considered the altitudinal vicariant of the subassociation *genistetosum michelii* that is typical of the peaks of the lower supratemperate belt under a Mediterranean influence.

CARICI MACROLEPIS-SESLERIETUM APENNINAE Biondi, Pinzi & Gubellini 2004 (Table 4; Cluster 9 of Fig. 6 and Fig. 7)

On the steep morphology of the summit slopes, in areas subjected to surface erosion, with the removal of the herbaceous cover (pH 7.35), there is the durable grassland pioneer of *Sesleria apennina* and *Carex macrolepis* that can be included in the association *Carici macrolepis-Seslerietum apenninae* (Table 4) of the alliance *Seslerion apenninae* that has been described for the Monte Cucco Massif of the Umbria-Marche Apennines. Among the species that have been identified as characteristic and differential in the study area, there are: *Sesleria apennina, Carex macrolepis, Laserpitium siler* subsp. *siculum, Helianthemum oelandicum* subsp. *incanum*, and *Dianthus sylvestris* subsp. *longicaulis*.

Tab. 3 - *Carici humilis-Seslerietum apenninae* Biondi, Guitian, Allegrezza & Ballelli 1988, *paronychietosum kapelae* subass. nova hoc loco (rels 1-4 of Table 3, holotypus rel. n. 2).

		Relevè number	1	2*	3	4	
		Relevè number from dendrogram Fig. 6 and fig. 7	13	16	17	26	
		Cluster	10	10	10	10	
		Geomorphological elements	C	C	C	C	
		Altitude (m a.s.l.) x 10	156	140	145	138	
		Aspect	ENE	E	ENE	E	
		Slope (°)	40	40	40	45	
Life Form	Chorotype	Coverage (%)	70	70	60	70	Presences
		Area (m²)	40	30	45	30	
		Charact. and diff. species of the ass.					
H caesp	ENDEM. ITAL.	Sesleria apennina Ujhely	3.4	3.3	3.3	4.4	4
Ch suffr	MEDIT. MONT.	Anthyllis montana L. subsp. atropurpurea (Vuk.) Pignatti	+.2	1.2	1.2	2.3	4
H scap	NE MEDIT. MONT.	Carum flexuosum (Ten.) Nyman	.	.	(+.2)	1.1	2
H caesp	EURASIAT.	Carex humilis Leyss.	.	.	+.2	+.2	2
		Diff. species of the *paronychietosum kapelae* subass.					
H caesp	MEDIT. MONT.	Paronychia kapela (Hacq.) A. Kern. subsp. kapela	+.2	1.1	1.2	+.2	4
Ch frut	W ALP.-PYR. (APENN.)	Astragalus sempervirens Lam.	+.2	1.1	2.3	+.2	4
Ch rept	SE EUROP.	Thymus striatus Vahl	1.2	1.2	2.2	+.2	4
H scap	S EUROP.	Potentilla incana G. Gaertn., B. Mey *et* Scherb.	2.3	+.2	+.2	+.2	4
Ch suffr	S EUROP.	Teucrium montanum L.	+.2	1.2	+.2	+.2	4
G bulb	EURASIAT.	Allium lusitanicum Lam.	+	+	+	+	4
Ch suffr	MEDIT.	Alyssum montanum L. subsp. montanum	.	.	.	+	1
H scap	ART.-ALP.	Saxifraga aizoides L.	.	.	.	1.2	1
		Charact. and diff. species of the *Carici humilis-Seslerion apenninae* all., *Seslerietalia tenuifoliae* ord. and *Festuco-Seslerietea* class					
Ch rept	ILLIR.-APENN.	Globularia meridionalis (Podp.) O. Schwarz	1.2	2.2	1.2	+.2	4
Ch suffr	EURASIAT.	Minuartia verna (L.) Hiern subsp. collina (Neilr.) Domin	+.2	1.1	+.2	+.2	4
Ch suffr	ENDEM.	Edraianthus graminifolius (L.) DC. subsp. graminifolius	+	+	+.2	+	4
H scap	SE EUROP. MONT.	Trinia glauca (L.) Dumort. cfr subsp. carniolica (A. Kern. *ex* Janch.) H. Wolff	+	+	+	+	4
Ch suffr	MEDIT.	Helianthemum oelandicum (L.) Dumort. subsp. incanum (Willk.) G. López	1.2	1.2	.	+.2	3
T scap	ENDEM.	Rhinanthus wettsteinii (Sterneck) Soó	.	+	+	.	2
H caesp	SE EUROP. MONT.	Carex kitaibeliana Degen *ex* Bech. subsp. kitaibeliana	.	.	+.2	+.2	2
Ch succ	S EUROP. MONT.	Sempervivum arachnoideum L.	+.2	.	.	+.2	2
H ros	EUROP.-N AMER.	Saxifraga paniculata Mill.	.	+	.	.	1
H scap	S EUROP. MONT.	Linum alpinum Jacq.	.	+	.	.	1
H scap	S EUROP. MONT.	Ranunculus breyninus Crantz	.	.	.	+	1
		Others species					
H scap	ENDEM.	Dianthus brachycalyx Huet *ex* Bacch., Brullo, Casti *et* Giusso	1.2	+.2	+.2	+	4
Ch succ	EUROP.-CAUC.	Sedum acre L.	+.2	+.2	+.2	+.2	4
H caesp	EUROP.	Bromopsis erecta (Huds.) Holub subsp. erecta	1.1	(+)	(+)	(+)	4
H caesp	ENDEM.	Koeleria splendens C. Presl subsp. grandiflora (Bertol. *ex* Schultes) Domin	+	+.2	+.2	+	4
H ros	S EUROP.	Leontodon crispus Vill. subsp. crispus	+.2	+	+	+	4
H caesp	S EUROP. MONT.	Poa molinierii Balb.	+.2	+	+	+	4
H scap	ENDEM.	Centaurea ambigua Guss. (*s.l.*)	+	(+)	+	+	4
Ch succ	EUROP.	Sedum rupestre L. subsp. rupestre	+.2	(+)	+.2	.	3
H scap	EURIMEDIT.	Anthyllis vulneraria L. ssp. weldeniana (Rchb.) Cullen	+.2	+	+	.	3
H caesp	S EUROP.	Petrorhagia saxifraga (L.) Link subsp. saxifraga	+.2	+.2	.	+.2	3
H caesp	ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	+	.	+	.	2
H scap	W ALP.-APENN.	Cerastium arvense L. subsp. suffruticosum (L.) Ces.	.	1.1	.	+.2	2
H caesp	MEDIT.	Festuca circummediterranea Patzke	.	+.2	1.2	.	2
NP	EUROSIB.-N AMER.	Juniperus communis L. subsp. nana Syme	.	+.2	+.2	.	2
H scap	EUROP.	Asperula cynanchica L.	.	+	+	.	2
H scap	ENDEM.	Erysimum pseudorhaeticum Polatschek	.	+	+	.	2
H scap	STENOMEDIT.	Galium corrudifolium Vill.	.	.	+.2	+.2	2
H scap	S-EUROP.-SUDSIB.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	.	.	+	+.2	2
G bulb	MEDIT.	Allium sphaerocephalon L.	+	.	.	.	1
H ros	MEDIT.-W ASIAT.	Silene italica (L.) Pers. subsp. italica	+	.	.	.	1
Ch suffr	SE EUROP.	Asperula purpurea (L.) Ehrend. subsp. purpurea	.	+	.	.	1
G bulb	EUROP.	Dactylorhiza sambucina (L.) Soó	.	+	.	.	1
Ch suffr	SE EUROP.	Genista januensis Viv.	.	.	+.2	.	1
H scap	SE EUROP.-SW ASIAT.	Polygala major Jacq.	.	.	+.2	.	1
H scap	MEDIT.	Eryngium amethystinum L.	.	.	+	.	1
H scap	SW EUROP. MONT.	Knautia purpurea (Vill.) Borbás	.	.	+	.	1
H scap	ENDEM.	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti *et* Gubellini	.	.	+	.	1
Ch suffr	MEDIT.	Teucrium chamaedrys L. subsp. chamaedrys	.	.	+	.	1
Ch suffr	MEDIT.	Coronilla minima L. subsp. minima	.	.	.	+	1
H scap	SUBATL.	Saxifraga granulata L. subsp. granulata	.	.	.	+	1

This is a coenosis that is of subprimary significance, as when the human factors that have occurred (i.e., deforestation and pastures) are combined with those climatic and geomorphological, these have in fact resulted in the loss of the soil, with the consequent regression of the secondary grasslands of the class *Festuco-Brometea* and the entry of species of the class *Festuco-Seslerietea*. Under these conditions, the return of forest vegetation can be ruled out. In particular, the grasslands of the association *Carici macrolepis-Seslerietum apenninae* in the study area are the result of the regression of the secondary grasslands of *Se-*

Tab. 4 - *Carici macrolepis-Seslerietum apenninae* Biondi, Pinzi & Gubellini 2004

		Relevè number	1	2	3	
		Relevè number from dendrogram Fig. 6 and Fig. 7	49	69	68	
		Cluster	9	9	9	
		Geomorphological elements	V	V	V	
		Altitude (m a.s.l.) x 10	150	152	156	
		Aspect	ENE	ENE	ENE	
		Slope (°)	40	40	40	Presences
Life Forms	Chorotype	Coverage (%)	80	80	80	
		Area (m²)	60	80	80	
		Charact. and diff. species of the ass.				
H caesp	ENDEM. ITAL.	Sesleria apennina Ujhely	4.4	3.4	3.3	3
H caesp	SUBENDEM.	Carex macrolepis DC.	1.2	3.3	2.3	3
H scap	ENDEM.	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti *et* Gubellini	1.2	1.1	1.1	3
Ch suffr	MEDIT.	Helianthemum oelandicum (L.) Dumort. subsp. incanum (Willk.) G. López	+.2	+.2	1.1	3
H scap	S EUROP. MONT	Leucanthemum adustum (W.D.J. Koch) Gremli	+	1.1	1.1	3
H scap	MEDIT. MONT.	Dianthus sylvestris Wulfen subsp. longicaulis (Ten.) Greuter *et* Burdet	.	1.2	+.2	2
		Charact. and diff. species of the *Carici humilis-Seslerion apenninae* all., the *Seslerietalia tenuifoliae* ord. and *Festuco-Seslerietea* class				
Ch suffr	MEDIT. MONT.	Anthyllis montana L. subsp. atropurpurea (Vuk.) Pignatti	+.3	+.2	1.1	3
Ch rept	ILLIR.-APPENN.	Globularia meridionalis (Podp.) O. Schwarz	+.2	1.2	1.2	3
T scap	ENDEM.	Rhinanthus wettsteinii (Sterneck) Soó	+.2	+	+	3
H caesp	SE EUROP. MONT	Carex kitaibeliana Degen *ex* Bech. subsp. kitaibeliana	1.2	.	+.2	2
H scap	S EUROP. MONT	Ranunculus breyninus Crantz	+.2	.	1.1	2
H ros	EURASIAT.	Gentiana verna L. subsp. verna	+.2	.	+.2	2
Ch rept	SE-EUROP.	Thymus striatus Vahl	2.3	.	.	1
Ch suffr	SE EUROP. MONT	Minuartia verna (L.) Hiern subsp. collina (Neilr.) Domin	+.2	.	.	1
Ch suffr	ENDEM.	Edraianthus graminifolius (L.) DC. subsp. graminifolius	+.2	.	.	1
H scap	SE EUROP. MONT	Trinia glauca (L.) Dumort. cfr subsp. carniolica (A. Kern. *ex* Janch.) H. Wolff	+.2	.	.	1
		Others species				
Ch suffr	MEDIT.	Teucrium chamaedrys L. subsp. chamaedrys	1.2	1.2	+.2	3
H scap	S EUROP.	Galium corrudifolium Vill.	+.2	1.1	1.1	3
H caesp	MEDIT.	Festuca circummediterranea Patzke	+.2	1.1	1.1	3
H scap	ENDEM.	Centaurea ambigua Guss. (*s.l.*)	+	1.1	1.1	3
H scap	W ALP.-APENN.	Cerastium arvense L. subsp. suffruticosum (L.) Ces.	+	1.1	1.1	3
H scap	E EUROP.-W ASIAT.	Pilosella cymosa (L.) F.W. Schultz *et* Sch. Bip. subsp. cymosa	+	1.1	1.1	3
H caesp	ENDEM.	Koeleria splendens C. Presl subsp. grandiflora (Bertol. *ex* Schultes) Domin	+	1.1	+.2	3
H scap	SW EUROP. MONT	Knautia purpurea (Vill.) Borbás	+	1.1	+	3
H ros	S EUROP. MONT	Plantago argentea Chaix subsp. argentea	+	+	1.1	3
H scap	EUROP.	Asperula cynanchica L.	+.2	+	+.2	3
H scap	MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter	+	+	+	3
H caesp	EUROP.	Bromopsis erecta (Huds.) Holub subsp. erecta	+.2	.	+.2	2
H scap	MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	+.2	.	+.2	2
H scap	MEDIT.	Eryngium amethystinum L.	+	.	+	2
H scap	S EUROP. MONT	Dianthus monspessulanus L.	.	1.2	1.1	2
H caesp	ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	.	1.2	+.2	2
H scap	S EUROP. MONT	Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang.	.	+	+	2
H scap	S EUROP. MONT	Polygala alpestris Rchb.	1.2	.	.	1
H scap	SE EUR.-SW ASIAT.	Polygala major Jacq.	1.2	.	.	1
H caesp	S EUROP. MONT	Luzula sylvatica (Huds.) Gaudin subsp. sieberi (Tausch) K. Richt.	+.3	.	.	1
NP	EUROSIB.-N AMER.	Juniperus communis L. subsp. nana Syme	+.2	.	.	1
H caesp	S EUROP. MONT	Poa molinierii Balb.	+.2	.	.	1
G bulb	EUROP.	Dactylorhiza sambucina (L.) Soó	+	.	.	1
G bulb	EUROSIB.	Gymnadenia conopsea (L.) R. Br.	+	.	.	1
H scap	EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	+	.	.	1
Ch rept	S EUROP. MONT	Thymus praecox Opiz subsp. polytrichus (Borbás) Jalas	.	1.2	.	1
H caesp	S EUROP. MONT	Silene ciliata Pourr. subsp. graefferi (Guss.) Nyman	.	+.2	.	1
H scap	EURASIAT.	Campanula glomerata L.	.	.	1.1	1
H ros	S EUROP. MONT.	Carlina acaulis L. subsp. caulescens (Lam.) Schübl. *et* G. Martens	.	.	+.2	1
Ch succ	EUROP.	Sedum rupestre L. subsp. rupestre	.	.	+.2	1
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	.	.	+	1

sleria nitida (s.l.) of the association *Polygalo majoris-Seslerietum nitidae*, which is found under conditions of greater edaphic stability.

POTENTILLO CINEREAE-BROMETUM ERECTI Biondi, Pinzi & Gubellini, 2004 (Table 5; Cluster 8 of Fig. 6 and Fig. 7)

trifolietosum alpestris subass. nova hoc loco (rels. 1-8 of Table 5; holotypus rel. 5).

Filipendula vulgaris and *Eryngium amethystinum* variant (rels. 1, 2)

On the sides of the ridges, and particularly on the southern aspects, on morphologies that are locally steep, on lithosoils (pH 7.0), and often interrupted by rocky outcrops, there is a discontinuous secondary xerophilous grassland of *Bromopsis erecta* subsp. *erecta*, *Koeleria splendens* subsp. *grandiflora* and *Potentilla incana* (Table 5). This is linked to the more rocky aspects of the tops of the ridges than those with *Sesleria apennina*. On the lower parts of these slopes, with a more developed soil on loose detritus and subject to surface erosion, the grassland takes on an aspect that is

Tab. 5 - *Potentillo cinereae-Brometum erecti* Biondi, Pinzi & Gubellini 2004, *trifolietosum alpestris* subass. nova hoc loco (rels. 1-8 of Table 5, holotypus rel. n. 5); rels. 7, 8 from Tab. 4 rels 2, 3 in Catorci *et al.* (2007), *Filipendula vulgaris* and *Eryngium amethystinum* variant (rels. 1, 2).

		Relevè number	1	2	3	4	5*	6	7	8	
		Relvè number from dendrogram Fig. 6 and Fig. 7	64	44	72	15	18	29			
		Cluster	9	9	9	9	9	9			
		Geomorphological elements	LC	LC	LC	LC	LC	LC			
		Altitude (m a.s.l.) x 10	146	147	148	141	143	138	120	125	
		Aspect	SW	SW	SW	SW	SW	SW	SSW	SW	
		Slope (°)	30	30	35	35	30	30	40	45	Presences
Life Form	Chorotype	Coverage (%)	90	90	85	80	80	80	95	98	
		Area (m^2)	100	90	90	70	70	60	100	100	
		Charact. and diff. species of the ass.									
H scap	S EUROP.	Potentilla incana G. Gaertn., B. Mey *et* Scherb.	+.2	+.2	2.3	1.2	2.3	3.4	2	2	8
H caesp	ENDEM.	Koeleria splendens C. Presl subsp. grandiflora (Bertol. *ex* Schultes) Domin	+.2	1.2	2.3	1.1	+.2	1.2	+	+	8
H scap	W ALP.-APENN.	Cerastium arvense L. subsp. suffruticosum (L.) Ces.	+.2	1.1	1.1	1.1	1.1	3.3	+	+	8
H scap	SW EUROP. MONT.	Knautia purpurea (Vill.) Borbás	2.2	1.1	1.2	+.2	+	.	+	+	7
Ch suffr	EURASIAT.	Minuartia verna (L.) Hiern subsp. collina (Neilr.) Domin	.	+.2	1.2	+.2	+.2	1.1	.	.	5
H scap	ENDEM.	Centaurea ambigua Guss. (*s.l.*)	.	1.1	1.1	+	.	.	+	+	5
H scap	S EUROP.-W ASIAT.	Cyanus triumfetti (All.) Dostal *ex* A'. *et* D. Löve	1.1	+	+	.	1.1	.	.	.	4
H scap	ENDEM.	Erysimum pseudorhaeticum Polatschek	.	+.2	.	.	+	.	.	+	3
Ch rept	S EUROP. MONT.	Thymus praecox Opiz subsp. polytrichus (Borbás) Jalas	.	.	1.2	.	.	.	.	.	1
		Diff. species of the *trifolietosum alpestris* subass.									
H scap	EUROP.-CAUC.	Trifolium alpestre L.	2.2	1.1	+	+.2	+.2	.	+	+	7
T scap	ENDEM.	Rhinanthus wettsteinii (Sterneck) Soó	+	1.1	.	1.1	1.1	1.1	+	+	7
H caesp	ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	+.2	1.2	.	1.2	1.2	.	+	.	5
Ch rept	ILLIR.-APENN.	Globularia meridionalis (Podp.) O. Schwarz	+.2	.	1.2	+.2	1.1	3.4	.	.	5
H scap	E EUROP.-W ASIAT.	Pilosella cymosa (L.) F.W. Schultz *et* Sch. Bip. subsp. cymosa	+	.	.	+	+	.	+	+	5
H scap	S EUROP.	Valeriana tuberosa L.	+	.	.	.	.	+	+	+	4
		Diff. species of the *Filipendula vulgaris* and *Eryngium amethystinum* variant									
H scap	EURASIAT.	Filipendula vulgaris Moench	1.1	1.1	+	+	.	.	.	.	4
H scap	SE EUROP.	Onobrychis viciifolia Scop.	1.2	2.2	.	.	.	.	.	+	3
H scap	EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	1.1	+.2	.	.	.	.	.	+	3
G bulb	SW EUROP.	Bunium bulbocastanum L.	+	+	.	.	.	.	.	.	2
		Charact. and diff. species of the *Brachypodenion genuensis* suball., the *Phleo ambigui-Bromion erecti* all. and the *Phleo ambigui-Brometalia erecti* ord.									
H scap	MEDIT.	Eryngium amethystinum L.	3.4	3.4	3.3	1.1	1.2	1.1	+	+	8
G rhiz	ENDEM.	Phleum hirsutum Honck. subsp. ambiguum (Ten.) Tzvelev	2.3	+.2	2.2	1.1	1.2	+	1	+	8
H scap	MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	+.2	2.2	1.2	+.2	+.2	+	+	1	8
H scap	S EUROP.	Galium corrudifolium Vill.	.	+	1.1	1.1	1.1	1.2	1	+	7
H scap	ENDEM.	Dianthus brachycalyx Huet *ex* Bacch., Brullo, Casti *et* Giusso	+	.	1.1	+	+	.	+	+	6
H caesp	SUBENDEM.	Carex macrolepis DC.	.	1.2	.	+.2	+.2	+.2	1	2	6
Ch suffr	MEDIT.	Helianthemum oelandicum (L.) Dumort. subsp. incanum (Willk.) G. López	.	.	1.2	+.2	1.2	2.3	1	2	6
H caesp	MEDIT.	Festuca circummediterranea Patzke	1.2	2.2	1.2	1.1	1.2	.	.	.	5
G bulb	MEDIT.	Allium sphaerocephalon L.	+	+	1.1	+	+	.	.	.	5
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	1.1	.	+.2	+.2	+.2	.	.	.	4
H ros	ENDEM.	Senecio scopolii Hoppe *et* Hornsch. subsp. floccosus (Bertol.) Greuter	+	.	.	.	.	+	.	.	2
H scap	ENDEM.	Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti *et* Gubellini	.	+	+	.	.	.	.	.	2
Ch suffr	S EUROP.	Teucrium montanum L.	.	.	.	+	+	.	.	.	2
H scap	SE EUR.-SW-ASIAT.	Polygala major Jacq.	.	.	.	+	.	+	.	.	2
H caesp	EURASIAT.	Carex humilis Leyss.	.	.	.	.	.	.	+	+	2
H scap	SUBENDEM.	Crepis lacera Ten.	.	.	.	.	.	.	+	+	2
H ros	S EUROP.	Leontodon crispus Vill. subsp. crispus	.	.	.	+.2	.	.	.	.	1
H caesp	ENDEM.	Festuca inops De Not.	.	.	.	.	.	1.2	.	.	1
H bienn	ENDEM.	Gentianella columnae (Ten.) Holub	.	.	.	.	.	.	+	.	1
H caesp	ENDEM.	Sesleria nitida Ten. (*s.l.*)	.	.	.	.	.	.	.	+	1
		Charact. species of the *Festuco-Brometea* class									
H caesp	EUROP.	Bromopsis erecta (Huds.) Holub subsp. erecta	4.4	3.4	3.3	2.3	3.3	2.3	3	3	8
Ch suffr	MEDIT.	Teucrium chamaedrys L. subsp. chamaedrys	+.2	1.1	.	.	2.2	+	1	+	6
G bulb	SW EUROP.	Narcissus poeticus L.	+.2	.	.	+.2	+.2	+.2	1	1	6
G bulb	MEDIT.	Muscari neglectum Guss.	+	+	+	.	.	+	+	.	5
Ch suffr	EUROP.-W ASIAT.	Helianthemum nummularium (L.) Mill. subsp. obscurum (Celak.) Holub	(1.2)	1.1	.	1.2	+.2	.	.	.	4
H scap	EURIMEDIT.	Anthyllis vulneraria L. ssp. weldeniana (Rchb.) Cullen	.	+	.	1.2	1.2	+	.	.	4
H caesp	S EUROP. MONT.	Poa molinierii Balb.	.	.	.	+	.	+.2	+	+	4
T scap	EUROP.-W ASIAT.	Linum catharticum L. subsp. catharticum	+	.	1.1	.	.	.	+	.	3
H ros	EUROSIB.	Pilosella officinarum Vaill.	+	.	.	.	.	.	+	+	3
H bienn	EURASIAT.	Arabis hirsuta (L.) Scop.	.	+	.	+	.	.	+	.	3
G bulb	EUROP.	Dactylorhiza sambucina (L.) Soó	.	.	.	.	.	+	+	+	3
H ros	S EUROP. MONT.	Plantago argentea Chaix subsp. argentea	1.1	.	.	+.2	.	.	.	.	2
H scap	EUROP.	Asperula cynanchica L.	+	.	.	+.2	.	.	.	.	2
G bulb	EUROP.	Allium vineale L.	+	.	+	.	.	.	.	.	2
H scap	EUROP.	Euphorbia cyparissias L.	+	.	.	+	.	.	.	.	2
H ros	S EUROP.	Silene otites (L.) Wibel subsp. otites	.	+	.	.	.	.	+	.	2
G bulb	EUROSIB.	Gymnadenia conopsea (L.) R. Br.	.	.	.	+	.	.	+	.	2
H ros	EUROP.-CAUC.	Leontodon hispidus L.	.	.	.	.	.	+.2	+	.	2
H scap	MEDIT.	Polygala nicaeensis W.D.J. Koch subsp. mediterranea Chodat	.	.	.	.	.	.	+	2	2
H caesp	EUROP.	Hippocrepis comosa L. subsp. comosa	.	.	.	.	.	.	+	1	2

H scap	EURASIAT.	Plantago lanceolata L.	.	.	.	.	.	.	+	1	2
G bulb	EUROP.	Orchis morio L.	.	.	.	.	.	.	+	+	2
H caesp	EUROP.	Brachypodium rupestre (Host) Roem. *et* Schult.	.	.	.	.	.	.	2	1	2
H scap	S EUROP.	Globularia bisnagarica L.	.	.	.	.	.	.	2	1	2
H scap	W EUROP.-MEDIT.	Stachys officinalis (L.) Trevis.	1.1	.	.	.	.	.	.	.	1
H scap	EURASIAT.	Carex caryophyllea Latourr.	+.2	.	.	.	.	.	.	.	1
H caesp	EUROP.	Luzula campestris (L.) DC.	.	+.2	.	.	.	.	.	.	1
H scap	SE EUROP.	Ranunculus illyricus L.	.	+	.	.	.	.	.	.	1
H scap	SUBCOSMOPOL.	Sanguisorba minor Scop. subsp. balearica (Bourg. *ex* Nyman) Muñoz Garm. *et* C. Navarro	.	+	.	.	.	.	.	.	1
H scap	SE EUROP.	Achillea collina Becker *ex* Rchb.	.	.	.	+	.	.	.	.	1
Ch suffr	MEDIT.	Coronilla minima L. subsp. minima	.	.	.	.	.	+.2	.	.	1
T scap	EURASIAT.-N AFR.	Medicago lupulina L.	.	.	.	.	.	+.2	.	.	1
		Others species									
H scap	SE EUROP. MONT.	Trinia glauca (L.) Dumort. cfr subsp. carniolica (A. Kern. *ex* Janch.) H. Wolff	+	+	+	+.2	+	+.2	+	+	8
H caesp	ART.-ALP.	Anthoxanthum odoratum L. subsp. nipponicum (Honda) Tzvelev	+	+.2	.	+.2	.	+	.	.	4
H scap	MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter	+	+	.	.	.	.	.	+	3
	S EUROP.	Arenaria serpyllifolia L. subsp. serpyllifolia	+	.	.	.	.	.	+	+	3
Ch succ	EUROP.	Sedum acre L.	.	.	.	1.2	+	1.2	.	.	3
H caesp	ENDEM. ITAL.	Sesleria apennina Ujhely	.	.	.	(+)	(+.2)	(+.2)	.	.	3
Ch succ	EUROP.	Sedum sexangulare L.	+	.	.	.	.	.	+	.	2
Ch suffr	S EUROP. MONT.	Helianthemum nummularium (L.) Mill. subsp. grandiflorum (Scop.) Schinz *et* Thell.	.	.	.	.	.	.	+	+	2
Ch rept	S EUROP. MONT.	Thymus glabrescens Willd. subsp. decipiens (Heinr. Braun) Domin	.	.	.	1.2	.	2.3	.	.	2
Ch suffr	MEDIT. MONT.	Anthyllis montana L. subsp. atropurpurea (Vuk.) Pignatti	.	.	.	+	.	+.2	.	.	2
		Sporadics species	7	3	2	4	3	5	3	4	

purely hemicryptophytic and is characterised by high coverage of *Eryngium amethystinum* and by the entry of species of grassland slopes of the association *Filipendulo-Trifolietum montani*.

From the phytosociological point of view, the grassland under study has floristic and ecological similarities with the association *Potentillo cinereae-Brometum erecti* Biondi, Pinzi & Gubellini 2004 that has been described for the lower supratemperate belt of the Monte Cucco Massif (Biondi *et al*., 2004). This was subsequently reported for the Macerata Apennines (Catorci *et al*., 2007) and indicated for the southern slopes of Mount Sassotetto in the Sibillini Mountains, up to an altitude of 1250 m a.s.l. (Catorci *et al*., 2008). Within the association, there are at present two recognized subassociations: *potentilletosum cinereae* Catorci, Gatti & Ballelli 2007subass. *typicum* and *caricetosum humilis* Catorci, Gatti & Ballelli 2007. Although the grasslands under study have the characteristic species combination indicated for the association *Potentillo cinereae-Brometum erecti*, this is differentiated by a contingent of high-mountain species that are typical of the association *Koelerio splendentis-Brometum erecti* that has been described for the upper supratemperate belt of Gran Sasso d'Italia (Biondi *et al*., 1999). This was subsequently indicated also for the Sibillini Mountains (Catorci *et al*., 2008). Based on the comparison of the relevés (Fig. 9), while the grasslands under study have a certain floristic autonomy, they are still included in the association *Potentillo cinereae-Brometum erecti*, which is here in the new subassociation *trifolietosum alpestris* subass. nova hoc loco (rels. 1-8 di Tab. 5; holotypus rel. 5), for which the characteristic and differential species are considered to be: *Trifolium alpestre, Globularia meridionalis, Rhinanthus wettsteinii, Valeriana tuberosa, Pilosella cymosa* subsp. *cymosa* and *Avenula praetutiana*. The new subassociation also includes the relevés from the southern slopes of Monte Sassotetto (included in the comparison of Figure 9) that were previously included in the subassociation *typicum potentilletosum cinereae* (Catorci *et al*., 2008). The new subassociation *trifolietosum alpestris* indicates the higher-altitude aspect of the association *Potentillo cinereae-Brometum erecti* that is linked with the typical high-montane grasslands of the association *Koelerio splendentis-Brometum erecti* that develops at the higher altitudes. Moreover, Table 5 shows also a variant of *Filipendula vulgaris* and *Eryngium amethystinum* (rels. 1, 2) differentiated by *Filipendula vulgaris, Onobrychis viciifolia, Lotus corniculatus* subsp. *corniculatus* and *Bunium bulbocastanum*. This variant develops in the lower areas of the sides of the ridges, in soil that is more developed on loose detritus, that is subject to surface erosion. The variant of *Filipendula vulgaris* and *Eryngium amethystinum* that is contrasted by the high coverage of *Eryngium amethystinum* might also be the result of the regression of the grassland of the association *Filipendulo-Trifolietum montani*, caused by surface erosion.

POLYGALO MAJORIS-SESLERIETUM NITIDAE Biondi, Ballelli, Allegrezza & Zuccarello 1995 (Table 6; cluster 7 of Fig. 6 and Fig. 7)

On the steep parts of the summit slope areas, where there is detritus that is mainly stabilised, on thin soil (pH 6.7), there are strips of grassland of *Sesleria nitida* (s.l.) and *Carex macrolepis* with *Laserpitium siler* subsp. *siculum*, *Bupleurum falcatum* subsp. *cernuum* and *Polygala major*, which are included in the association *Polygalo mayoris-Seslerietum nitidae* (Table 6). These often form a mosaic with more xerophilous aspects of the *Bromopsis erecta* subsp. *erecta* grasslands of the associations *Filipendulo vulgaris-Trifolietum montani*

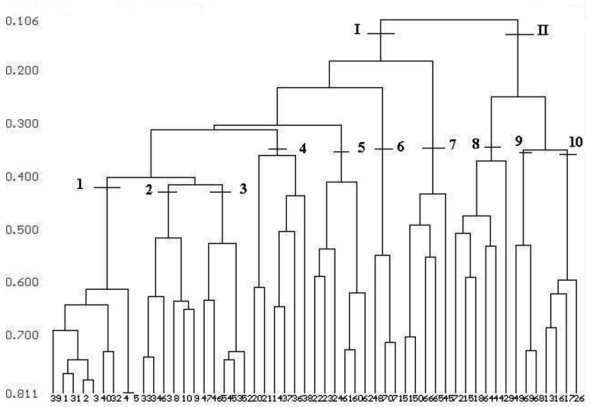

Fig. 6 - Dendrogram of the erbaceosus phytocoenosis phytosociological relevés.

and *Potentillo cinereae-Brometum erecti*. The typical aspect of the association is seen under the conditions of greater edaphic instability (rel. 1 of Table 6), which arise in chain connection with the *Sesleria apennina* grasslands of the association *Carici macrolepis-Seslerietum apenninae* and with the nuclei of *Juniperus communis* subsp. *nana*. In the situations that have stabilised (rels. 2, 3 of Table 6), the entry can be seen of edge species of the accelerated vegetation from isolated nuclei of preforest vegetation, which indicate the forthcoming replacement of the grasslands due to a floristic-vegetation change.

FILIPENDULO VULGARIS-TRIFOLIETUM MONTANI Hruska, Francalancia & Orsomando 1981 in Francalancia *et al*. (1981) (Table 7; cluster 2 of Fig. 6 and Fig. 7)

gentianelletosum columnae Hruska, Francalancia & Orsomando 1981 in Francalancia *et al*. (1981) (rels. 1-6 of Table 7)

Brachypodium genuense and *Gentiana lutea* subsp. *lutea* variant (rels. 1-3)

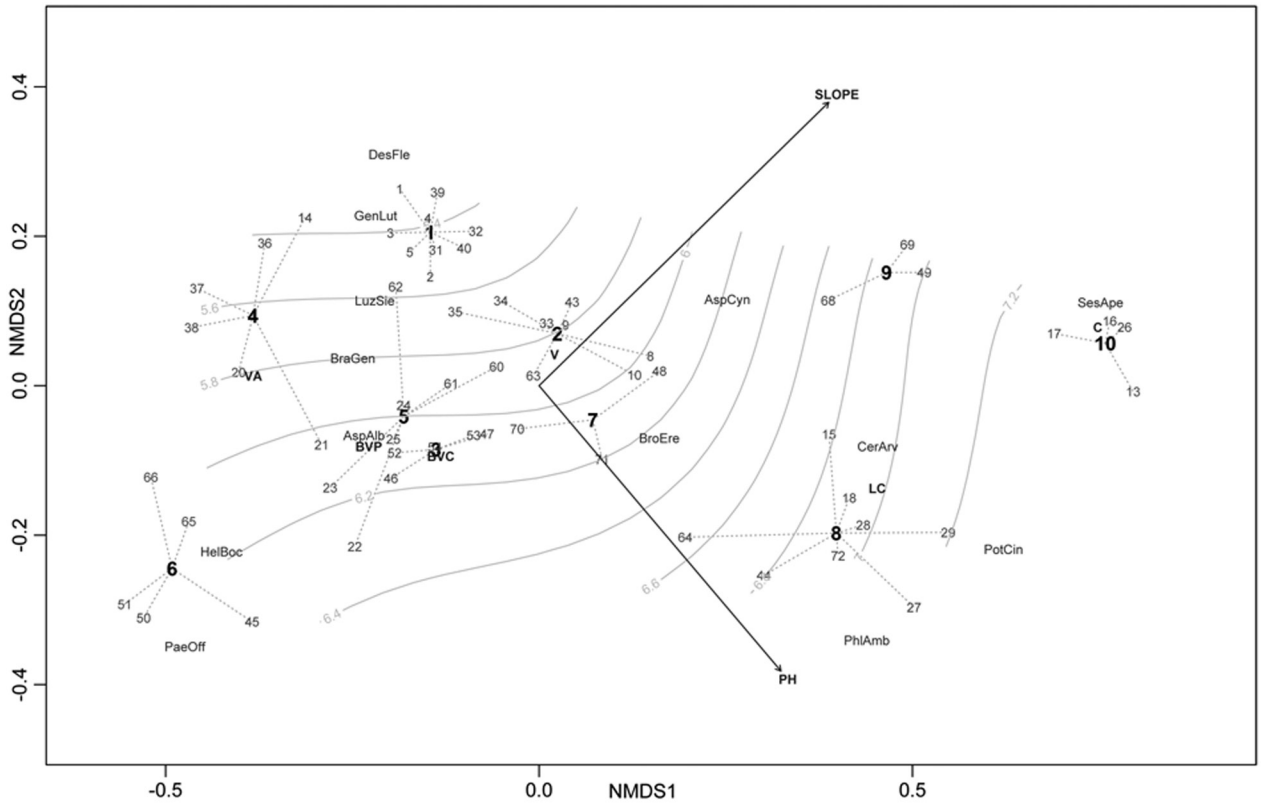

Fig. 7 - Nonmetric Multi-Dimensional Scaling (NMDS) ordination (axis NMDS1 e NMDS2) of the erbaceosus phytocoenosis. Dasched lines represent the cluster (associations): Solid line represent the direction and strength of Slope e pH gradients. Furthemore the isolines represents the trend surface of the pH. Legend: 10 - *Carici humilis-Seslerietum apenninae*; 9 - *Carici macrolepis-Seslerietum apenninae*; 8 - *Potentillo cinereae-Brometum erecti*; 7 - *Polygalo majoris-Seslerietum nitidae*; 2 - *Filipendulo vulgaris-Trifolietum montani*; 1 - *Gentiano luteae-Brachypodietum genuensis;* 5: *Senecio scopolii-Asphodeletum macrocarpi*; 3 - *Luzulo sieberi-Brachypodietum genuensis* ass. *helleboretosum bocconei* subass. *Trifolium alpestre* variant; 4 - *Luzulo sieberi-Brachypodietum genuensis* ass. *helleboretosum bocconei* subass. and *Luzulo sieberi-Brachypodietum genuensis* ass. *helleboretosum bocconei* subass. *Gentiana lutea* variant; group 6 – *Dichoropetalo carvifolii-chabraeii-Paeonietum italicae*. Geomorphological elements: (C) ridges, (LC) the lateral parts of the ridges, (V) slopes, (BVP) rolling plain areas, (BVC) wide valleys, (VA) narrow valleys. Species: paoOff: *Paeonia officinalis* subsp. *italica;* HelBoc: *Helleborus bocconei* subsp. *bocconei;* AsphAlb: *Asphodelus macrocarpus* subsp. *macrocarpus;* BraGen: *Brachypodium genuense;* LuzSie: *Luzula sylvatica* subsp. *sieberi;* GenLut: *Gentiana lutea* subps. *lutea;* DesFle: *Deschampsia flexuosa* subsp. *flexuosa;* BroEre: *Bromus erectus* subsp. *erectus;* AspCyn: *Asperula cynanchica;* PhlAmb: *Phleum hirsutum* subsp. *ambiguum;* PotCin: *Potentilla incana;* SesApe: *Sesleria apennina*.

This is a mesophilous grassland that is weakly subacidophilous with a continuous herbaceous cover of *Bromopsis erecta* subsp. *erecta* and *Brachypodium genuense* with *Trifolium montanum* subsp. *rupestre*, *Filipendula vulgaris, Cynosurus cristatus* and *Knautia purpurea*, and others. It is particularly widespread on the slopes of the study area, on deep soil (pH 5.9). The widespread human abandonment of the grassland is seen by the cover of *Brachypodium genuense*, which sometimes shares the dominance of the herbaceous layer with *Bromopsis erecta* subsp. *erecta*.

From the phytosociological point of view, the grassland under study is included in the association *Filipendulo vulgaris-Trifolietum montani* Hruska, Francalancia & Orsomando 1981 (subass. *typicum*: *gentianelletosum columnae* Hruska, Francalancia & Orsomando 1981) described for the "Prati di Ragnolo" in the Sibillini Mountains, bordering on the study area, on rolling plains or slightly sloping morphologies. Based on the results of the syntaxonomic revision of the Apennine grasslands of the order *Brometalia erecti* (Biondi *et al*., 2005), the association *Filipendulo vulgaris-Trifolietum montani* has been downgraded to the level of the subassociation *trifolietosum montani* of the association *Brizo mediae-Brometum erecti*. This classification was carried out on the basis of the original relevés in Francalancia *et al*. (1981). In agreement with Catorci *et al*. (2007), the association *Filipendulo vulgaris-Trifolietum montani*, which is differentiated by a contingent of species of the classes *Nardetea strictae* and *Molinio-Arrhenatheretea*, is therefore confirmed and recognized for the upper bioclimatic belt of the central Apennines. Among the characteristic and differential species that follow the areal of the association *typicum*, there are: *Trifolium montanum* subsp. *rupestre, Filipendula vulgaris, Alchemilla glaucescens,*

Tab. 6 - *Polygalo majoris-Seslerietum nitidae* Biondi, Ballelli, Allegrezza & Zuccarello 1995

		Relevè number	1	2	3	
		Relevè number from dendrogram Fig. 6 e Fig. 7	48	70	71	
		Cluster	7	7	7	
		Geomorphological elements	V	V	V	
		Altitude (m a.s.l.) x 10	155	150	156	
		Aspect	ENE	ENE	ENE	
		Slope (°)	30	30	30	
Life Form	Chorotype	Coverage (%)	90	90	90	Presence
		Area (m^2)	100	100	100	
		Charact. and diff. species of the ass.				
H caesp	ENDEM.	Sesleria nitida Ten. (*s.l.*)	3.4	3.4	4.4	3
H caesp	SUBENDEM.	Carex macrolepis DC.	2.3	3.4	2.3	3
		Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti *et*				
H scap	ENDEM.	Gubellini	2.2	+	+	3
H scap	S EUROP. MONT.	Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang.	.	+	1.1	2
H scap	SE EUR.-SW ASIAT.	Polygala major Jacq.	1.1	.	.	1
		Charact. and diff. species of the *Brachypodenion genuensis* suball., the *Phleo ambigui-Bromion* all. and the *Phleo ambigui-Brometalia* ord.				
H caesp	MEDIT.	Festuca circummediterranea Patzke	2.3	1.2	1.2	3
H scap	MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	+.2	1.2	1.1	3
H ros	ENDEM.	Senecio scopolii Hoppe *et* Hornsch. subsp. floccosus (Bertol.) Greuter	+.2	2.3	1.1	3
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	+.2	2.2	.	2
H scap	S EUROP.	Galium corrudifolium Vill.	+.2	+	.	2
H scap	MEDIT.	Eryngium amethystinum L.	+	.	+.2	2
H scap	SW EUROP. MONT.	Knautia purpurea (Vill.) Borbás	+	.	+	2
H caesp	ENDEM.	Koeleria splendens C. Presl subsp. grandiflora (Bertol. *ex* Schultes) Domin	+.2	.	.	1
H scap	ENDEM.	Centaurea ambigua Guss. (*s.l.*)	+.2	.	.	1
H caesp	ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	1.2	.	.	1
H scap	S EUROP.-W ASIAT.	Cyanus triumfetti (All.) Dostal *ex* A'. *et* D. Löve	.	+.2	.	1
		Charact. species of the *Festuco-Brometea* class				
H caesp	EUROP.	Bromopsis erecta (Huds.) Holub subsp. erecta	1.2	3.4	2.3	3
H ros	S EUROP. MONT.	Plantago argentea Chaix subsp. argentea	+	+.2	1.1	3
H ros	S EUROP.-W ASIAT.	Primula veris L. subsp. suaveolens (Bertol.) Gutermann *et* Ehrend.	+	.	+	2
H scap	W EUROP.-MEDIT.	Stachys officinalis (L.) Trevisan	+	.	+	2
H scap	EURASIAT.	Campanula glomerata L.	.	1.2	+.2	2
H caesp	S EUROP. MONT.	Silene ciliata Pourr. subsp. graefferi (Guss.) Nyman	.	1.1	+.2	2
H scap	EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	1.1	.	.	1
G bulb	EUROP.	Dactylorhiza sambucina (L.) Soó	+	.	.	1
H scap	E EUROP.-W ASIAT.	Pilosella cymosa (L.) F.W. Schultz *et* Sch. Bip. subsp. cymosa	+	.	.	1
Ch suffr	EUROP.-W ASIAT.	Helianthemum nummularium (L.) Mill. subsp.obscurum (Celak.) Holub	+.2	.	.	1
G bulb	MEDIT.	Muscari neglectum Guss.	+	.	.	1
H scap	EUROP.	Euphorbia cyparissias L.	.	+.2	.	1
H scap	S EUROP. MONT.	Dianthus monspessulanus L.	.	+	.	1
		Others species				
H scap	S EUROP. MONT.	Ranunculus breyninus Crantz	1.1	1.2	1.1	3
H scap	MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter	1.1	1.1	1.1	3
H caesp	S EUROP. MONT.	Luzula sylvatica (Huds.) Gaudin subsp. sieberi (Tausch) K. Richt.	1.1	+.2	+.2	3
H scap	S EUROP. MONT.	Gentiana lutea L. subsp. lutea	+	1.1	+	3
T scap	ENDEM.	Rhinanthus wettsteinii (Sterneck) Soó	+	.	+	2
H scap	ENDEM.	Campanula micrantha Bertol.	.	1.1	1.1	2
H scap	S EUROP. MONT.	Cruciata glabra (L.) Ehrend. subsp. glabra	.	+	+	2
G rhiz	ENDEM.	Paeonia officinalis L. subsp. italica N.G. Passal. *et* Bernardo	.	+.2	+	2
Ch succ	EUROP.	Sedum acre L.	+	.	.	1
H scap	S EUROP.	Dichoropetalum carvifolium-chabraei (Crantz) Soldano, Galasso et Banfi	.	1.1	.	1
H scap	SE EUROP. MONT.	Grafia golaka (Hacq.) Rchb.	.	.	+	1

Tab. 7 - *Filipendulo vulgaris-Trifolietum montani* Hruska, Francalancia & Orsomando 1981 in Francalancia, Hruska & Orsomando, 1981, *gentianelletosum columnae* Hruska, Francalancia & Orsomando 1981 in Francalancia, Hruska & Orsomando, 1981 (rels. 1-6 of Table 7), *Brachypodium genuensis* and *Gentiana lutea* variant (rels. 1-3)

		Relevè number	1	2	3	4	5	6	
		Relevè number from dendrogram Fig. 6 and Fig. 7	33	34	63	8	10	9	
		Cluster	2	2	2	2	2	2	
		Geomorphological elements	V	V	V	V	V	V	
		Altitude (m a.s.l.) x 10	145	145	144	146	145	147	
		Aspect	N	N	NE	NNE	NNE	NNE	
		Slope (°)	25	25	20	35	25	30	
Life		Coverage (%)	100	100	100	100	100	95	Presences
Form	Chorotype	Area (m^2)	100	100	100	100	100	100	
		Charact. and diff. species of the ass.							
H caesp	EUROP.	Bromopsis erecta (Huds.) Holub subsp. erecta	3.3	2.3	3.4	3.3	4.4	3.4	6
H ros	ENDEM.	Senecio scopolii Hoppe *et* Hornsch. subsp. floccosus (Bertol.) Greuter	1.2	2.2	1.1	1.1	1.1	1.2	6
H scap	SW EUR. MONT.	Knautia purpurea (Vill.) Borbás	2.3	1.2	1.2	1.2	2.2	1.2	6
H scap	EURASIAT.	Filipendula vulgaris Moench	+.3	1.2	1.2	1.1	1.1	1.2	6
G bulb	EUROSIB.	Gymnadenia conopsea (L.) R. Br.	1.1	+	+	+.2	+	1.1	6
H scap	ENDEM.	Potentilla rigoana Th. Wolf	1.1	+.2	+.2	+.2	+.2	+	6
T scap	EUROP.	Rhinanthus alectorolophus (Scop.) Pollich subsp. alectorolophus	+	+	+	2.2	2.2	+	6
H scap	EUROP.	Asperula cynanchica L.	+.2	+.2	+	+	+.2	+.2	6
H scap	MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	1.1	1.2	+.2	.	1.2	2.2	5
H scap	W ALP.-APENN.	Cerastium arvense L. subsp. suffruticosum (L.) Ces.	+	+	+.2	+	1.1	.	5
H scap	EURIMEDIT.	Anthyllis vulneraria L. ssp. weldeniana (Rchb.) Cullen	.	.	.	+	+.2	.	2
		Diff. species of the *Brachypodium genuensis* and *Gentiana lutea* variant							
H scap	ENDEM.	Campanula micrantha Bertol.	+	+.2	+	+.2	.	.	4
H scap	S EUROP. MONT.	Gentiana lutea L. subsp. lutea	1.1	1.2	+	.	.	+	4
H caesp	SE EUROP. MONT.	Bellardiochloa variegata (Lam.) Kerguélen subsp. variegata	1.1	1.1	+.2	.	(+.2)	.	4
H caesp	S EUROP. MONT.	Luzula sylvatica (Huds.) Gaudin subsp. sieberi (Tausch) K. Richt.	.	+.2	.	.	.	.	1
		Charact. and diff. species of the *Brachypodenion genuensis* suball., the *Phleo ambigui-Bromion erecti* all. and the *Phleo ambigui-Brometalia erecti* ord.							
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	3.4	3.4	3.4	2.3	2.3	2.3	6
H scap	S EUROP.	Galium corrudifolium Vill.	1.2	+.2	+.2	1.1	1.2	+.2	6
H caesp	ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	+.2	+	+	+.2	1.1	+.2	6
H caesp	MEDIT.	Festuca circummediterranea Patzke	1.2	1.2	2.2	1.2	.	1.2	5
H caesp	SUBENDEM.	Carex macrolepis DC.	2.2	.	.	2.2	+.2	2.2	4
H caesp	ENDEM.	Koeleria splendens C. Presl subsp. grandiflora (Bertol. *ex* Schultes) Domin	+.2	.	+	.	.	.	2
H scap	S EUROP.	Potentilla incana G. Gaertn., B. Mey *et* Scherb.	.	.	.	+.2	+.3	.	2
H ros	S EUROP. MONT.	Carlina acaulis L. subsp. caulescens (Lam.) Schübl. *et* G. Martens	.	+	.	.	.	.	1
H scap	MEDIT.	Eryngium amethystinum L.	.	.	+	.	.	.	1
Ch rept	ILLIR.-APENN.	Globularia meridionalis (Podp.) O. Schwarz	.	.	.	+.2	.	.	1
Ch suffr	MEDIT.	Helianthemum oelandicum (L.) Dumort. subsp. incanum (Willk.) G. López	.	.	.	+.2	.	.	1
H scap	EUROP.-W ASIAT.	Cyanus triumfetti (All.) Dostal *ex* A'. *et* D. Löve	.	.	.	.	1.1	.	1
H scap	SE EUROP. MONT.	Trinia glauca (L.) Dumort. cfr subsp. carniolica (A. Kern. *ex* Janch.) H. Wolff	.	.	.	.	1.1	.	1
		Charact. species of the *Festuco-Brometea* class							
H scap	EUROP.	Trifolium alpestre L.	1.2	+.2	2.2	1.2	+.2	+.2	6
H caesp	EUROP.	Luzula campestris (L.) DC.	1.1	+.2	1.1	+	+.2	1.2	6
H scap	E EUR.-W ASIAT.	Pilosella cymosa (L.) F.W. Schultz *et* Sch. Bip. subsp. cymosa	+	+	1.1	+	1.1	+	6
H scap	S EUROP. MONT.	Dianthus monspessulanus L.	+.2	+.2	1.2	+	.	.	4
H scap	EURASIAT.	Campanula glomerata L.	1.2	+	1.1	.	.	+.2	4
H scap	S EUROP. MONT.	Leucanthemum adustum (W.D.J. Koch) Gremli	+.2	1.1	.	+	.	+	4
H ros	S EUROP. MONT.	Plantago argentea Chaix subsp. argentea	.	+.2	.	+	+	1.1	4
H caesp	EUROP.-W ASIAT.	Trifolium ochroleucum Huds.	.	.	+.2	+.2	+.2	+.2	4
H scap	EUROSIB.	Galium verum L. subsp. verum	2.3	1.2	+.2	.	.	.	3
G bulb	EUROP.	Dactylorhiza sambucina (L.) Soó	.	.	.	+	+	+	3
Ch suffr	EUROP.-W ASIAT.	Helianthemum nummularium (L.) Mill. subsp. obscurum (Celak.) Holub	.	.	.	1.2	1.1	+.2	3
H scap	EURASIAT.	Carex caryophyllea Latourr.	1.2	.	1.2	.	.	.	2
G bulb	SW EUROP.	Narcissus poeticus L.	.	+	.	.	+	.	2
H ros	S EUROP. MONT.	Armeria canescens (Host) Ebel	.	.	+	+	.	.	2
T scap	EUROP.-W ASIAT.	Linum catharticum L. subsp. catharticum	.	.	.	+.2	.	+.2	2
H scap	EUROP.	Euphorbia cyparissias L.	.	.	1.1	.	.	.	1
G bulb	SW EUROP.	Bunium bulbocastanum L.	.	.	+	.	.	.	1
H scap	SUBCOSMOPOL.	Sanguisorba minor Scop. subsp. balearica (Bourg. *ex* Nyman) Muñoz Garm. *et* C. Navarro	.	.	+	.	.	.	1
H scap	W EUROP.-MEDIT.	Stachys officinalis (L.) Trevis.	.	.	+	.	.	.	1
H bienn	EURASIAT.	Arabis hirsuta (L.) Scop.	.	.	.	+	.	.	1
H scap	S EUROP.	Valeriana tuberosa L.	.	.	.	+	.	.	1
T scap	W EUROP.-MEDIT.	Aira caryophyllea L. subsp. caryophyllea	.	.	.	.	+	.	1
		Molinio-Arrhenatheretea class							
H scap	EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	+.2	1.1	1.1	+	+	.	5
H caesp	EURASIAT.	Cynosurus cristatus L.	+	1.2	+.2	.	+.2	+.2	5
H caesp	EUROP.-W ASIAT.	Briza media L.	1.2	2.2	1.2	.	.	+.2	4
H scap	EURASIAT.	Tragopogon pratensis L. subsp. pratensis	+	+	+	.	.	.	3
H ros	EUROP.-W ASIAT.	Leontodon hispidus L.	+.2	.	.	.	+.2	.	2
H caesp	ART.-ALP.	Anthoxanthum odoratum L. subsp. nipponicum (Honda) Tzvelev	.	.	.	.	1.1	+.2	2
H scap	EUROSIB.	Trifolium pratense L. subsp. pratense	.	.	+.2	.	.	.	1
H rept	EUROSIB.	Trifolium repens L. subsp. repens	.	.	+.2	.	.	.	1

		Nardetea strictae class						
H caesp	EUSIB.-N AMER.	Poa alpina L. subsp. alpina	+.2	1.2	.	+.2	1.1	+	5
H caesp	EURASIAT.	Agrostis capillaris L.	+.2	+.2	2.2	.	+.2	+.2	5
H scap	MEDIT. MONT.	Rumex nebroides Campd.	+	+	+	.	+	+	5
H caesp	EUROP.	Festuca rubra L. subsp. commutata (Gaudin) Markgr.-Dann.	2.2	2.3	+.2	.	.	1.2	4
H ros	S EUROP. MONT.	Pedicularis tuberosa L.	+	.	.	.	.	.	1
H scap	ENDEM.	Viola eugeniae Parl. subsp. eugeniae	.	.	+	.	.	.	1
		Other species							
H scap	MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter	+.2	.	+	+.2	+	+.2	5
G rad	SE EUROP.	Thesium linophyllon L.	+	.	+	+.2	+.2	+.2	5
H scap	S EUROP. MONT.	Ranunculus breyninus Crantz	.	+	+	1.2	+	+	5
Ch suffr	S EUROP. MONT.	Thymus praecox Opiz subsp. polytrichus (Borbás) Jalas	.	+.2	.	+.2	+.2	+	4
Ch succ	EUROP.	Sedum rupestre L. subsp. rupestre	+	+	+	.	.	.	3
		Sporadics species	0	0	7	3	0	1	

Anthyllis vulneraria subsp. *weldeniana, Gymnadenia conopsea, Gentianella columnae* and *Gentiana verna* subsp. *verna*. *Senecio scopolii* subsp. *floccosus* is also suggested for this location, which is an endemic species of the central-southern Apennines indicated for the upper supratemperate belt of the mountain group of Monte Coscerno and the Sibillini Mountains, where it is particularly widespread in the mesophilous and mesoacidophilous grasslands of the associations *Filipendulo vulgaris-Trifolietum montani* and *Senecio scopolii-Ranunculetum pollinensis*. Among the species that are characteristic and differential in the study area, there are: *Senecio scopolii* subsp. *floccosus, Trifolium montanum* subsp. *rupestre, Filipendula vulgaris, Alchemilla glaucescens, Anthyllis vulneraria* subsp. *weldeniana* and *Gymnadenia conopsea*. A group of species can be added to the characteristic species combination in the Table 7, which includes: *Cerastium arvense* subsp. *suffruticosum, Potentilla rigoana, Knautia purpurea, Rhinanthus alectorolophus* subsp. *alectorolophus* and *Asperula cynanchica*. In the study area, these take on the significance of differentials of the association *Filipendulo vulgaris-Trifolietum montani* with respect to the *Brachypodium genuense* associations: *Gentiano luteae-Brachypodietum genuensis* and *Luzulo sieberi-Brachypodietum genuensis*. To highlight the chain and dynamic relationships of the association in the study area, Table 7 also shows a variant of *Brachypodium genuense* and *Gentiana lutea* subsp. *lutea*. The variant of *Brachypodium genuense* and *Gentiana lutea* subsp. *lutea* (rels. 1-3) is differentiated by *Bellardiochloa variegata* subsp. *variegata, Gentiana lutea* subsp. *lutea, Campanula micrantha* and *Luzula sylvatica* subsp. *sieberi*, and by the cover of *Brachypodium genuense,* which shares the dominance of the herbaceous layer with *Bromopsis erecta* subsp. *erecta*. This indicates the local conditions of the initial edge development of the grassland of the association *Filipendulo vulgaris-Trifolietum montani* that takes place in the positions of moderate steepness of the slopes (20°-25°) on deep and moist soil, and in the areas adjacent to the ski slopes where the snow cover lasts for longer.

GENTIANO LUTEAE-BRACHYPODIETUM GENUENSIS ass. nova hoc loco holotypus rel. 2 of Table 8 (Table 8; cluster 1of Fig. 6 and Fig. 7)
deschampsietosum flexuosae subass. nova hoc loco subass. *typicum* (rels 1-9 of Table 8; holotypus rel. n. 2)

The continuous mesophilous and acidophilous gras-

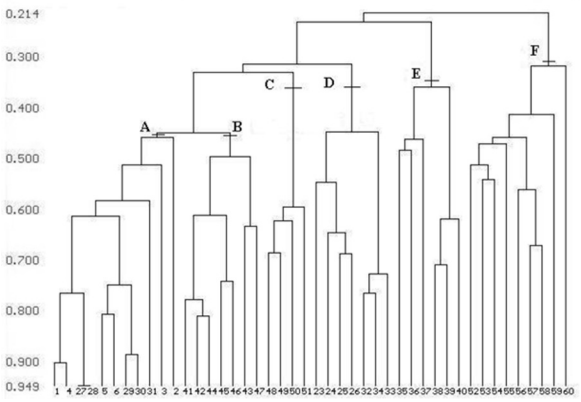

Fig. 8 - Dendrogram from the *Sesleria apennina* grasslands community phytosociological relevés and published relevés belong to the *Carici humilis-Seslerietum apenninae* association as comparation (A - *Carici humilis-Seslerietum apenninae* subass. *caricetosum humilis* subass. *typicum*; B - *anthyllidetosum pulchellae* subass.; C - *paronychietosum kapelae* subass. nova hoc loco (area study); D - *genistetosum michelii* subass.; E - *hieracietosum cymosi* subass.; F - *astragaletosum sempervirentis* subass.).

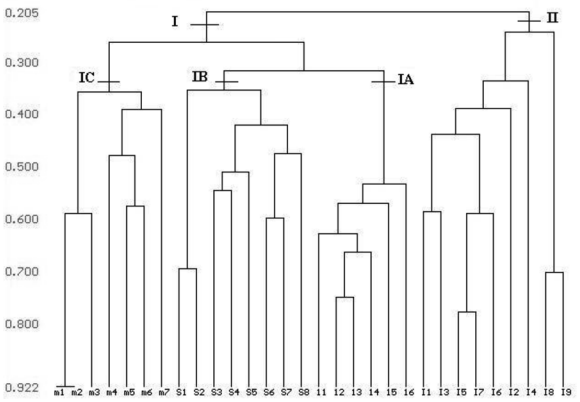

Fig. 9 - Dendrogram from the *Potentilla incana* community phytosociological relevés and published relevés belong to the *Potentillo cinerae-Brometum erecti* association and *Koelerio splendentis-Brometum erecti* association (I – *Potentillo cinerae-Brometum erecti*; subcluster IA - subass. *potentilletosum cinereae* subass. *typicum*, subcluster IB - *caricetosum humilis* subass., subcluster IC - *trifolietosum alpestris* subass. nova hoc loco (area study); II – *Koelerio splendentis-Brometum erecti*).

Tab. 8 - *Gentiano luteae-Brachypodietum genuensis* ass. nova hoc loco (holotypus rel. n. 2), *deschampsietosum flexuosae* subass. nova hoc loco subass. *typicum* (rels. 1-9, holotypus rel. n. 2).

		Relevè number	1	2*	3	4	5	6	7	8	9	
		Relevè number from dendrogram Fig. 6 and Fig. 7	39	1	31	2	3	40	32	4	5	
		Cluster	1	1	1	1	1	1	1	1	1	
		Geomorphological elements	V	V	V	V	V	V	V	V	V	
		Altitude (m a.s.l.) x 10	145	144	145	147	148	147	145	150	148	
		Aspect	N	N	N	N	N	N	N	N	N	
		Slope (°)	30	30	30	30	30	25	25	30	30	Presences
Life Form	Chorotype	Coverage (%)	100	100	100	100	100	100	100	100	95	
		Area (m²)	100	100	150	100	100	100	100	100	100	
		Charact. and diff. species of the ass.										
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	4.4	4.4	4.4	5.5	4.5	4.4	3.4	4.4	4.4	9
H scap	S EUROP. MONT.	Gentiana lutea L. subsp. lutea	3.3	3.3	3.3	3.3	3.3	1.2	1.2	2.2	2.3	9
H ros	ENDEM.	Senecio scopolii Hoppe *et* Hornsch. subsp. floccosus (Bertol.) Greuter	1.1	2.2	2.2	1.1	1.2	1.1	2.2	1.2	2.2	9
H scap	ENDEM.	Campanula micrantha Bertol.	1.1	+.2	1.2	1.1	1.1	1.1	1.1	+.2	+	9
H scap	ENDEM.	Ranunculus apenninus Chiov.	1.2	+	+	1.1	+.2	1.1	1.2	1.1	1.1	9
H scap	S EUROP. MONT.	Linum alpinum Jacq.	1.1	+	+	+.2	+	1.1	+	+	+	9
H caesp	ART.-ALP.	Anthoxanthum odoratum L. subsp. nipponicum (Honda) Tzvelev	2.2	1.2	1.2	+.2	1.2	1.1	+	+.2	+.2	9
H caesp	S EUROP. MONT.	Luzula sylvatica (Huds.) Gaudin subsp. sieberi (Tausch) K. Richt.	1.1	+	1.2	+	+.2	1.2	+.2	.	+.2	8
H caesp	SUBCOSMOP.	Deschampsia flexuosa (L.) Trin. subsp. flexuosa	+.2	2.2	2.2	+.2	+.3	(+)	.	+.2	+.2	8
H scap	S EUROP. MONT.	Leucanthemum adustum (W.D.J. Koch) Gremli	1.2	1.1	1.2	+	+	+	1.1	+	.	8
H ros	S EUROP. MONT.	Carlina acaulis L. subsp. caulescens (Lam.) Schübl. *et* G. Martens	+	1.1	+.2	.	+	+	+	.	.	6
T scap	EUROSIB.	Rhinanthus minor L.	+	+.2	1.1	+.2	+.2	.	.	.	.	5
		Charact. and diff. species of the *Brachypodenion genuensis* suball., the *Phleo ambigui-Bromion erecti* all. and the *Phleo ambigui-Brometalia erecti* ord.										
H scap	MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	1.2	1.2	2.3	1.2	1.1	2.3	1.2	1.2	1.2	9
H caesp	SUBENDEM.	Carex macrolepis DC.	1.2	1.2	1.2	1.2	+.2	2.3	3.3	2.3	2.3	9
H caesp	ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	+.2	1.1	+.2	+.2	+.2	+.2	1.1	+.2	+.2	9
H caesp	MEDIT.	Festuca circummediterranea Patzke	+.2	1.2	1.2	1.2	+.2	+.2	2.2	.	.	7
H scap	SW EUROP. MONT.	Knautia purpurea (Vill.) Borbás	.	.	+.2	+.2	+	.	.	.	.	3
H bienn	ENDEM.	Gentianella columnae (Ten.) Holub	.	.	.	(+)	.	.	.	+.2	.	2
H scap	SE EUR.-SW ASIAT.	Polygala major Jacq.	.	.	.	.	.	.	.	+	.	1
		Charact. species of the *Festuco-Brometea* class										
H ros	S EUROP. MONT.	Plantago argentea Chaix subsp. argentea	+.2	+	+	1.1	+	1.2	+.2	+.2	1.1	9
G rad	SE EUROP.	Thesium linophyllon L.	1.1	+.2	+.3	+	+	1.1	+.2	1.1	1.1	9
G bulb	EUROSIB.	Gymnadenia conopsea (L.) R. Br.	+	+	+.2	+.2	+	+	+.2	+.2	+.2	9
H scap	E EUR.-W ASIAT.	Pilosella cymosa (L.) F.W. Schultz *et* Sch. Bip. subsp. cymosa	1.2	1.1	+.2	+	1.1	1.1	+.2	+	.	8
H scap	EURASIAT.	Campanula glomerata L.	1.1	+.2	1.2	+.2	+.2	+.2	1.1	.	+	8
H caesp	EUROP.	Luzula campestris (L.) DC.	+.2	+	+.2	+.2	.	+	+	+	+.2	8
H caesp	EUROP.-W ASIAT.	Briza media L.	+.2	+	1.1	+	.	1.2	1.1	+.2	+.2	8
H caesp	EUROP.	Bromopsis erecta (Huds.) Holub subsp. erecta	+.2	.	+.2	+	.	1.2	+.2	+.2	+.2	7
H scap	EURASIAT.	Filipendula vulgaris Moench	+	.	+.2	+	+.2	.	.	+	+	6
G bulb	EUROP.	Dactylorhiza sambucina (L.) Soó	+	+	.	+	+	+	.	.	+	6
H scap	S EUROP. MONT.	Dianthus monspessulanus L.	+	+	+.2	.	+	.	+	.	.	5
H scap	EUROP.-CAUC.	Trifolium alpestre L.	+.2	.	+.2	+	.	+	.	.	+.2	5
T scap	EUROP.-W ASIAT.	Linum catharticum L. subsp. catharticum	+	+.2	.	+.2	+	+	.	.	.	5
H ros	SE EUROP. MONT.	Armeria canescens (Host) Ebel	.	.	+	.	.	+	+	.	+	4
T scap	EUROP.	Rhinanthus alectorolophus (Scop.) Pollich subsp. alectorolophus	.	.	.	.	.	+	+	1.2	+	4
H ros	EUROSIB.	Pilosella officinarum Vaill.	+	+.2	.	.	.	.	.	.	.	2
H ros	MEDIT: MONT.	Scorzoneroides cichoracea (Ten.) Greuter	+	.	.	.	.	(+)	.	.	.	2
H scap	EUROP.	Asperula cynanchica L.	.	.	+.2	.	.	.	+	.	.	2
H ros	S EUROP.-W ASIAT.	Primula veris L. subsp. suaveolens (Bertol.) Gutermann *et* Ehrend.	.	.	+	.	+	.	.	.	.	2
H caesp	EUROP.-W ASIAT.	Trifolium ochroleucum Huds.	.	.	.	+.2	+.2	.	.	.	.	2
H bienn	ENDEM.	Cirsium morisianum Rchb.	.	.	.	.	.	.	.	+	+	2
T scap	W EUROP.-MEDIT.	Aira caryophyllea L. subsp. caryophyllea	.	.	.	.	.	.	.	+	+	2
H scap	EURASIAT.	Carex caryophyllea Latourr.	1.1	.	.	.	.	.	.	.	.	1
H scap	EUROSIB.	Achillea millefolium L. subsp. millefolium	+	.	.	.	.	.	.	.	.	1
H caesp	S EUROP. MONT.	Silene ciliata Pourr. subsp. graefferi (Guss.) Nyman	+	.	.	.	.	.	.	.	.	1
H caesp	EUROP.	Hippocrepis comosa L. subsp. comosa	.	.	.	.	.	+	.	.	.	1
H scap	EUROSIB.	Galium verum L. subsp. verum	.	.	.	.	.	+	.	.	.	1
		Molinio-Arrhenatheretea class										
H scap	EURASIAt.-AFR.	Lotus corniculatus L. subsp. corniculatus	1.2	+	+.2	+.2	+.2	1.2	+.2	+.2	+.2	9
H caesp	EURASIAT.	Cynosurus cristatus L.	.	+	+.2	+	1.2	1.1	+	+	.	7
H scap	EUROSIB.	Trifolium pratense L. subsp. pratense	.	+.2	+.2	+.2	+.2	+	.	+.2	+.2	7
H ros	EUROP.-CAUC.	Leontodon hispidus L.	.	.	.	(+)	.	+	+.2	1.1	1.1	5
G bulb	SW EUROP.	Narcissus poeticus L.	+	.	.	+	.	+	.	+	.	4
H scap	EURASIAT.	Tragopogon pratensis L. subsp. pratensis	.	.	+.2	.	+	+	+	.	.	4
		Nardetea strictae class										
H scap	ENDEM.	Ranunculus pollinensis (N. Terracc.) Chiov.	1.1	1.1	1.1	1.1	1.1	+	+	+.2	+	9
H caesp	CIRCUMBOR.	Poa alpina L. subsp. alpina	1.2	+.2	1.2	+.2	+.2	+.2	+.2	+.2	+	9
H caesp	S EUROP. MONT.	Festuca microphylla (St.-Yves) Patzke	3.3	1.2	2.3	1.2	+.2	2.2	2.2	+.2	.	8
H ros	S EUROP. MONT.	Pedicularis tuberosa L.	+	+	.	+	.	+.2	1.1	.	.	5
H caesp	EURASIAT.	Agrostis capillaris L.	.	1.2	+	+.2	.	.	.	1.1	+.2	5
H caesp	S EUROP.-SUDSIB.	Nardus stricta L.	+.2	+.2	.	.	.	.	.	.	.	2
H caesp	SE EUROP. MONT.	Bellardiochloa variegata (Lam.) Kerguélen subsp. variegata	.	.	1.2	.	.	.	+.2	.	.	2
H scap	MEDIT. MONT.	Rumex nebroides Campd.	.	.	.	+	.	+	.	.	.	2
		Festuco-Seslerietea caeruleae class										
H scap	S EUROP. MONT.	Biscutella laevigata L. subsp. laevigata	.	.	.	.	+	+.2	+.2	+.2	+.2	5
H scap	EUROP.	Phyteuma orbiculare L.	+	.	.	.	.	(+)	.	1.1	+.2	4
H scap	S EUROP. MONT.	Galium anisophyllon Vill.	+	.	+	.	.	+	.	.	.	3
Ch rept	S EUROP. MONT.	Thymus praecox Opiz subsp. polytrichus (Borbás) Jalas	.	.	.	+	.	+.2	+	.	.	3
		Other species										
H scap	MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter	.	.	+	1.1	1.1	.	.	.	.	3
H scap	S EUROP.	Cruciata glabra (L.) Ehrend. subsp. glabra	+	.	+.2	.	.	.	.	.	.	2
H scap	S EUROP. MONT.	Polygala alpestris Rchb.	+	.	.	.	.	+.2	.	.	.	2
H scap	EUROP.	Laserpitium latifolium L.	.	.	.	.	.	.	+.2	+	.	2
		Sporadics species	2	1	1	0	0	2	1	0	0	

slands with a dominance of *Brachypodium genuense* and *Gentiana lutea* subsp. *lutea* (Table 6) are widely represented on the steep slopes (slope, 30°; soil acidity, pH 5.5), which are affected by the ski lifts of Santa Maria Maddalena. The preparation of the snow on the ski slopes in these areas creates compaction of the snow cover, which means that it lasts longer on the ground compared to natural conditions. The acidification of the grassland caused by this persistence of the snow cover in the winter to spring period is shown by the presence of several species of the class *Nardetea strictae*: *Ranunculus pollinensis, R. apenninus, Luzula campestris, Deschampsia flexuosa* subsp. *flexuosa, Poa alpina* subsp. *alpina, Festuca microphylla, Agrostis capillaris, Bellardiochloa variegata* subsp. *variegata* and *Pedicularis tuberosa*, and others. These are part of a floristic context that is typical of the class *Festuco-Brometea*. In time, the compaction of the snow also results in conditions for a surface layer of frozen soil that favours microthermal species of this class, including: *Linum alpinum, Anthoxanthum odoratum* subsp. *nipponicum* and *Leucanthemum adustum*, and others.

As has been shown by a large phytosociological study on the grasslands of the high plains of Campo Imperatore of Gran Sasso d'Italia (Biondi *et al*., 1999) the effects of this persistence of the snow cover on the species diversity mainly result in reduced morphologies, with progressive decarbonisation of the soil. This then results typically acidophilic grasslands of the class *Nardetea strictae*, which are otherwise not common on these limestone lithologies.

From the phytosociological point of view, the grassland in the study area has floristic similarities with the association *Senecio scopolii-Ranunculetum pollinensis* that has been described for the acidophilous grasslands on the reduced morphologies of the summit areas of the supratemperate belt (from 1500 m to 1570 m a.s.l.) of Monte Coscerno and Monte Civitella in the Umbrian Apennines (Biondi & Ballelli, 1995). The characteristic and differential species of the association included in the alliance *Ranunculo-Nardion strictae* are considered to be: *Senecio scopolii* subsp. *floccosus, Ranunculus pollinensis, Tulipa australis, Campanula micrantha* and *Genista sagittalis*. For this same association for Monte Coscerno, the subassociation *hypericetosum richerii* has also been described that shows the connection of the association with the strips of *Vaccinium* of the association *Luzulo sieberi-Vaccinietum myrtilli*. The association *Senecio scopolii-Ranunculetum pollinensis*, subassociation *senecionetosum scopolii* Catorci *et al*. 2007 (subass. *typicum*), was subsequently indicated for the Sibillini Mountains at altitudes between 1500 m and 1700 m a.s.l., where it is vicariant at altitudes above those of the subassociation *plantaginetosum atratae* Catorci *et al*. 2007 of the transition towards the grasslands of the association *Luzulo italicae-Nardetum strictate* Biondi *et al*. 1992. From the comparison of the relevés shown in the dendrogram (Fig. 10), there are three blocks of relevés that are clearly distinguished: the coenoses of Monte Coscerno and Monte Civitella with the association tipicum *Senecio scopolii-Ranunculetum pollinesis* (subass. *senecionetosum scopolii* subass. *typicum*) and the subassociation *hypericetosum richerii* (group 1); the grasslands of *Brachypodium genuense* and *Gentiana lutea* subsp. *lutea* in the study area (group 2); and finally, the coenoses that are clearly separated in the Sibillini Mountains at higher altitudes (1500-1950 m a.s.l.) (group 3). As has already been shown also from the comparison in the synoptic Table and the relevant dendrogram shown in Catorci *et al*. (2007), the coenoses of the Sibillini Mountains are clearly differentiated from those of the association *Senecio scopolii-Ranunculetum pollinensis* described for Monte Coscerno. This is both because, in addition to the coverage of *Nardus stricta* (sometimes dominant), of the presence of a large number of acidophilous species, some of which are microthermal (*Luzula spicata* subsp. *italica, Plantago atrata* subsp. *atrata*, and others) of the class *Nardetea strictae*, and because of the group of species of the class *Festuco-Brometea* that are typical of the higher altitudes (*Anthyllis vulneria* subsp. *pulchella, Anthemis cretica* subsp. *columnae, Achillea tenorii*, and others). On the basis of the available data, these coenoses cannot be included in the association *Senecio scopolii-Ranunculetum pollinensis*. For the studied

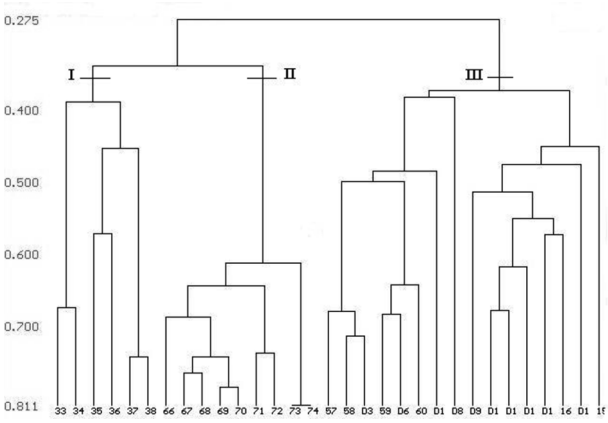

Fig. 10 – Dendrogram from the *Brachypodium genuense* and *Gentiana lutea* subsp. *lutea* community phytosociological relevés and published relevés as comparation: I – *Senecio scopolii-Ranunculetum pollinensis, senecionetosum scopolii* subass. *typicum* and *hypericetosum richerii* subass. (from Biondi & Ballelli, 1995, tab. 4); II – *Gentiano luteae-Brachypodietum genuensis* ass. nova hoc loco (area study, Tab. 8); III - *Senecio scopolii-Ranunculetum pollinensis senecionetosum scopolii* subass. *typicum* and *plantaginetosum atratae* (from Catorci *et al*., 2007, Table2).

coenoses, these can be differentiated by the significant group of species with high coverage, including: *Gentiana lutea* subsp. *lutea, Luzula sylvatica* subsp. *sieberi, Deschampsia flexuosa* subsp. *flexuosa, Ranunculus apenninus, Linum alpinum, Rhinanthus minor, Anthoxanthum odoratum* subsp. *nipponicum, Leucanthemum adustum, Carlina acaulis* subsp. *caulescens*, and others. This allows the proposal of the new association *Gentiano luteae-Brachypodietum genuensis* ass. nova hoc loco (holotypus ril. n. 2 di Tab. 8) , subass. *deschampsietosum flexuosae* subass. nova hoc loco subass. *typicum* which is included in the suballiance *Brachypodenion genuensis*. The following are considered characteristic and differential of the new association: *Brachypodium genuense, Gentiana lutea* subsp. *lutea, Deschampsia flexuosa* subsp. *flexuosa, Senecio scopolii* subsp. *floccosus, Ranunculus apenninus, Linum alpinum, Luzula sylvatica* subsp. *sieberi, Rhinanthus minor, Anthoxanthum odoratum* subsp. *nipponicum, Campanula micrantha, Leucanthemum adustum* e *Carlina acaulis* subsp. *caulescens*. The three phytosociological relevés realized in the same territory that were included in *Filipendulo-Trifolietum montani* subass. *gentianelletosum columnae* variant with *Brachypodium rupestre* and *Carex macrolepis* (Tab. 9 rels. 1-3 in Catorci *et al*., 2008) can also be included in the new association. The grasslands of the new association *Gentiano luteae-Brachypodietum genuensis*, subassociation *deschampsietosum flexuosae*, can be considered to be due to the edge development and acidification of the mountain grasslands of the association *Filipendulo vulgaris-Trifolietum montani*, which is related to the management of the ski slopes.

SENECIO SCOPOLII-ASPHODELETUM MACROCARPI Biondi & Allegrezza 2014 in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi, 2014 (Table 9; cluster 5 of Fig. 6 and Fig. 7) *luzuletosum sieberi* Biondi & Allegrezza subass. nova hoc loco (rels. 1-6 of Table 9, holotypus rel. 1) *Deschampsia flexuosa* subsp. *flexuosa* variant (rels. 4-6)

On the rolling plain morphologies, with soil that is deep, moist and rich in organic matter (pH 6.1), there are the grasslands included in the association *Filipendulo vulgaris-Trifolietum montani* Hruska, Francalancia & Orsomando 1981 subass. *asphodeletosum albi* Hruska, Francalancia & Orsomando 1981. However, these have been abandoned for a long time in terms of the human activities (mowing), and they are largely being replaced by the dense vegetation of *Asphodelus macrocarpus* subsp. *macrocarpus*, which reaches high coverage of this *Asphodelus* (Table 9). This species is a rhizomatous geophyte that has a strong ability to colonise abandoned or underused grasslands. Like *Brachypodium genuense*, with which it often shares the dominance of the herbaceous layer, it results in a drastic reduction in the species diversity of the grasslands, while at the same time facilitating the entry of forest-edge species of the class *Trifolio-Geranietea sanguinei*. This behaviour is typically found in the absence of human disturbance at the edges of the woods, in the heliophilous ecotonal positions immediately external to the space occupied by the typical forest edge (pH 6.7). Under these conditions (rels 1, 2 of Table 9), *Asphodelus macrocarpus* subsp. *macrocarpus* is clearly dominant, with *Brachypodium genuense, Senecio scopoli* subsp. *floccosus, Hypericum perforatum, Filipendula vulgaris* and *Luzula sylvatica* subsp. *sieberi*, together with the characteristic species of the forest edges: *Helleborus bocconei* subsp. *bocconei, Paeonia officinalis* subsp. *italica, Trifolium medium* subsp. *me-*

Tab. 9 - *Senecio scopolii-Asphodeletum macrocarpi* Biondi & Allegrezza 2014 in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi, 2014, *luzuletosum sieberi* Biondi & Allegrezza subass. nova hoc loco (rels 1-6 of Table 9, holotypus rel. n. 1), *Deschampsia flexuosa* subsp. *flexuosa* variant (rels. 4-6).

		Relevè number	1*	2	3	4	5	6	
		Relevè number from dendrogram Fig. 6 and Fig. 7	22	23	24	61	60	62	
		Cluster	5	5	5	5	5	5	
		Geomorphological elements	BVP	BVP	BVP	VA	BVP	VA	
		Altitude (m a.s.l.) x 10	140	140	142	143	142	143	
		Aspect	ENE		ENE	ENE	ENE	ENE	
		Slope (°)	15	-	10	5	10	15	Presences
Life Form	Chorotype	Coverage (%)	100	100	100	100	100	100	
		Area (m^2)	30	30	90	60	100	60	
		Charact. and diff. species of the ass.							
G rhiz	MEDIT. MONT.	Asphodelus macrocarpus Parl. subsp. macrocarpus	4.5	3.3	4.4	5.5	4.4	4.4	6
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	2.3	4.4	3.4	3.3	3.3	3.4	6
H ros	ENDEM.	Senecio scopolii Hoppe *et* Hornsch. subsp. floccosus (Bertol.) Greuter	2.2	1.1	3.3	+	+	+	6
H scap	ENDEM.	Viola eugeniae Parl. subsp. eugeniae	+	+	+.2	+.2	1.1	.	5
		Diff. species of the *luzuletosum sieberi* subass.							
H caesp	S EUROP. MONT.	Luzula sylvatica (Huds.) Gaudin subsp. sieberi (Tausch) K. Richt.	+.2	+.2	1.1	+.2	+.2	+.2	6
H scap	EUROSIB.	Hypericum perforatum L. subsp. perforatum	1.2	2.3	3.3	2.3	3.3	1.2	6
H scap	EUROP.	Euphorbia cyparissias L.	+.2	+.2	1.2	1.2	1.2	+.2	6
H caesp	S EUROP. MONT.	Festuca microphylla (St.-Yves) Patzke	.	+.2	1.2	1.2	1.1	(+.2)	5

		Diff. species of the *Deschampsia flexuosa* subsp. *flexuosa* variant							
H scap	S EUROP. MONT.	Gentiana lutea L. subsp. lutea	.	.	1.1	+	+	3.4	4
H caesp	EURASIAT.	Agrostis capillaris L.	.	.	.	2.2	3.3	2.2	3
H caesp	SUBCOSMOP.	Deschampsia flexuosa (L.) Trin. subsp. flexuosa	.	.	.	+.2	+.2	2.2	3
		Charact. and diff. species of the *Cyano triumfetti-Asphodelion macrocarpi* all. and the *Asphodeletalia macrocarpi* ord.							
H scap	EURASIAT.	Filipendula vulgaris Moench	+.2	+.2	1.1	1.2	2.3	+.2	6
H scap	ENDEM.	Campanula micrantha Bertol.	+.2	+	1.1	+	+	(+)	6
H scap	SW EUROP. MONT.	Knautia purpurea (Vill.) Borbás	+.2	.	+	1.1	1.1	+	5
H caesp	EUROP.-W ASIAT.	Trifolium ochroleucum Huds.	1.2	+.2	.	.	.	.	2
H scap	S EUROP.-W ASIAT.	Cyanus triumfetti (All.) Dostal *ex* A'. *et* D. Löve	+.2	+.2	.	.	.	.	2
		Charact. species of the *Trifolio-Geranietea* class.							
H scap	MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter	1.2	1.2	1.1	+.2	1.1	.	5
H scap	S EUROP.	Cruciata glabra (L.) Ehrend. subsp. glabra	.	+.2	.	1.1	+.2	1.1	4
H scap	EURASIAT.-N AMER.	Clinopodium vulgare L. subsp. vulgare	+.2	+	.	.	.	+	3
G rhiz	ENDEM.	Helleborus bocconei Ten. subsp. bocconei	+.2	+.2	.	.	.	(+)	3
G rhiz	ENDEM.	Paeonia officinalis L. subsp. italica N.G. Passal. *et* Bernardo	1.2	+.2	.	.	.	.	2
H caesp	S EUROP. MONT.	Veronica orsiniana Ten. subsp. orsiniana	.	+	1.1	.	.	.	2
H scap		Myosotis sylvatica Hoffm. (*s.l.*)	+	.	.	.	.	.	1
G rhiz	EUROSIB.	Trifolium medium L. subsp. medium	+.2	.	.	.	.	.	1
H scap	EUROP.	Trifolium rubens L.	+.2	.	.	.	.	.	1
H scap	EURASIAT.	Veronica chamedrys L. subsp. chamedrys	.	.	.	.	+	.	1
H rept	EUROP.-W ASIAT.	Ajuga reptans L.	.	.	.	.	.	(+)	1
		Festuco-Brometea class							
H caesp	EUROP.	Bromopsis erecta (Huds.) Holub subsp. erecta	+.2	+.2	1.2	2.3	3.3	1.2	6
H scap	EUROP.-CAUC.	Galium verum L. subsp. verum	1.1	+	1.1	3.3	2.3	2.2	6
H scap	MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	1.2	1.1	1.1	+.2	+.2	.	5
H scap	MEDIT.	Eryngium amethystinum L.	+.2	+	+	+	+	.	5
H caesp	MEDIT.	Festuca circummediterranea Patzke	.	.	+.2	1.2	2.2	2.2	4
H ros	S EUROP. MONT.	Armeria canescens (Host) Ebel	.	.	1.1	+	1.1	+.2	4
H caesp	EUROP.-W ASIAT.	Briza media L.	.	.	+.2	1.1	1.1	+.2	4
H scap	E EUROP.-W ASIAT.	Pilosella cymosa (L.) F.W. Schultz *et* Sch. Bip. subsp. cymosa	.	.	+	1.1	1.1	+	4
H scap	W EUROP.-MEDIT.	Stachys officinalis (L.) Trevis.	+.2	+	.	.	+	.	3
H scap	EURASIAT.	Campanula glomerata L.	.	.	+	+	1.2	.	3
H scap	S EUROP. MONT.	Dianthus monspessulanus L.	.	.	.	+.2	1.1	+	3
G bulb	SW EUROP.	Bunium bulbocastanum L.	.	.	.	+	+	(+)	3
H ros	S EUROP. MONT.	Plantago argentea Chaix subsp. argentea	.	.	+.2	.	+	.	2
H caesp	S EUROP. MONT.	Silene ciliata Pourr. subsp. graefferi (Guss.) Nyman	.	.	.	1.1	+	.	2
H caesp	ENDEM.	Avenula praetutiana (Parl. *ex* Arcang.) Pignatti	.	.	.	+	.	+.2	2
T scap	EUROP.	Rhinanthus alectorolophus (Scop.) Pollich subsp. alectorolophus	.	.	.	.	+	(+.2)	2
G rad	SE EUROP.	Thesium linophyllon L.	.	.	.	.	+	+	2
		Molinio-Arrhenatheretea class							
H caesp	EURASIAT.	Dactylis glomerata L. subsp. glomerata	1.2	.	+.2	.	+.2	+.2	4
H scap	EURASIAT.	Tragopogon pratensis L. subsp. pratensis	.	.	+	+	+	+	4
T scap	EUROSIB.	Rhinanthus minor L.	+.2	+.2	1.1	.	.	.	3
H scap	EUROSIB.	Achillea millefolium L. subsp. millefolium	1.1	+	+.2	.	.	.	3
G bulb	SW EUROP.	Narcissus poeticus L.	.	.	+.2	+	+	.	3
H scap	EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	.	.	.	+.2	1.1	.	2
H scap	EUROSIB.	Trifolium pratense L. subsp. pratense	.	.	.	.	+	+	2
H caesp	EURASIAT.	Cynosurus cristatus L.	.	.	.	.	+.2	+.2	2
		Nardetea strictae class							
H caesp	EUROP.	Luzula campestris (L.) DC.	.	.	+.2	+.2	1.1	.	3
H scap	MEDIT. MONT.	Rumex nebroides Campd.	.	+	.	.	+	.	2
H caesp	SE EUROP. MONT.	Bellardiochloa variegata (Lam.) Kerguélen subsp. variegata	.	.	.	+.2	+.2	.	2
	EUROSIB.-N AMER.	Rumex acetosella L. subsp. angiocarpus (Murb.) Murb.	.	.	.	+	+	.	2
H caesp	EUROSIB.-N AMER.	Poa alpina L. subsp. alpina	.	.	.	.	1.2	+.2	2
H caesp	ART.-ALP.	Anthoxanthum odoratum L. subsp. nipponicum (Honda) Tzvelev	.	.	.	.	+.2	(+)	2
		Other species							
H ros	MEDIT.-W ASIAT.	Silene italica (L.) Pers. subsp. italica	.	+	+.2	.	.	+	3
P caesp	SW EUROP. MONT.	Rhamnus alpina L. subsp. alpina	+.2	+.2	.	.	.	.	2
H scap	SE EUROP. MONT.	Verbascum longifolium Ten.	+.2	.	+.2	.	.	.	2
		Sporadics species	4	4	5	0	5	2	

dium, T. ochroleucon, Tanacetum corymbosum subsp. *achillae* and others, which constitute the appearance of a typical heliophilous edge included in the *Trifolio-Geranietea* class, *Asphodeletalia macrocarpi* order and the *Cyano triumfetti-Asphodelion macrocarpi* alliance (ass. *typus Senecio scopolii-Asphodeletum macrocarpi*). The *Asphodeletalia macrocarpi* order, sin-

taxon recently proposed in Biondi *et al*. (2014) aims to conceptually represent the ecotonal space occurring between the wood and the grassland, where the dynamic recovery of serial vegetation starts separating the heliophilous edge from the wood. Compared to the *Senecio scopolii-Asphodeletum macrocarpi* association (*senecionetosum scopolii* Biondi & Allegrezza subass.

nova subass. *typicum* holotypus rel. 8 of Table II in Biondi *et al.* (2014) the vegetation in object is inserted in a typical acidophilous and hight mountain floristic context mainly due to prolonged snow cover. Here, the new subassociation *luzuletosum sieberi* Biondi & Allegrezza subass. nova hoc loco (holotypus rel. 1 of Table 9) is proposed, for which the differential species are considered to be: *Luzula sylvatica* subsp. *sieberi*, *Hypericum perforatum* subsp. *perforatum*, *Euphorbia cyparissias* and *Festuca microphylla*. The new subassociation refers to the *Asphodelus macrocarpus* subsp. *macrocarpus* heliophilous and subacidophilous edge of the limestone Central Apennines in the supratemperate upper termotype. This vegetation is present on the rolling plain morphologies and depressed (wide valley and narrow valley) on the soil deep, moist, rich in organic matter, subject to prolonged snow cover. In the territory investigated, the *Senecio scopolii-Asphodeletum macrocarpi* association *luzuletosum sieberi* subassociation replaces the grasslands of the *Filipendulo vulgaris-Trifolietum montani* association *asphodeletosum albi* subassociation. For the new subassociation *luzuletosum sieberi*, there is also indicated the *Deschampsia flexuosa* subsp. *flexuosa* acidophilus variant (rels. 4-6) differentiated by *Deschampsia flexuosa* subsp. *flexuosa*, *Gentiana lutea* subsp. *lutea* and *Agrostis capillaris* which is found typically on the narrow valley.

LUZULO SIEBERI-BRACHYPODIETUM GENUENSIS ass. nova hoc loco holotypus rel. 2 of Table 10 (Table 10; clusters 3 e 4 of Fig 6 and Fig. 7)
helleboretosum bocconei subass. nova hoc loco subass. *typicum* (rels. 1-11 of Table 10, holotypus rel. 2)
Gentiana lutea subsp. *lutea* , *Scilla bifolia* and *Ranunculus ficaria* (s.l.) variant (rels. 3-6; cluster 4)
Trifolium alpestre variant (rels. 7-11; cluster 3)

At the edges of the forest vegetation, in deep moist soil (pH 6.0), in an ecotonal position and in direct contact with the beech wood, there is a strip of dense herbaceous vegetation dominated by *Brachypodium genuense*. This combines several species that are typical of the forest-edge class *Trifolio-Geranietea*, including: *Helloborus bocconei* subsp. *bocconei*, *Veratrum nigrum*, *Paeonia officinalis* subsp. *italica* and

Tab. 10 - *Luzulo sieberi-Brachypodietum genuensis* ass. nova hoc loco (holotypus rel. n. 2), *helleboretosum bocconei* subass. nova hoc loco subass. *typicum* (rels. 1-11, holotypus ril. n. 2), *Gentiana lutea* subsp. *lutea*, *Scilla bifolia* and *Ranunculus ficaria* (s.l.) variant (rels. 3-6), *Trifolium alpestre* variant (rels. 7-11).

		Relevè number	1	2*	3	4	5	6	7	8	9	10	11	
		Relevè number from dendrogram Fig. 6 and Fig. 7	20	21	14	36	37	38	54	53	52	47	46	
		Cluster	4	4	4	4	4	4	3	3	3	3	3	
		Geomorphological elements	V	V	VA	VA	VA	VA	V	V	V	BVC	BVC	
		Altitude (m a.s.l.) x 10	137	140	143	144	144	141	142	143	146	141	142	
		Aspect	ENE	ENE	NNE	NNE	NNE	NNE	ENE	ENE	ENE	ENE	ENE	
		Slope (°)	35	20	20	20	15	25	20	25	25	20	20	
Life Form	Chorotype	Coverage (%)	100	100	100	100	100	100	100	100	100	100	100	Presences
		Area (m²)	20	20	30	30	30	30	60	60	60	60	60	
		Charact. and diff. species of the ass.												
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	5.5	5.5	5.5	5.5	5.5	5.5	4.4	3.4	4.5	4.4	4.4	11
H caesp	S EUROP. MONT.	Luzula sylvatica (Huds.) Gaudin subsp. sieberi (Tausch) K. Richt.	+	+.2	1.1	3.3	2.3	+.2	1.1	1.2	1.2	+.2	+.2	11
G rhiz	EUROP.	Anemonoides ranunculoides (L.) Holub	+	+	1.1	+	1.1	1.1	+	+	+	+	+	11
H scap	ENDEM.	Campanula micrantha Bertol.	1.1	1.2	1.1	1.2	1.1	.	1.1	1.1	1.1	.	+	9
G rhiz	ENDEM.	Helleborus bocconei Ten. subsp. bocconei	1.2	2.3	.	.	1.2	1.1	1.1	1.2	1.1	1.1	+	9
		Diff. species of the G*entiana lutea* subsp. *lutea, Scilla bifolia and Ranunculus ficaria* (*s.l.)* variant												
H scap	S EUROP. MONT.	Gentiana lutea L. subsp. lutea	.	.	3.4	1.2	1.2	1.2	(+)	+	.	.	.	6
H caesp	EUROSIB.-N AMER.	Poa alpina L. subsp. alpina	.	.	+.2	+.2	+.2	+.2	.	.	.	1.2	+.2	6
H caesp	EURASIAT.	Agrostis capillaris L.	.	.	2.3	1.2	3.4	.	.	+.2	.	.	+.2	5
G bulb	EUROP.	Dactylorhiza sambucina (L.) Soó	.	.	+	+	+	+	.	.	.	.	.	4
G bulb		Ranunculus ficaria L. (*s.l.*)	.	.	1.1	+	1.1	1.1	.	.	.	.	.	4
G bulb	S EUROP.	Scilla bifolia L.	.	.	1.1	+	1.1	1.1	.	.	.	.	.	4
		Diff. species of the *Trifolium alpestre* variant												
G rhiz	ENDEM.	Paeonia officinalis L. subsp. italica N.G. Passal. *et* Bernardo	+.2	.	.	.	.	.	2.3	1.2	1.2	+.2	1.2	6
H scap	EUROP.-CAUCAS.	Trifolium alpestre L.	.	.	.	.	.	+.2	+.2	1.2	+	1.2	1.3	6
H scap	S EUROP.-W ASIAT.	Cyanus triumfetti (All.) Dostal *ex* A'. *et* D. Löve	.	.	.	.	.	.	+.2	+	+	+.2	+	5
H scap	S EUROP. MONT.	Ranunculus breyninus Crantz	.	.	.	.	.	.	(+)	+	+.2	+	.	4
H scap	ENDEM.	Stachys alopecuros (L.) Benth. subsp. divulsa (Ten.) Grande	.	.	.	.	.	.	+	+	+.2	.	.	3
		Charact. and diff. species of the *Cyano triumfetti-Asphodelion macrocarpi* all. and the *Asphodeletalia macrocarpi* ord.												
H ros	ENDEM.	Senecio scopolii Hoppe *et* Hornsch. subsp. floccosus (Bertol.) Greuter	+	+.2	1.2	3.3	+.2	1.1	2.3	2.2	2.3	2.2	1.2	11
H scap	EURASIAT.	Filipendula vulgaris Moench	+	+	.	+	.	.	+.2	1.1	1.1	+.2	+.2	8
H caesp	EUROP.-W ASIAT.	Trifolium ochroleucum Huds.	.	1.1	+.2	.	.	.	1.2	.	.	2.3	2.3	5
H scap	SW EUROP. MONT.	Knautia purpurea (Vill.) Borbás	.	.	.	.	.	.	1.1	1.2	+	1.1	.	4
G rhiz	MEDIT. MONT.	Asphodelus macrocarpus Parl. subsp. macrocarpus	.	.		2.3	.	.	.	.	.	.	.	1

		Charact. species of the *Trifolio-Geranietea* class											
H scap	EUROSIB.	Hypericum perforatum L. subsp. perforatum	.	+	+.2	.	+	.	1.2	+.2	+.2	+.2	1.2	8
G rhiz	E EUROP.-ASIAT.	Veratrum nigrum L.	+	+.2	.	.	.	.	+.3	+.2	2.3	.	+	6
H scap	MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter	1.1	1.1	.	.	.	.	1.2	1.1	.	+	.	5
H scap	SE EUROP. MONT.	Grafia golaka (Hacq.) Rchb.	1.1	.	.	.	.	.	.	+.2	+.2	.	.	3
H scap	S EUROP. MONT.	Delphinium fissum Waldst. *et* Kit. subsp. fissum	.	.	.	.	.	.	+	.	.	.	+.2	2
H scap	S EUROP.	Cruciata glabra (L.) Ehrend. subsp. glabra	.	.	.	+.2	.	1.1	.	.	.	.	.	2
H scap	EUROP.	Laserpitium latifolium L.	+	.	.	.	.	.	.	.	.	.	.	1
H ros	ENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	.	+	.	.	.	.	.	.	.	.	.	1
H caesp	S EUROP. MONT.	Veronica orsiniana Ten. subsp. orsiniana	.	.	.	.	.	.	.	.	.	+	.	1
H scap	W EUROP.-MEDIT.	Stachys officinalis (L.) Trevis.	.	.	.	.	.	.	.	.	.	+	.	1
H scap	EURASIAT.	Lathyrus pratensis L. subsp. pratensis	.	.	.	.	+	.	.	.	.	.	.	1
H scap	EURASIAT.-N AMER.	Clinopodium vulgare L. subsp. vulgare	.	.	.	.	.	+.2	.	.	.	.	.	1
H scap	NE-MEDIT. MONT.	Stachys tymphaea Hausskn.	.	.	.	.	.	+.2	.	.	.	.	.	1
		Festuco-Brometea class												
H scap	MEDIT. MONT.	Trifolium montanum L. subsp. rupestre (Ten.) Nyman	+.2	1.1	+.2	+	.	.	2.3	1.2	(+.2)	3.4	3.3	9
H scap	EUROP.	Euphorbia cyparissias L.	.	+.2	.	.	+	.	1.1	1.1	1.1	+.2	+	7
H caesp	EUROP.	Bromopsis erecta (Huds.) Holub subsp. erecta	.	+	.	.	.	.	2.3	2.2	1.2	1.2	1.1	6
H ros	S EUROP. MONT.	Plantago argentea Chaix subsp. argentea	.	+	.	.	.	.	1.1	+.2	+	1.1	1.2	6
H caesp	SUBENDEM.	Carex macrolepis DC.	.	+	+.2	.	.	.	1.2	2.3	+.2	1.2	.	6
H caesp	MEDIT.	Festuca circummediterranea Patzke	.	.	1.2	.	.	.	1.2	1.2	1.2	1.2	1.2	6
H scap	EUROP.-CAUC.	Galium verum L. subsp. verum	.	.	.	.	+.3	2.3	+.2	.	+	+.3	3.4	6
H scap	EURASIAT.	Campanula glomerata L.	.	.	.	.	+	+	+.2	+	+	+	.	6
H caesp	EUROP.-W ASIAT.	Briza media L.	.	.	+	.	.	.	(+)	+	+	1.1	.	5
H scap	S EUROP. MONT.	Leucanthemum adustum (W.D.J. Koch) Gremli	+.2	.	.	+.2	.	+	.	+	.	.	.	4
H ros	S EUROP.-W ASIAT.	Primula veris L. subsp. suaveolens (Bertol.) Gutermann *et* Ehrend.	.	+	.	.	.	.	+.2	+	+	.	.	4
H scap	S EUROP.	Galium corrudifolium Vill.	.	.	.	.	.	.	1.1	1.1	+.2	+.2	.	4
T scap	EUROP.	Rhinanthus alectorolophus (Scop.) Pollich subsp. alectorolophus	.	.	.	.	.	.	+.2	.	.	+.2	2.2	3
G bulb	SW EUROP.	Bunium bulbocastanum L.	.	.	.	.	.	.	+	.	.	+	+.3	3
H scap	E EUR.-SW ASIAT.	Polygala major Jacq.	.	.	.	.	.	.	+	+	.	+	.	3
H scap	MEDIT.	Eryngium amethystinum L.	.	.	.	.	.	.	.	+	.	1.2	+	3
H scap	S EUROP. MONT.	Dianthus monspessulanus L.	.	.	.	.	.	+.2	.	.	.	+	+	3
G rad	SE EUROP.	Thesium linophyllon L.	.	.	.	.	.	.	.	.	+	+.3	.	2
		Molinio-Arrhenatheretea class												
H caesp	ART.-ALP.	Anthoxanthum odoratum L. subsp. nipponicum	.	.	1.1	+.2	+.2	+	+.2	+.2	+.2	+.2	+.2	9
H scap	EUROSIB.	Achillea millefolium L. subsp. millefolium	.	.	.	.	+	+.2	+	+.3	+	1.1	1.1	7
H scap	EURASIAT.	Tragopogon pratensis L. subsp. pratensis	.	.	.	.	.	+	+	+	+	+	+	6
H scap	EURASIAT.-AFR.	Lotus corniculatus L. subsp. corniculatus	+	+	.	+	.	.	+.2	+.2	.	.	.	5
H ros	EUROP.-CAUC.	Leontodon hispidus L.	+.2	+	.	.	.	.	+	.	+	+	.	5
H scap	EUROSIB.	Trifolium pratense L. subsp. pratense	+.2	+.2	+	+	.	.	+.2	.	.	.	.	5
G bulb	SW EUROP.	Narcissus poeticus L. subsp. poeticus	.	.	.	.	.	.	+.2	+	+	+	+	5
H caesp	EURASIAT.	Dactylis glomerata L. subsp. glomerata	.	+.2	.	.	+.2	2.2	+.2	.	.	.	.	4
T scap	EUROSIB.	Rhinanthus minor L.	.	.	+	.	+	+.2	.	.	.	.	+	4
H caesp	EURASIAT.	Cynosurus cristatus L.	.	.	+	.	.	.	.	.	.	+	1.1	3
		Nardetea strictae class												
H scap	MEDIT. MONT.	Rumex nebroides Campd.	.	.	+	.	.	+	+.2	+	+	+	+	7
H caesp	EUROP.	Festuca rubra L. subsp. commutata (Gaudin) Markgr.-Dann.	.	.	.	.	.	.	.	.	+.2	1.2	2.2	3
H scap	ENDEM.	Ranunculus pollinensis (N. Terracc.) Chiov.	.	.	.	.	.	.	.	.	.	+.2	1.1	2
		Other species												
P caesp	EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria	+.2	.	.	.	.	+	.	+.2	.	.	.	3
H scap	S EUROP. MONT.	Linum alpinum Jacq.	.	.	.	.	.	.	+.2	+	+	.	.	3
H scap	S EUROP. MONT.	Biscutella laevigata L. subsp. laevigata	.	.	.	.	.	.	(+)	.	(+)	(+)	.	3
H scap	SE EUROP. MONT.	Verbascum longifolium Ten.	.	.	.	.	+.2	2.2	.	.	.	.	+	3
G rhiz	EUROP.	Hepatica nobilis Mill.	+.2	+.2	.	.	.	.	.	.	.	.	.	2
P caesp	EUROP.	Fagus sylvatica L. subsp. sylvatica (pl.)	+.2	+	.	.	.	.	.	.	.	.	.	2
H scap		Alchemilla sp.	.	.	.	.	.	.	+	.	+	.	.	2
G bulb	C EUROP. MONT.	Lilium bulbiferum L. subsp. croceum (Chaix) Jan	.	.	.	.	.	.	.	+	+	.	.	2
		Sporadics species	1	4	3	2	0	3	1	4	0	9	1	

Tanacetum corymbosum subsp. *achillae*, and some shrubby seedlings of herbaceous nemoral and prefo-rest species: *Anemonoides ranunculoides, Hepatica nobilis, Sorbus aria* subsp. *aria* and *Fagus sylvatica* subsp. *sylvatica* (rels. 1, 2 of Table 10). In the study area it can be seen that the floristic composition of the vegetation in an ecotonal position at the forest edge is in the heliophilous position of the margin occupied by the grassland (long abandoned by pasture). This is in a wide strip along the edge of the wood, up to an altitude of about 1550 m a.s.l. and on morphologies that are moderately steep (25°) and with deep soil (pH 6.1), which are subject to prolonged snow cover, thus taking on the meaning of a typical heliophilous edge (Table 10, rels. 7-9). This vegetation also affects the wide valley (rels. 10-11) and the narrow valley (ril. 3-6) on the

slopes of the study area that because of their hollow morphology, have within them particular microclimatic conditions. Indeed, it is known that in the supratemperate bioclimatic belt, the temperature inside hollows during the night when there is a clear sky can reach values much lower than the surrounding areas. In addition, the morphology of the narrow valley themselves provide places for the natural accumulation of the snow, especially with the action of the winds, which tend to accumulate the snow in the dips provided in the soil. In these positions (pH 5.2), the grasslands of *Brachypodium genuense* take on a more mesophilous and subacidophilous character than that of the edges, and they are characterised by: *Ranunculus ficaria* s.l.), *Gentiana lutea* subsp. *lutea, Poa alpina* subsp. *alpina* and *Anthoxanthum odoratum* subsp. *nipponicum*, while the species of the class *Festuco-Brometea* are reduced. Conditions of accumulation of organic matter often favour the development of nitrophilous species, which can include *Asphodelus macrocarpus* subsp. *macrocarpus* and *Verbascum longifolium*. Of interest, there is the presence of early flowering nemoral and forest-edge geophytes until late winter and early spring, such as: *Scilla bifolia, Crocus vernus* subsp. *vernus, Ranunculus ficaria* (s.l.) and *Anemonoides ranunculoides*. These develop in the abundant dry leaf litter of *Brachypodium genuense*, taking advantage of the conditions of high edaphic moisture that are promoted in the hollows of the narrow valley.

From the phytosociological point of view, the vegetation under study has floristic and ecological autonomy of the association of mesoacidophilous and heliophilous edges included in the class *Trifolio-Geranietea sanguinei*. This develops spontaneously in the absence of disturbance after the slope *Bromopsis erecta* subsp. *erecta* grassland of the association *Filipendulo vulgaris-Trifolietum montani*, as a prelude to the development of the forest vegetation of the class *Quercо-Fagetea*. In this place, the new association *Luzulo sieberi-Brachypodietum genuensis* ass. nova hoc loco (holotypus rel. 2 of Tab. 10; subass. *helleboretosum bocconei* subass. nova hoc loco subass. *typicum*) is proposed, for which the characteristic and differential species are considered to be: *Brachypodium genuense, Luzula sylvatica* subsp. *sieberi, Campanula micrantha, Helleborus bocconei* subsp. *bocconei, Anemonoides ranunculoides*. For the new association, there are also two variants described: variant with *Gentiana lutea* subsp. *lutea, Ranunculus ficaria* (s.l.) and *Scilla bifolia* and the variant with *Trifolium alpestre*. The *Gentiana lutea* subsp. *lutea, Ranunculus ficaria* (s.l.) and *Scilla bifolia* variant (rels. 3-6 of Tab. 10) is distinguished by the cover of *Brachypodium genuense* and *Luzula sylvatica* subsp. *sieberi*, and differentiated by: *Gentiana lutea* subsp. *lutea, Dactylorhiza sambucina, Poa alpina* subsp. *alpina, Ranunculus ficaria* (s.l.), *Scilla bifolia* and *Agrostis capillaris*. This is included in the most mesophilous and acidophilous of the *Luzulo sieberi-Brachypodietum genuensis* association that is found in the narrow valley of the slopes, in connection with the *Bromopsis erecta* subsp. *erecta* grassland of the association *Filipendulo vulgaris-Trifolietum montani* variant with *Brachypodium genuense* and *Gentiana lutea* subsp. *lutea*. The *Trifolium alpestre* variant (rels. 7-11 of Tab. 10) that is differentiated by: *Trifolium alpestre, Paeonia officinalis* subsp. *italica, Cyanus triumfetti, Ranunculus breyninus* and *Stachys alopecuros* subsp. *divulsa*, and characterized by numerous species of the class *Festuco-Brometea*, refer to the heliophilous edge of the dynamically developed slopes of *Bromopsis erecta* subsp. *erecta* grassland of the association *Filipendulo-Trifolietum montani* that follow the abandonment of pastoral activities over time. The *Trifolium alpestre* variant has floristic similarities with the subassociation *luzuletosum sieberi* of the association *Stachydo divulsae-Brachypodietum genuensis* (suballiance *Brachypodenion genuense*) described for the grasslands of *Brachypodium genuense* of the upper supratemperate belt of Gran Sasso d'Italia above 1900 m a.s.l.. Here, *Brachypodium genuense* takes on a pioneer character in the primary colonisation of the steep slopes of the ridges (Biondi *et al*., 2002). The association *Stachydo divulsae-Brachypodietum genuensis* is also indicated for the Sibillini Mountains (Catorci *et al*., 2008), where it is described as the subassociation *trifolietosum alpestris* nom. inv. (art. 4 del ICPN), which is given the significance of a dynamic evolution of the *Bromopsis erecta* subsp. *erecta* grassland of the steep slopes (slope, 25°/55°) at 1400 m to 1800 m a.s.l.. This is a mesoxerophilous coenosis of *Carex macrolepis, Brachypodium genuense, Avenula praetutiana, Festuca laevigata* subsp. *laevigata, Leucanthemum adustum* that is clearly included in the class *Festuco-Brometea*. From the comparisons, there is floristic and ecological autonomy of the association *Luzulo sieberi-Brachypodietum genuensis* for the variant with *Trifolium alpestre*. This is differentiated from the association *Stachydo divulsae-Brachypodietum genuensis* and from the subassociation indicated due to a large contingent of species, some of which have high coverage, such as: *Luzula sylvatica* ssp. *sieberi, Senecio scopolii* subsp. *floccosus, Helleborus bocconei* subsp. *bocconei, Anemonoides ranunculoides, Paeonia officinalis* subsp. *italica, Filipendula vulgaris*, and others that justify the establishment of a new association of *Brachypodium genuense* and belonging to the *Trifolio-Geranietea* class.

DICHOROPETALO CARVIFOLII-CHABRAEII-PAEONIETUM ITALICAE ass. nova hoc loco holotypus rel. 1 of Table 11) (Table 11; cluster 6 of Fig. 6 and Fig. 7)

Tab. 11 - *Dichoropetalo carvifolii-chabraeii-Paeonietum italicae* ass. nova hoc loco (holotypus rel. n. 1), *dichoropetaletosum carvifolii-chabraeii* subass. nova hoc loco subass. *typicum* (rels. 1-5, holotypus rel. n. 1).

Life Form	Chorotype							
		Relevè number	1*	2	3	4	5	
		Relevè number from dendrogram Fig. 6 and Fig. 7	51	50	66	65	45	
		Cluster	6	6	6	6	6	
		Geomorphological elements	V	V	V	V	VA	
		Altitude (m a.s.l.) x 10	155	156	158	157	147	
		Aspect	ENE	ENE	ENE	ENE	ENE	
		Slope (°)	20	15	35	35	10	
		Coverage (%)	100	100	100	100	100	
		Area (m^2)	15	10	20	10	10	Presences
		Charact. and diff. species of the ass. and the *Digitalidi micranthae-Helleborion bocconei* all.						
G rhiz	ENDEM.	Paeonia officinalis L. subsp. italica N.G. Passal. *et* Bernardo	3.4	4.4	3.3	3.4	3.4	5
G rhiz	ENDEM.	Helleborus bocconei Ten. subsp. bocconei	1.2	1.1	+	3.4	1.2	5
G rhiz	EURASIAT.	Veratrum nigrum L.	1.2	+.2	+	+	.	4
H scap	S. EUROP.	Dichoropetalum carvifolium-chabraei (Crantz) Soldano, Galasso et Banfi	+	1.2	.	1.2	+	4
H ros	ENDEM.	Digitalis lutea L. subsp. australis (Ten.) Arcang.	.	.	+.3	(+)	.	3
G rhiz	SE EUR. MONT.	Doronicum columnae Ten.	1.1	1.1	.	.	.	2
		Charact. and diff. species *Origanetalia vulgaris* ord. and the *Trifolio-Geranietea* class						
H scap	MEDIT.	Tanacetum corymbosum (L.) Sch. Bip. subsp. achilleae (L.) Greuter	(+)	+.2	1.1	+	.	4
H scap	EUROP.	Thalictrum aquilegifolium L. subsp. aquilegifolium	+.2	+	.	.	.	3
H scap	ENDEM.	Campanula micrantha Bertol.	.	.	1.1	1.1	.	3
H scap	S EUROP.	Cruciata glabra (L.) Ehrend. subsp. glabra	.	.	.	+.2	+.2	3
H scap	S EUR. MONT.	Delphinium fissum Waldst. *et* Kit. subsp. fissum	2.2	.	.	.	+.2	2
H scap	S EUR.-W ASIAT.	Cyanus triumfetti (All.) Dostal *ex* A'. *et* D. Löve	.	+	.	.	(+)	2
H scap	EUROP.	Trifolium alpestre L.	.	.	.	1.1	(+.2)	2
H scap	S EUR. MONT.	Adenostyles glabra (Mill.) DC. subsp. glabra	.	.	+.2	.	.	1
H scap	C EUROP.	Senecio ovatus (G. Gaertn., B. Mey. *et* Scherb.) Willd. subsp. alpestris (Gaudin) Herborg	.	.	+	.	.	1
H scap	EUROP.	Laserpitium latifolium L.	.	.	+	.	.	1
H rept	EUR.-W ASIAT.	Ajuga reptans L.	.	.	.	+	.	1
H scap	EUROSIB.	Hypericum perforatum L. subsp. perforatum	.	.	.	.	+	1
		Querco-Fagetea class and *Rhamno-Prunetea* class						
NP	EUROSIB.	Rubus idaeus L.	+.2	1.1	+.3	.	.	3
P caesp	EUROP. MONT.	Sorbus aria (L.) Crantz subsp. aria	(+.2)	.	+.2	+.2	.	3
G rhiz	EUROP.	Anemonoides ranunculoides (L.) Holub	+	+	.	.	+	3
H caesp	EURAS.-N AMER.	Poa nemoralis L. subsp. nemoralis	+	.	.	.	.	1
H scap	EURASIAT.	Lactuca muralis (L.) Gaertn.	.	.	+	.	.	1
P caesp	SW EUR. MONT.	Rhamnus alpina L. subsp. alpina	.	.	+.2	.	.	1
P caesp	EUROP.	Fagus sylvatica L. subsp. sylvatica (pl.)	.	.	.	+.2	.	1
G rhiz	EUROP.	Hepatica nobilis Schreb.	.	.	.	+.3	.	1
		Other species						
H caesp	EUROP. MONT.	Brachypodium genuense (DC.) Roem. *et* Schult.	2.2	2.2	3.3	3.3	2.2	5
H ros	ENDEM.	Senecio scopolii Hoppe *et* Hornsch. subsp. floccosus (Bertol.) Greuter	+	1.1	.	+	1.1	4
H scap	ENDEM.	Stachys alopecuros (L.) Benth. subsp. divulsa (Ten.) Grande	+.2	1.2	.	+	.	3
H scap	EURASIAT.	Campanula glomerata L.	+.2	.	1.1	+.2	.	3
H scap	EUROSIB.	Galium verum L. subsp. verum	.	+.2	.	.	1.1	2
H ros	S EUROP. MONT.	Carlina acaulis L. subsp. caulescens (Lam.) Schübl. *et* G. Martens	.	.	+.2	+	.	2
H scap	EUROP.	Euphorbia cyparissias L.			.	+	(+)	2
		Sporadics species	2	0	2	2	10	

dichoropetaletosum carvifolii-chabraei subass. nova subass. *typicum* (rels. 1-5 of Table 11, holotypus rel. 1)

This is a basophilous, dense, forest edge with a dominance of *Paeonia officinalis* ssp. *italica* with *Helleborus bocconei* subsp. *bocconei, Veratrum nigrum* and *Dichoropetalum carvifolium-chabraei* that develops at the edges of the forest (rels. 1-2 of Tab. 11) and preforest vegetation (rels. 3-4) on the slopes with moderate to high steepness (15°-35°), and at altitudes between 1450 m and 1580 m a.s.l., and locally at the bottom of the narrow valley of the slopes (rel. 5), on deep and well nitrified soil (pH 6.1). *Paeonia officialis* ssp. *italica* is an endemic and rare species. It has a strong colonising ability and often makes up the strips within the heliophilous edges of the association *Luzulo sieberi-Brachypodietum genuensis*. According to the data in the literature, forest edges of *Paeonia officinalis* subsp. *italica* are very rare in the Apennines. The only association that is currently recognized is *Geranio sanguinei-Paeonietum officialis* which has been described for the lower supratemperate belt of Monte San Vicino of the Marche Apennines (Allegrezza, 2003). From the comparisons, the floristic autonomy of the vegetation under study that develops at particularly higher altitudes favours a characteristic specific combination that is typically high mountain. The new association *Dichoropetalo carvifolii-chabraeii-Paeonietum italicae* ass. nova hoc loco (holotypus rel. 1 of Table 11; *dichoropetaletosum carvifolii-chabraei* subass. nova subass. *typicum*) of the *Digitali-Helleborion bocconei* alliance is therefore proposed, for which the characteristic and differential species are considered to be: *Paeonia officinalis* subsp. *italica, Veratrum nigrum, Helleborus bocconei* subsp. *bocconei, Dichoropetalum carvifolium-chabraei* and *Doronicum columnae*. This new association is in dynamic connection with the preforest vegetation of *Rubus idaeus, Sorbus aria* subsp. *aria* and *Rhamnus alpina* ssp. *alpina*, the prelude to the basophilous beech wood of the association *Cardamino kitaibelii-Fagetum sylvaticae*.

Discussion

The phytosociological study conducted on the grasslands of the north-eastern slopes of Monte Sassotetto have allowed the description of the high phytocoenotic diversity, as shown by the 11 vegetational typologies, and as updated with the latest nomenclature and syntaxonomic revisions (Biondi *et al*., 2013; 2014). The following new associations are described here: *Gentiano luteae-Brachypodietum genunesis, Luzulo sieberi-Brachypodietum genuensis* and *Dichoropetalo carvifolii-chabraeii-Paeonietum italicae*, along with the new subassociations and the syntaxon variants already described in the literature. According to the Italian interpretation manual of the 92/43/EEC Habitats Directive (Biondi, 2013; Biondi *et al*., 2009; 2012), three habitats in the area under study are recognized to be of European Community interest, which include eight of the associations that have been described here (as indicated in parentheses): 9210* "Apennine beech forests with *Taxus* and *Ilex*" (*Cardamino kitaibelii-Fagetum sylvaticae* and *Actaeo spicatae-Fagetum sylvaticae*); 6210* Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites) (*Filipendulo vulgaris-Trifolietum montani, Polygalo-Seslerietum nitidae, Potentillo cinereae-Brometum erecti* and *Gentiano luteae-Brachypodietum genuensis*); 4170* "Alpine and subalpine calcareous grasslands" (*Carici humilis-Seslerietum apenninae, Carici macrolepis-Seslerietum apenninae*).

The high phytocoenotic diversity in the territory that is shown by the results of this phytosociological study is related to its geology, geomorphology, and human management.

The geological diversity, and therefore the physicochemical characteristics of the slope, have provided the conditions for the establishment of two clearly distinct microthermal forest associations within the alliance *Aremonio-Fagion sylvaticae*, suballiance *Cardamino kitaibelii-Fagenion sylvaticae*. The geomorphology described for the slopes, together with their steepness and the acidity of the soil, are the main abiotic factors that affect the phytocoenotic diversity of the grasslands. This allows their separation into six typologies: the grasslands of the ridges, the lateral parts of the ridges, the slopes, the rolling plain, the wide valley and the narrow valley. The surface erosion that is due to the altitude, the steepness of the slopes, and the morphogenetic processes has led to the regression of some of the grasslands, and in particular those of the association *Polygalo-Seslerietum nitidae* (Habitat 6210*), which are being replaced by the durable subprimary grasslands of *Carici macrolepis-Seslerietum apenninae*.

The effects of the abandonment of traditional human practices (pasture and mowing) are more evident where the disturbance is largely absent, under conditions of deep soil and with prolonged snow. In these situations, the progression of the natural dynamic processes that are also accelerated by the forest coenoses have led to the replacement of these grasslands of the association *Filipendulo vulgaris-Trifolietum montani* (Habitat 6210*) with communities that can be included in the class *Trifolio-Geranietea* (*Luzulo sieberi-Brachypodietum genuesis* and *Senecio scopolii-Asphodeletum macrocarpi*) and the subsequent loss of the Habitat. Finally, the management of the snow cover for the preparation of the ski slopes, and in particular the compaction of the snow that causes it to remain for a long time, is one of the ecological factors that is responsible for the acidification and edge development of the grasslands of the slopes of the association *Filipendulo vulgaris-Trifolietum montani*, which is replaced by those that are microthermal and acidophilous, of the association *Gentiano luteae-Brachypodietum genuensis*.

As can be seen from the phytosociological tables, the species that are particularly active in the natural dynamic processes of edge development of the mesophilous grasslands in the study area are: *Brachypodium genuense, Luzula sylvatica* subsp. *sieberi, Gentiana lutea* subsp. *lutea, Helleborus bocconei* subsp. *bocconei, Deshampsia flexuosa* subsp. *flexuosa* e *Asphodelus macrocarpus* subsp. *macrocarpus*. In particular, *Brachypodium genuense* is an orophyte that is widespread in the Apennine grasslands from the supratemperate bioclimatic belt up to the orotemperate bioclimatic belt. As has been shown in a recent ecological study carried out on the "Prati di Ragnolo" that border the study area, the invasion of *Brachypodium genuense* in the grasslands abandoned by traditional human activities results in a decrease in the temperature and pH of the soil, with its consequent acidification, thus favouring the entry of acidophilous species included in the class *Nardetea strictae* (Catorci *et al*., 2011).

This appears to be confirmed in part also in the study area, where the dynamics of the edge development by *Brachypodium genuense* also shows partial acidification of the grassland under study, as witnessed by: *Luzula sylvatica* subsp. *sieberi, Gentiana lutea* subsp. *lutea*, *Deschamspia flexuosa* subsp. *flexuosa*. However, this is always confirmed under conditions of prolonged natural snow cover, or where it is induced (ski slopes) by the decarbonisation due to the snow, which naturally leads to acidification of the soil and the consequent entry of species of *Nardetea strictae*, as described in Biondi *et al*. (1999) for the high plains of Campo Imperatore.

Syntaxonomic scheme

TRIFOLIO MEDII-GERANIETEA SANGUINEI Müller 1962
Origanetalia vulgaris Müller 1962
Digitali australis-Helleborion bocconei Biondi, Vagge & Galdenzi 2014 in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi, 2014
Dichoropetalo carvifolii-chabraeii-Paeonietum italicae ass. nova hoc loco
dichoropetaletosum carvifolii-chabraei subass. nova hoc loco subass. *typicum*
Asphodeletalia macrocarpae Biondi & Allegrezza 2014 in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi, 2014
Cyano triumfetti-Asphodelion macrocarpi Biondi & Allegrezza 2014 in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi, 2014
Senecio scopolii-Asphodeletum macrocarpi Biondi & Allegrezza 2014 in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi, 2014
luzuletosum sieberi Biondi & Allegrezza subass. nova hoc loco
Deschampsia flexuosa subsp. *flexuosa* variant
Luzulo sieberi-Brachypodietum genuensis ass. nova hoc loco
helleboretosum bocconei subass. nova hoc loco subass. *typicum*
Gentiana lutea subsp. *lutea, Scilla bifolia* and *Ranunculus ficaria* (s.l.) variant
Trifolium alpestre variant

FESTUCO VALESIACAE-BROMETEA ERECTI Br.-Bl. & Tüxen ex Br.-Bl. 1949
Phleo ambigui-Brometalia erecti Biondi, Allegrezza, Blasi & Galdenzi 2014 in Biondi, Allegrezza, Casavecchia Galdenzi, Gasparri, Pesaresi , Vagge & Blasi, 2014
Phleo ambigui-Bromion erecti Biondi & Blasi ex Biondi, Allegrezza & Zuccarello ex Biondi & Galdenzi 2012
Brachypodenion genuensis Biondi, Ballelli, Allegrezza & Zuccarello 1995 ex Biondi & Galdenzi 2012
Potentillo cinerae-Brometum erecti Biondi, Pinzi & Gubellini 2004
trifolietosum alpestris subass. nova hoco loco
Filipendula vulgaris and *Eryngium amethystimum* variant
Polygalo majoris-Seslerietum nitidae Biondi, Ballelli, Allegrezza & Zuccarello 1995
Filipendulo vulgaris-Trifolietum montani Hruska, Francalancia & Orsomando 1981 in Francalancia Hruska & Orsomando, 1981
gentianelletosum columnae Hruska, Francalancia & Orsomando 1981 in Francalancia Hruska & Orsomando, 1981
Brachypodium genuense and *Gentiana lutea* subsp. *lutea* variant
Gentiano luteae-Brachypodietum genuensis ass. nova hoc loco
deschampsietosum flexuosae subass. nova hoc loco subass. *typicum*

FESTUCO-SESLERIETEA Barbéro & Bonin 1969
Seslerietalia tenuifoliae Horvat 1930
Seslerienalia apenninae Bruno & Furnari 1966 em. Lancioni, Facchi & Taffetani 2011
Carici humilis-Seslerion apenninae Biondi & Allegrezza 2014 in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge & Blasi, 2014
Carici humilis-Seslerietum apenninae Biondi, Guitian, Allegrezza & Zuccarello 1988
subass. *paronychietosum kapelae* subass. nova hoco loco
Carici macrolepis-Seslerietum apenninae Biondi, Pinzi & Gubellini 2004

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Appendix: sporadic species

Table. 5: Rel. 1: H scap EURASIAT. Tragopogon pratensis L. subsp. pratensis +, H scap S EUROP. MONT. Dianthus monspessulanus L. +, H ros S EUROP.-W ASIAT. Primula veris L. subsp. suaveolens (Bertol.) Gutermann et Ehrend. +, H caesp EURASIAT. Agrostis capillaris L. + , H caesp Festuca rubra L. (s.l.) + , G bulb EUROP. Orchis mascula (L.) L. subsp. mascula +,H scap MEDIT. MONT. Rumex nebroides Campd. +. Rel. 2: H caesp EURASIAT. Cynosurus cristatus L +.2, G rhiz MEDIT. MONT. Asphodelus macrocarpus Parl. subsp. macrocarpus +, G rhiz ENDEM. Helleborus bocconei Ten. subsp. bocconei +. Rel. 3: H scap S EUROP. MONT. Ranunculus breyninus Crantz 1, NP EUROSIB.-N AMER. Juniperus communis L. subsp. nana Syme (+.2). Rel. 4: H scap S EUROP. MONT. Linum alpinum Jacq. +, H bienn EURASIAT. Centaurium erythraea Rafn subsp. erythraea +, Ch suffr SE EUROP. Genista januensis Viv. +, G bulb C EUROP. MONT. Lilium bulbiferum L. subsp. croceum (Chaix) Jan +.Rel. 5: H ros MEDIT. Bellis sylvestris Cirillo +, T par Orobanche sp. +, H caesp S EUROP. MONT. Paronychia kapela (Hacq.) A. Kern. subsp. kapela +. Rel. 6: Ch suffr S EUROP. MONT. Acinos alpinus (L.) Moench subsp. alpinus +.2, H scap EUROSIB. Hypericum perforatum L. subsp. perforatum +, H scap EUROP. Saxifraga granulata L. subsp. granulata +,Ch succ EUROP. Sedum rupestre L. subsp. rupestre +, Ch succ S EUROP. MONT. Sempervivum arachnoideum L. +. Rel. 7: T scap MEDIT. Acinos arvensis (Lam.) Dandy subsp. arvensis +, G bulb MEDIT. MONT. Crocus vernus (L.) Hill subsp. vernus +, T scap MEDIT. Minuartia hybrida (Vill.) Shischk. subsp. hybrida +. Rel. 8: H caesp EURASIAT. Anthoxanthum odoratum L. subsp. odoratum +, H scap S EUROP. MONT. Biscutella laevigata L. subsp. laevigata +, H caesp ENDEM. Homalotrichon pubescens (Huds.) Banfi, Galasso et Bracchi (s.l.) +, T scap MEDIT. Linum bienne Mill. +.

Table 7: Rel. 3: H scap EUROSIB. Hypericum perforatum L. 1.1, G rhiz MEDIT. MONT. Asphodelus macrocarpus Parl. subsp. macrocarpus +.2, H scap S EUROP. Cruciata glabra (L.) Ehrend. subsp. glabra +.2, H caesp EURASIAT. Dactylis glomerata L. subsp. glomerata +.2, H scap EUROP. Saxifraga granulata L. subsp. granulata +, Ch succ EUROP. Sedum sexangulare L. +, T scap MEDIT. Trifolium arvense L. subsp. arvense +. Rel. 4: H ros S EUROP.-W ASIAT. Primula veris L. subsp. suaveolens (Bertol.) Gutermann et Ehrend. +.2, H ros SE EUROP. Gentiana dinarica Beck

+, H caesp ILLIR.-APENN. Sesleria juncifolia Suffren subsp. juncifolia +. Rel. 6: H scap ENDEM. Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti et Gubellini +.

Table 8: Rel. 1: H ros EURASIAT. Gentiana verna L. subsp. verna +, H scap ENDEM. Viola eugeniae Parl. subsp. eugeniae +. Rel. 2: H scap EURASIAT. Cruciata laevipes Opiz +.2. Rel. 3: Ch succ EUROP. Sedum rupestre L. subsp. rupestre +.2. Rel. 6: H rept EUROP.-W ASIAT. Ajuga reptans L. +.2, G bulb MEDIT. MONT. Crocus vernus (L.) Hill subsp. vernus +. Rel. 7: H caesp EUROP. Danthonia decumbens (L.) DC. subsp. decumbens +.2.

Table 9: Rel. 1: G bulb S EUROP. MONT. Lilium bulbiferum L. subsp. croceum (Chaix) Jan +, H scap ENDEM. Ranunculus apenninus Chiov. +.2, P caesp EUROP. Fraxinus excelsior L. subsp. excelsior +, H scap ENDEM. Laserpitium siler L. subsp. siculum (Spreng.) Santangelo, F. Conti et Gubellini +. Rel. 2: H ros MEDIT. Viola alba Besser subsp. dehnhardtii (Ten.) W. Becker +, H scap ENDEM. Dianthus carthusianorum L. subsp. tenorei (Lacaita) Pignatti +, H scap EURASIAT. Picris hieracioides L. subsp. hieracioides +, H caesp EURASIAT.-N AMER. Poa trivialis L. +. Rel. 3: G bulb MEDIT. Allium sphaerocephalon L. +, H caesp EUROP. Brachypodium rupestre (Host) Roemer et Schultes +.2, H scap S EUROP. MONT. Leucanthemum adustum (W.D.J. Koch) Gremli +, H scap S EUROP. MONT. Linum alpinum Jacq. +, Ch suffr MEDIT. Teucrium chamaedrys L. subsp. chamaedrys +. Rel. 5: H rept EUROSIB.-N AMER. Veronica officinalis L. +, Ch rept S EUROP. MONT. Thymus praecox Opiz subsp. polytrichus (Borbás) Jalas 1.1, H scap EUROP. Trifolium alpestre L. 1.1, G bulb EUROP. Allium vineale L. +, H bienn EURASIAT. Arabis hirsuta (L.) Scop. +, H scap EUROP. Asperula cynanchica L. +, H scap S EUROP. MONT. Barbarea bracteosa Guss. +, H scap S EUROP. Galium corrudifolium Vill. +, H scap S-EUROP. Galium mollugo L. subsp. mollugo +, H caesp ENDEM. Koeleria splendens C. Presl subsp. grandiflora (Bertol. ex Schultes) Domin +.2, Ch suffr ENDEM. Potentilla rigoana Th. Wolf +, H scap EUROP. MONT. Ranunculus serpens Schrank subsp. nemorosus (DC.) G. López +, H scap EUROP. Saxifraga granulata L. subsp. granulata +, Ch succ EUROP. Sedum rupestre L. subsp. rupestre +, Ch succ EUROP. Sedum sexangulare L. +. Rel. 6: G bulb EUROSIB. Gymnadenia conopsea (L.) R. Br. +, H caesp S EUROP.-S SIBER. Nardus stricta L. (+.2).

Table 10: Rel. 1: H scap EUROP.-W ASIAT. Sanicula europaea L. +. Rel. 2: H caesp S EUROP.-W ASIAT. Poa sylvicola Guss. +.2, P scap C EUROP. Rubus hirtus Waldst. et Kit. +, H scap W EUROP.-MEDIT. Oenanthe pimpinelloides L. +.2, H caesp S EUROP. MONT. Silene ciliata Pourr. subsp. graefferi (Guss.) Nyman +. Rel. 3: H scap ENDEM. Ranunculus apenninus Chiov. 1.1, H scap EURASIAT. Cruciata laevipes Opiz +, G bulb EUROSIB. Gymnadenia conopsea (L.) R. Br. +. Rel. 4: H caesp SE EUROP. MONT. Bellardiochloa variegata (Lam.) Kerguélen subsp. variegata 3.4, H ros S EUROP. MONT. Carlina acaulis L. subsp. caulescens (Lam.) Schübl. et G. Martens +. Rel. 6: G bulb MEDIT. MONT. Crocus vernus (L.) Hill subsp. vernus +.2, H scap E EUROP.-W ASIAT. Pilosella cymosa (L.) F.W. Schultz et Sch. Bip. subsp. cymosa +, H ros EUROSIB. Taraxacum officinale (group) +. Rel. 7: H scap SUBCOSMOPOL. Sanguisorba minor Scop. subsp. balearica (Bourg. ex Nyman) Muñoz Garm. et C. Navarro +. Rel. 8: H scap S EUROP. MONT. Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang. +, H scap W ALP.-APENN. Cerastium arvense L. subsp. suffruticosum (L.) Ces. +, H scap S EUROP. MONT. Galium anisophyllon Vill. +, Ch suffr EUROP.-W ASIAT. Helianthemum nummularium (L.) Mill. subsp. obscurum (Celak.) Holub +. Rel. 10: H caesp ENDEM. Koeleria splendens C. Presl subsp. grandiflora (Bertol. ex Schultes) Domin 1.2, H bienn EURASIAT. Arabis hirsuta (L.) Scop. +, H scap EUROP. Asperula cynanchica L. +, H caesp ENDEM. Avenula praetutiana (Parl. ex Arcang.) Pignatti +, H scap ENDEM. Dianthus carthusianorum L. subsp. tenorei (Lacaita) Pignatti +, H scap EURASIAT. Carex caryophyllea Latourr. +, H caesp EUROP. Luzula campestris (L.) DC. +, G rhiz ENDEM. Phleum hirsutum Honck. subsp. ambiguum (Ten.) Tzvelev +, H scap SE EUROP. Ranunculus illyricus L. +. Rel. 11: G bulb SE EUROP. MONT. Fritillaria montana Hoppe ex Koch +.

Table 11 : Rel. 1 : T scap EURASIAT. Galium aparine L. +, H scap EUROP. Ranunculus lanuginosus L. +; rel. 3: H scap SUBCOSMOPOL. Urtica dioica L. subsp. pubescens (Ledeb.) Domin + , H scap S EUROP. MONT Bupleurum falcatum L. subsp. cernuum (Ten.) Arcang. +; rel. 4 : H ros S EUROP.-W ASIAT. Primula veris L. subsp. suaveolens (Bertol.) Gutermann et Ehrend. +, H scap S EUROP. MONT. Ranunculus breyninus Crantz + ; rel. 5 : H scap EUROSIB. Achillea millefolium L. subsp. millefolium 1.2, H scap EURASIAT. Filipendula vulgaris Moench 1.1, H scap SE EUROP. MONT. Verbascum longifolium Ten. +.2, H caesp MEDIT. Festuca circummediterranea Patzke +.2, NP Rosa sp. +.2, H scap S EUROP. Malva moschata L. +.3, G bulb SW EUROP. Bunium bulbocastanum L. +, T scap EUROSIB. Rhinanthus minor L. +, H scap MEDIT. Eryngium amethystinum L. (+), H caesp EURASIAT. Dactylis glomerata L. subsp. glomerata +.