

## The vegetation of the Maddalena Mountains (Southern Italy)

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### Abstract

Using the data contained in the Lucanian Vegetation Database, the focus of our paper is the vegetation classification of the Maddalena mountains, a calcareous range not previously surveyed, placed between the Basilicata and Southern Campania regions. By using multivariate and phytosociological analyses we detected the presence of seven types of broad leaved forests: four of these (*Anemone apenninae-Fagetum sylvaticae*, *Aro lucani-Aceretum lobelii*, *Physospermo verticillati-Quercetum cerridis*, *Seslerio autumnalis-Aceretum obtusati*) are formerly associated with the Southern Apennines, meanwhile three are herein described as new associations (*Aceri neapolitani-Quercetum virgiliana*, *Roso spinosissima-Quercetum dalechampii*, *Geranio versicoloris-Populetum tremulae*). Shrublands are referred to *Cytisium sessilifolii* and *Pruno-Rubion (Rhamno-Prunetea)* and a new association is described (*Roso squarrosae-Rubetum ulmifolii*). Dry grasslands (*Anthemido creticae-Stipetum austroitalicae*) belonging to *Festuco-Brometea (Phleo-Bromion)* and garrigues (*Onosmo lucanae-Lomelosietum crenatae*) of *Cisto-Micromeritea (Cisto-Ericion)* are also described as new syntaxa.

Key words: Appennino Lucano National Park, Basilicata Region, phytosociology, vegetation classification.

### Introduction

Vegetation classification is considered an important element both for scientific issues and environmental studies, in particular monitoring habitats and biodiversity conservation (De Cáceres & Wiser 2011; Schaminée *et al.* 2011; Pott, 2011). In recent years, vegetation ecologists devolved a particular interest in databases and ecoinformatics as useful instruments to improve vegetation classification, biodiversity analyses at local, regional, and international levels and as a source of information about plant species and communities' distribution (Feoli *et al.* 2011, Dimopoulos *et al.*, 2012; Font *et al.*, 2012; Gigante *et al.* 2012; Landucci *et al.* 2012).

With this premise, in 2010 we started to assemble a regional database of vegetation plots (Lucanian Vegetation Database, Rosati *et al.* 2012). In this paper we query the database to focus on vegetation classification of the southern part of Maddalena Mountains, a mountain ridge placed between the intra-mountain basins of the upper Val d'Agri (Basilicata) and the Vallo di Diano (Campania region). The study area lies entirely in the Appennino Lucano-Val d'Agri-Lagonegrese National Park and includes the SCI IT9210110 "Faggeta di Moliterno". This biotope is of special interest because, in the census of the Italian Society of Botany (Società Botanica Italiana, 1971) it was reported to have remnants of ancient forests that survived the severe cutting that occurred between the nineteenth and

twentieth century and have sharply reduced the forest extension in Southern Italy. This territory has rarely produced any specific botanical contributions (Pirone 1980; Fascetti *et al.*, 2006) and the vascular flora references for this geographic sector only concern the neighbouring central Lucan Apennines ridges (e.g. Gavioli, 1947). Until now, there have been no specific vegetation studies performed in this mountainous sector.

### Study area

The investigated territory includes the carbonate ridge of about 40 km placed in the NNW-SSE direction along the border between the regions of Basilicata and S-Campania. It is delimited to the west from the Vallo di Diano and to the east from the valley of the Agri River (Fig.1). In the territory of the Moliterno municipalities, the Calvarosa Mountain (1261 m a.s.l.) is the highest mountain relief. This sector of S-Apennines is characterized by remarkable geological complexity due mainly to the effects of a translational tectonic that placed the formations of the Mesozoic carbonatic platform on the silico-clastic Lagonegrese Units and fore deep flyschoid deposits (Grimaldi & Summa, 2005). However the dominant substrata belong to the stratigraphic sequence of a carbonatic platform, made up of dolomitic limestones, limestones, and calcarenites ranging from the Middle Trias to the Cretaceous. Holocene detritus represents the connection with the recent

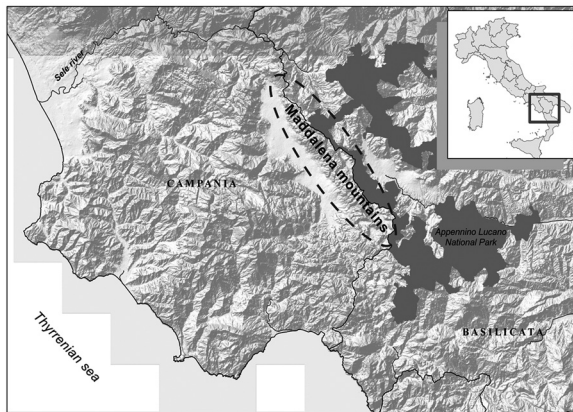


Fig. 1 - Study area.

alluvial deposits of the main valley due to late tectonic morfostructures shaped like a “graben”.

The bioclimate features were defined using rainfall and temperature data from the Moliterno (879 m a.s.l.) meteorological station (1926-1987 data source: Servizio Idrografico e Mareografico Nazionale; 1990-2003 data source: Servizio Agrometeorologico Regione Basilicata).

The annual average rainfall is 1094 mm, the wettest month is December (161 mm) and the driest is July (32 mm). More than 65% of the total rainfall is concentrated in autumn-winter period. The annual average temperature is 12.5 °C. The hottest month is August (22.3 °C) and the coldest is January (3.9 °C). The ombrothermic diagram, confirmed by Mitrakos Index (1980), shows a climatic pattern which is mesothermic sub-Mediterranean with rainfalls mainly from October to February and a summer drought period (SDS) from July to August (Fig. 2 and 3).

For the bioclimatic characterization we used the classification method proposed by Rivas-Martinez (2004). The Moliterno station belongs to the Mediterranean pluviseasonal oceanic-semicontinental macrobioclimate and to the lower humid supramediterranean phytoclimatic belt. However, local factors as altitude and aspect determine the transitions towards supra-temperate and mesomediterranean belt. According to the European biogeographic classification, this area is a part of the Western Mediterranean Region, Italo-Tyrrhenian Province and Western-Italic Subprovince (Rivas-Martinez et al., 2004).

**Data and Methods**

Available data (92 phytosociological surveys) for the study area span from 2001 to 2009 and were collected according to Braun-Blanquet method (Braun-Blanquet, 1964, Rivas-Martinez, 1976) for each vegetation type detected according to physiognomy and environmental features (land units, see Blasi et al. 2000;

Blasi & Frondoni 2011). Vascular plants nomenclature follows Conti et al. (2005) except for some taxa (e.g. *Quercus*, *Pyrus*, *Acer*) that are according to Pignatti (1982) and the Orchidaceae that are according to Delforge (2005). Life forms and chorological categories for plant species were derived from Pignatti (1982).

Species composition and relative abundances were analysed using the software SYN-TAX (Podani, 2001) and JUICE (Tychy, 2002); cover values were transformed according to Van der Maarel (1979). Data were not standardized. Cluster analysis was performed using the modified TWINSpan procedure (Roleček et al., 2009) and ‘Total Inertia’ as a measure of cluster heterogeneity. Ordinations were performed using a Non-metric Multidimensional Scaling (NMDS) through Goodman-Kruskal lambda algorithm.

Syntaxonomic nomenclature was in accord with the International Code of Phytosociological Nomenclature (Weber et al., 2000), whereas phytosociological terms

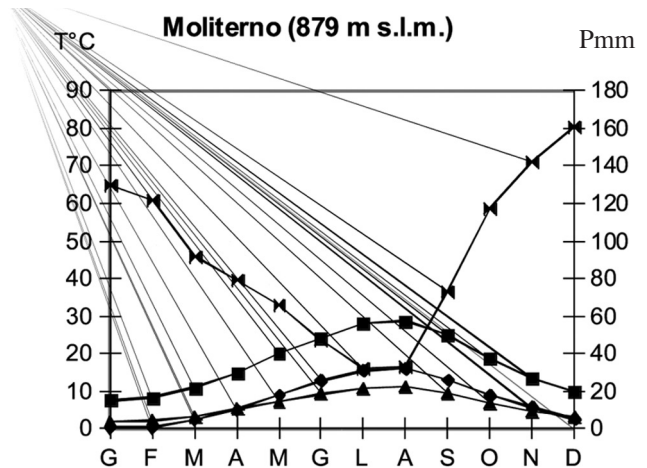


Fig. 2 - Pluviothermic diagram according to Bagnouls & Gausson (1957) of Moliterno station (data 1923-2007). Continuality index 18,4; Thermicity index 142; Ombrothermic index 7,3. Bioclimatic classification: lower humid supramediterranean pluviseasonal semicontinental.

Monthly Cold Stress (MCS) and Monthly Drought Stress (MDS) of Moliterno (879m a.s.l.)

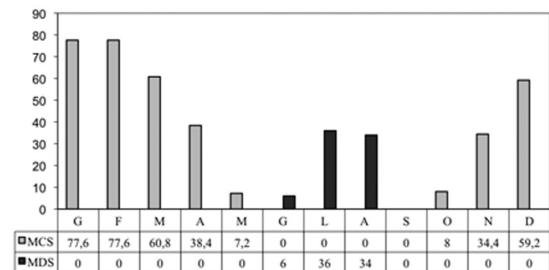


Fig. 3 - Bioclimatic diagram according to Mitrakos (1980): MCS = monthly cold stress; MDS = monthly drought stress.

agree with Poldini & Sburlino (2005). Correspondence between syntaxa and Habitats (UE Directive 92/43, European Commission, 2007) refers to Biondi *et al.* (2012).

## Results and Discussion

Multivariate analysis (Fig. 4) shows the presence of three main clusters of forest vegetation: clusters 1 and 2 include edapho-xerophilous woods found on calcareous substrata, the third group includes mesophilous woods found on northern slopes or flysch substrata (clusters 3-9). In fact, the geomorphological conformation of the area determines a significant variety of forest vegetation types, assuming the role of edapho-climax, according to the characteristic of substrata, slopes and aspect rather than altitude. For example, the presence of sub-mountain depressions and karst plains in the study area, due to the phenomenon of temperature inversion, determines the findings of beech forests at altitudes less than or equal to oak supramediterranean forests. Meanwhile on the top of mountain ridges we frequently detected oro-xerophilous oak woods dominated by *Quercus dalechampii*. Instead, mesohigrophilous forests are localized along ravines and depressions.

Regarding garrigues and grasslands, three main vegetation types were identified, both in cluster analyses (not shown here) and in the ordination diagram (Fig. 5), where the main axes identify a gradient of soil depth.

### THERMOPHILOUS BEECH FORESTS

9210\*Apennine beech forests with *Taxus* and *Ilex*  
**ANEMONO APENNINAE-FAGETUM SYLVATICAE**  
 (Gentile 1970) Brullo 1984 (Tab. 1)

**Distribution:** over 900-1000 m a.s.l. on the northern

slopes of the main reliefs of the Monti della Maddalena (e.g. M. Calvarosa, Serra Polosano, M. La Gattina, M. Aquila) and at lower altitudes where there are particular microclimate conditions (e.g. base of slopes and karst basins with inversion of temperature).

**Structure and synecology:** beech forests with high tree coverage (80-100%), particularly demanding in atmospheric moisture, developed on deep, mature and subacid brunisols.

Xerophilous aspects with *Ostrya carpinifolia* are present on rocky substrates or shallow soils (Table 1, rel. 1-2). In the shrub layer (coverage up to 80%) the prevailing species are: *Ilex aquifolium*, *Daphne laureola*, *Ruscus aculeatus*, *Rubus hirtus* and *Hedera helix* ssp. *helix*. Floristic composition is characterized by numerous mesophytes shared with *Quercetalia pubescentis* woods and several taxa with Apenninic distribution limited to the southern sector (e.g. *Geranium versicolor*, *Melittis melissophyllum* ssp. *albida*, *Festuca exaltata*, *Alnus cordata*)

The beech forest of "Faggeto Moliterno" is a biotope of high conservation value consisting in an ancient forest with big trees (up to Ø 90 cm, average height of 20-25 m)

**Characteristic taxa of association:** *Ilex aquifolium*, *Lathyrus venetus*, *Melica uniflora*, *Ranunculus lanuginosus*, *Anemone apennina* ssp. *apennina*.

**High frequency taxa:** *Fagus sylvatica* ssp. *sylvatica*, *Hedera helix* ssp. *helix*, *Tamus communis*, *Ilex aquifolium*, *Daphne laureola*, *Lathyrus venetus*, *Galium odoratum*, *Rubus hirtus*, *Melica uniflora*, *Lonicera caprifolium*.

**Syntaxonomy:** these forests have been referred to *Anemone apenninae-Fagetum sylvaticae* (Gentile, 1970; Brullo 1984); they are quite similar to the ones already described and widely distributed at altitudes generally below 1300 m a.s.l. along the Central-Southern Apennines, in Molise (Blasi *et al.*, 2005), Cilento (Corbetta *et al.*, 2004; Rosati *et al.*, 2005; Rosati *et al.*,

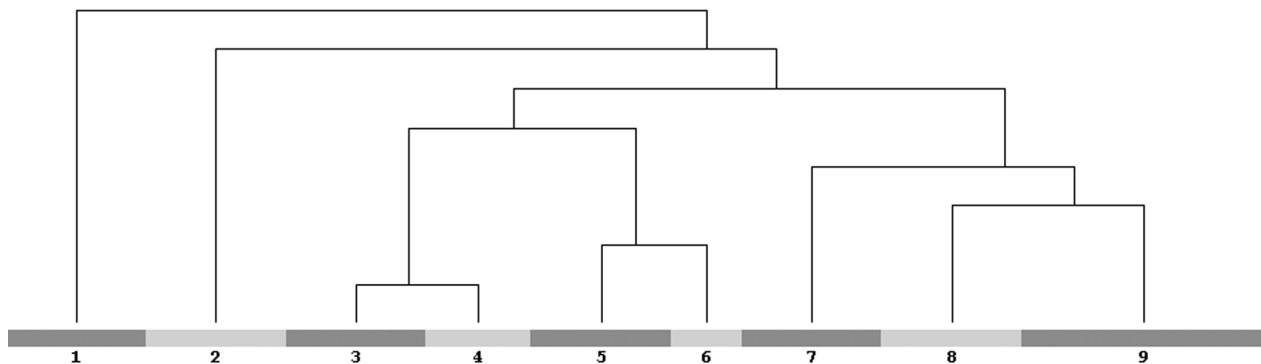


Fig. 4 - classification of forest vegetation by the Two Ways Indicator Species Analysis (TWINSPAN) modified from Rolecek *et al.* (2009): 1: *Roso spinosissima-Quercetum dalechampii*; 2: *Aceri neapolitani-Quercetum virgiliana*; 3: *Physofermo verticillati-Quercetum cerridis*; 4: *Seslerio autumnalis-Aceretum obtusati*; 5-6: *Geranio versicoloris-Populetum tremulae*; 7: *Aro lucani-Aceretum lobelii*; 8: *Anemone apenninae-Fagetum sylvaticae* facies with *Ostrya carpinifolia*; 9: *Anemone apenninae-Fagetum sylvaticae*.

Tab. 1 - *Anemone apenninae-Fagetum sylvaticae* (Gentile 1970) Brullo 1983

		Relevè number											presence
		1	2	3	4	5	6	7	8	9	10	11	
		Altitude (m a.s.l.)											
		1100	1080	1130	1050	1030	1000	1000	1027	950	1000	1050	
		Aspect											
		NE	ENE	NNE	ENE	NE	N	NE	NW	ENE	NNE	N	
		Slope (°)											
		30	30	30	35	40	25	-	20	10	30	20	
		Trees height (m)											
		25	17	25	25	15	25	15	20	25	23	15	
		Trees cover (%)											
		95	25	95	100	100	95	90	90	90	100	90	
		Shrubs height (m)											
		1	2	1	2	2	1,5	2	3	1,5	2	3	
		Shrubs cover (%)											
		30	95	40	60	50	80	70	70	30	20	70	
		Herb layer cover (%)											
		40	70	60	40	60	30	30	50	40	50	30	
		Area (m <sup>2</sup> )											
		300	200	300	250	200	200	100	100	200	300	100	
		species richness											
		34	54	52	29	39	28	18	26	33	30	31	
char. and diff. species of <i>Anemone-Fagetum</i> , <i>Doronic-Fagenion</i> , <i>Geranio versicoloris-Fagion</i>													
P caesp	Eurimedit	Ilex aquifolium L.	2	4	.	3	3	4	1	3	2	3	V
P caesp	Subatl	Daphne laureola L.	1	.	+	1	1	1	+	1	+	+	V
G rhiz	S-Europ-S-Siber	Lathyrus venetus (Mill.) Wolhf.	1	1	2	+	+	+	.	1	+	+	V
H caesp	Paleotemp	Melica uniflora Retz.	2	1	1	1	+	+	.	1	+	+	IV
G rhiz	NE-Medit-Mont	Geranium versicolor L.	+	+	+	.	+	+	.	.	+	.	IV
H caesp	Endem	Luzula sicula Parl.	+	+	1	1	2	.	.	1	.	.	III
H scap	Europ-Caucas	Ranunculus lanuginosus L.	1	.	1	+	.	.	.	.	+	+	III
H scap	NW-Medit-Mont	Lamium flexuosum Ten.	.	+	.	+	+	.	.	.	+	.	II
H scap	NE-Medit-Mont	Melittis melissophyllum L. ssp. albidus Guss.	.	+	+	+	.	.	.	+	.	.	II
Ch suff	Europ-Caucas	Euphorbia amygdaloides L. ssp. amygdaloides	.	.	+	.	+	+	.	.	+	.	II
G rhiz	SE-Europ	Anemone apennina L. ssp. apennina	.	.	+	+	.	+	.	1	.	.	II
G rhiz	Endem	Festuca exaltata C. Presl.	.	1	.	1	1	.	.	2	.	.	II
G rhiz	Orof-SE-Eur-Caucas	Doronicum orientale Hoffm.	.	+	.	.	.	.	.	.	1	.	I
G rhiz	Endem	Arum cylindraceum Gasp.	.	.	.	.	.	.	.	.	+	+	I
G bulb	W-Stenomedit	Allium pendulinum Ten.	.	.	.	.	.	.	1	.	1	.	I
G rhiz	Endem	Euphorbia corallionides L.	.	+	.	.	.	.	.	.	.	.	I
G rhiz	Endem	Epipactis meridionalis H. Baumann & R. Lopez	.	.	.	.	.	.	.	.	.	+	I
T scap	N-Medit	Cardamine graeca L.	.	.	1	.	.	.	.	.	.	.	I
P scap	Endem	Acer cappadocicum Gled ssp. lobelii (Ten.) Murray	.	.	.	.	.	1	.	.	.	.	I
H ros	Eurimedit	Potentilla micrantha Ramond ex DC:	.	.	.	.	.	+	.	.	.	.	I
diff. species of facies with <i>Ostrya carpinifolia</i>													
H caesp	Europ-Caucas	Festuca heterophylla Lam.	.	+	1	+	+	.	.	.	.	.	II
H scap	Eurosib	Vicia sepium L.	.	+	1	1	+	.	.	.	.	.	II
H scap	Eurosib	Veronica chamaedrys L. ssp. chamaedrys	1	.	1	+	.	+	.	.	.	.	II
P caesp	Pontica	Ostrya carpinifolia Scop.	2	2	+	.	.	.	.	.	.	.	II
char. and diff. species of <i>Fagetalia sylvaticae</i>													
P scap	C-Europ	Fagus sylvatica L. ssp. sylvatica	4	5	5	5	5	5	4	5	4	5	V
G rhiz	Europ-Caucas	Galium odoratum (L.) Scop.	3	+	2	2	+	1	.	1	1	3	V
Pn	N-Eurimedit	Rubus hirtus Waldst. et Kit.	2	3	3	2	2	2	.	3	+	3	V
H scap	S-Medit-Subatl	Viola reichenbachiana Jord. Ex Boreau	1	+	1	1	+	.	+	1	.	+	V
G rhiz	C-Europ	Cardamine bulbifera (L.) Crantz	.	+	.	.	+	+	+	.	1	+	IV
G rhiz	Eurasiat	Polygonatum multiflorum (L.) All.	.	+	.	.	+	.	+	.	+	+	III
G rhiz	Eurasiat	Neottia nidus-avis (L.) Rich.	+	+	+	+	.	.	.	.	+	+	III
T scap	Subcosmopol	Geranium robertianum L.	+	.	+	.	.	+	+	.	.	+	III
H scap	Europ-Caucas	Lactuca muralis (L.) Gaertn.	+	.	1	.	+	+	.	+	.	+	III
G rhiz	Circumbor	Milium effusum L.	1	.	2	+	.	.	.	+	.	.	III
P caesp	Europ-Caucas	Corylus avellana L.	.	.	.	.	1	3	.	1	3	+	III
H scap	Paleotemp	Sanicula europaea L.	1	.	1	1	.	.	.	.	1	.	III
Symphytum tuberosum L. ssp. angustifolium (A. Kerner) Nyman													
G rhiz	SE-Europ	Kerner) Nyman	+	.	+	.	.	.	.	+	1	.	III
H ros	Orof-NE-Europ	Aremonia agrimonoides (L.) DC. ssp. agrimonoides	+	.	.	.	+	.	+	.	1	.	II
H scap	Orof-Medit	Calamintha grandiflora (L.) Moench	1	+	+	.	+	.	.	.	.	.	II
Pn	S-Medit-Subatl	Rosa arvensis Huds.	.	1	.	.	.	+	.	1	+	.	II
G rhiz	Paleotemp	Epipactis helleborine (L.) Crantz s.l.	1	.	+	+	.	+	.	.	.	.	II
H scap	Paleotemp	Campanula trachelium L. ssp. trachelium	.	.	+	.	+	+	.	1	.	.	II
G rhiz	Europ-Caucas	Epipactis microphylla (Ehrh.) Swartz	.	.	.	+	.	.	.	.	.	.	I
G rhiz	Eurasiat	Actaea spicata (L.) Moench	.	.	.	+	.	+	.	.	.	.	I
G rhiz	Europ-Caucas	Mercurialis perennis L.	.	.	.	.	.	.	.	1	1	.	I
T scap	Eurasiat	Chaerophyllum temulum L.	.	.	+	.	.	.	.	.	.	+	I
H scap	Endem	Pulmonaria apennina Cristof. & Puppi	+	+	.	.	.	.	+	.	.	.	I
G rhiz	Orof-S-Europ	Asperula taurina L.	.	.	.	.	.	.	.	.	.	+	I
H scap	Eurosib	Thalictrum aquilegifolium L. ssp. aquilegifolium	.	+	.	.	.	.	.	.	.	.	I
P scap	Europ-Caucas	Tilia platyphyllos Scop.ssp. platyphyllos	.	+	.	.	.	.	.	.	.	.	I
H scap	Orof-Eurasiat	Scrophularia scopoli Hoppe	.	.	.	+	.	.	.	.	.	.	I
H scap	Eurasiat	Epilobium montanum L.	.	.	.	+	.	.	.	.	.	.	I
Loncomelos pyrenaicus (L.) Hrouda ex J. Holub ssp.													
G bulb	Eurimedit	pyrenaicus	.	.	.	.	.	.	+	.	.	.	I
G rhiz	Eurasiat	Paris quadrifolia L.	.	.	.	.	.	.	.	.	+	.	I
G rhiz	Circumbor	Polystichum setiferum (Forssk.) T. Moore ex Woyn.	.	.	.	.	.	.	.	.	.	+	I
G rhiz	Subcosmopol	Dryopteris filix-mas (L.) Schott	.	.	.	.	.	.	.	.	.	+	I
G rhiz	Circumbor	Anemone nemorosa L.	.	.	.	.	.	.	.	.	.	+	I
char. and diff. species of <i>Quercus-Fagetea</i>													
P lian	Eurimedit	Hedera helix L. ssp. helix	+	1	1	1	1	1	1	1	+	+	V
G rad	Eurimedit	Tamus communis L.	1	1	1	1	1	+	1	+	+	+	V

P lian	S-Europ-S-Siber	Lonicera caprifolium L.	1	+	1	.	1	.	1	1	+	+	+	V
G rhiz	Eurasiat	Cephalanthera rubra (L.) Richb.	+	.	+	1	+	.	+	.	.	.	+	III
P caesp	SE-Europ-Pont	Euonymus verrucosus Scop.	.	.	.	1	+	.	1	1	1	.	.	III
H scap	W-Europ	Digitalis lutea L. ssp. australis (Ten.) Arcang.	+	+	+	.	+	+	.	.	.	.	.	III
H rept	Europ-Caucas	Ajuga reptans L.	.	.	1	.	+	+	.	+	.	.	+	III
P caesp	S-Europ-S-Siber	Cornus mas L.	.	+	.	.	+	.	.	.	+	+	.	II
P scap	Europ-Caucas	Acer pseudoplatanus L.	+	3	+	+	.	.	.	.	.	.	.	II
H rept	Eurosib	Fragaria vesca L. ssp. vesca	.	1	.	.	.	.	.	1	+	.	+	II
P scap	N-Eurimedit	Quercus cerris L.	.	+	.	.	.	+	.	.	+	.	+	II
G bulb	Orof-C-Europ	Lilium bulbiferum L. ssp. croceum (Chaix) Jan	+	+	.	.	.	.	.	.	.	+	.	II
P scap	Eurosib	Populus tremula L.	+	+	.	.	+	.	.	.	.	.	.	II
H scap	S-Europ	Ptilostemon strictus (Ten.) Greuter	.	+	1	.	+	.	.	.	.	.	.	II
P caesp	Eurasiat	Euonymus europaeus L.	.	1	.	.	.	.	+	+	.	.	.	II
H caesp	Orof-C-Europ	Bromus ramosus Hudson	+	.	1	.	.	.	.	.	.	.	.	I
H caesp	Paleotemp	Brachypodium sylvaticum (Huds.) P. Beauv. ssp. sylv.	.	1	+	.	.	.	.	.	.	.	.	I
P caesp	Paleotemp	Sorbus torminalis (L.) Crantz	.	+	.	.	+	.	.	.	.	.	.	I
Ch suff	Subatl	Helleborus foetidus L. ssp. foetidus	.	.	.	.	+	.	.	.	.	.	+	I
H bienn	S-Europ-S-Siber	Arabis turrita L.	.	.	.	+	.	.	.	.	.	.	.	I
H scap	Pont	Buglossoides purpurocaerulea (L.) I.M. Johnston	.	1	.	.	.	.	.	+	.	.	.	I
H rept	S-Europ-S-Siber	Silene viridiflora L.	.	+	+	.	.	.	.	.	.	.	.	I
H scap	NE-Medit-Mont	Scutellaria columnae All.	.	+	+	.	.	.	.	.	.	.	.	I
H scap	Endem	Teucrium siculum (Raf.) Guss. ssp. siculum	.	1	.	.	.	.	.	.	.	.	.	I
Pn	W-C-Europ	Cytisus villosus Pourret	.	1	.	.	.	.	.	.	.	.	.	I
P scap	Europ-Caucas	Tilia phatyphyllos Scop.ssp. platyphyllos	.	.	.	.	.	.	.	.	.	.	.	I
H caesp	Orof-SE-Europ	Luzula sylvatica (Huds.) Gaudin ssp. sylvatica	.	.	+	.	.	.	.	.	.	.	.	I
		Myosotis sylvatica Hoffm. ssp. elongata (Strobl.)	.	.	.	.	.	.	.	.	.	.	.	I
H scap	Paleotemp	Grau	.	.	.	+	.	.	.	.	.	.	.	I
H ros	Europ-Caucas	Primula vulgaris Huds. ssp. vulgaris	.	.	1	.	.	.	.	.	.	.	.	I
H ros	Eurimedit	Silene italica (L.) Pers.ssp. italica	.	.	+	.	.	.	.	.	.	.	.	I
H caesp	SE-Europ	Sesleria autumnalis (Scop.) Schultz	.	.	.	.	+	.	.	.	.	.	.	I
P caesp	S-Europ-S-Siber	Fraxinus ornus L. ssp. ornus	.	.	.	.	+	.	.	.	.	.	.	I
H ros	Eurimedit	Viola alba Besser ssp. dehnhardtii (Ten.) W. Becker	.	.	.	.	+	.	.	.	.	.	.	I
H scap	Europ-Caucas	Stachys officinalis (L.) Trevis.	.	.	.	.	.	.	.	+	.	.	.	I
G bulb	NW-Stenomedit	Cyclamen hederifolium Aiton ssp. hederifolium	.	.	.	.	.	.	.	.	.	1	.	I
H scap	Medit-Mont	Physospermum verticillatum (W. & K.) Vis.	.	.	.	.	.	.	.	.	.	1	.	I
H caesp	Circumbor	Poa nemoralis L. ssp. nemoralis	.	.	.	.	.	.	.	.	.	.	+	I
		others	.	.	.	.	.	.	.	.	.	.	.	.
G rhiz	Eurimedit	Ruscus aculeatus L.	.	1	.	1	+	.	1	.	.	+	+	IV
G rhiz	Cosmopol	Pteridium aquilinum (L.) Kuhn ssp. aquilinum	.	.	1	1	.	.	1	.	.	.	+	II
P lian	Europ-Caucas	Clematis vitalba L.	.	1	+	.	.	.	.	+	.	.	.	II
G bulb	Paleotemp	Platanthera bifolia (L.) Rich.	.	.	+	+	.	.	.	.	.	.	.	I
H caesp	Paleotemp	Dactylis glomerata L. ssp. glomerata	.	+	.	.	+	.	.	.	.	.	.	I
G rhiz	Eurosib	Aegopodium podagraria L.	.	.	.	.	+	1	.	.	.	.	.	I
		sporadic species	.	4	3	.	1	.	.	4	1	.	.	.

2010), Central Lucanian Apennines (Aita *et al.*, 1984), Pollino (Gentile, 1970; Corbetta & Pirone, 1981; Di Pietro & Fascetti 2005; Maiorca & Spampinato, 1999), Calabria (Maiorca *et al.*, 2006; Brullo *et al.*, 2001) and Sicily (Gentile, 1970; Brullo, 1984).

**Dynamic:** *Anemone apennine-Fagetum sylvaticae* coenoses are dynamically linked in the study area mainly to shrublands referring to *Spartio juncei-Cytisetum sessilifolii*.

**Chorology:** chorological analyses showed that most of species belong to European-Caucasian chorotype (27,3%), followed by Eurimediterranean (18,7) and Euroasiatic species (12,8%). Only 5% of the species were endemic: this percentage is lower in respect to the other vegetation types surveyed in this study. Moreover the presence of many species with Western European chorotypes (about 9 %) is similar to the findings for the beech woods of neighbouring mountains of Calabria and Campania.

## TURKEY OAK FORESTS

91L0 Illyrian oak-hornbeam forests (Erythronio-Carpinion)

**PHYSOSPERMO VERTICILLATI-QUERCETUM CERRIDIS** Aita, Corbetta & Orsino 1977  
**PULMONIARETOSUM APENNINAE** Zanotti, Ubaldi, Corbetta & Pirone 1993 (Tab. 2)

**Distribution:** Turkey oak woods were found mainly in the north-eastern slopes up to 990-1000 m a.s.l., on deep soil developed on flysch substrata.

**Structure and synecology:** these forests are managed like high forests with a dominant tree layer 15-20 m high and canopy cover up to 90%. The tree layer presents: *Quercus cerris*, *Fagus sylvatica* ssp. *sylvatica*, *Carpinus betulus*, *Fraxinus ornus* ssp. *ornus*, *Ostrya carpinifolia*, *Sorbus torminalis* and *Populus tremula*. The understorey is characterized by acidophilous and transgressive species from the beech woods such as: *Ilex aquifolium*, *Corylus avellana*, *Aremonia agrimonioides* ssp. *agrimonioides*, *Loncomelos pyrenaicus* ssp. *pyrenaicus*, *Vinca major* ssp. *major*, *Teucrium siculum* ssp. *siculum*, *Festuca heterophylla*, *Luzula sylvatica* ssp. *sieberi* as well as several species geographically limited to the central-southern Apennines (*Melittis albidia*, *Doronicum orientale*, *Euphorbia corallioides*).

Tab. 2 - *Physospermo verticillati-Quercetum cerridis* Aita, Corbetta & Orsino 1977 *pulmonarietosum apenninae* Zanotti, Ubaldi, Corbetta & Pirone 1993

		Relevè number	1	2	3	4	5		
		Altitude (m a.s.l.)	980	1000	1040	1000	1000		
		Aspect	NE	NNW	W	S	S		
		Slope (°)	20	-	5	10	10	presence	
		Trees height (m)	20	15	15	15	15		
		Trees cover (%)	95	90	20	40	40		
		Shrubs height (m)	1	2	3	0,9	0,9		
		Shrubs cover (%)	40	60	15	40	70		
		Herb layer cover (%)	70	20	80	30	30		
		Area (m <sup>2</sup> )	200	120	50	80	100		
		species richness	46	28	21	28	24		
char. and diff. species of <i>Physospermo verticillati-Quercetum cerridis pulmonarietosum</i>									
P scap	N-Eurimedit	<i>Quercus cerris</i> Mill.	5	4	5	4	4		V
H scap	Endem	<i>Pulmonaria apennina</i> Cristof. & Puppi	+	+	+	+	.	IV	
P caesp	S-Europ-S-Siber	<i>Cornus mas</i> L.	1	1	.	.	+	III	
Ch rept	C-Europ-Caucas	<i>Vinca major</i> L. ssp. major	.	1	1	+	.	III	
H ros	Orof-NE-Medit	<i>Aremonia agrimonoides</i> (L.) DC. ssp. agrimonoides	1	+	.	.	.	II	
P scap	C-Europ-Caucas	<i>Carpinus betulus</i> L.	.	.	.	2	1	II	
H scap	Paleotemp	<i>Sanicula europaea</i> L.	.	+	.	.	+	II	
G rhiz	Endem	<i>Euphorbia corallioidea</i> L.	+	.	.	.	.	I	
H scap	Eurosib	<i>Thalictrum aquilegifolium</i> L. ssp. aquilegifolium	1	.	.	.	.	I	
P scap	Eurasiat	<i>Pyrus pyrastrer</i> Burgsd.	.	.	.	.	1	I	
char. and diff. species of <i>Ptilostemone-Quercenion cerridis</i> and <i>Physospermo verticillati-Quercion</i>									
H scap	Endem	<i>Teucrium siculum</i> (Rafn.) Guss. ssp. siculum	1	+	.	.	1	III	
H scap	NE-Medit-Mont	<i>Melittis melissophyllum</i> L. ssp. albida (Guss.) P. W. Ball	.	.	+	+	.	II	
P scap	Endem	<i>Acer cappadocicum</i> Gled. ssp. lobelii Ten. (Murray)	1	.	.	.	+	II	
H ros	Eurimedit	<i>Viola odorata</i> L.	.	.	.	+	.	I	
G rhiz	Endem	<i>Festuca exaltata</i> C. Presl.	1	.	.	.	.	I	
P scap	Endem	<i>Acer obtusatum</i> W. et K. ssp. neapolitanum (Ten.) Pax	.	+	.	.	.	I	
char. and diff. species of <i>Fagetalia sylvaticae</i>									
P scap	C-Europ	<i>Fagus sylvatica</i> L. ssp. sylvatica	1	1	.	1	.	III	
P caesp	Europ-Caucas	<i>Corylus avellana</i> L.	.	3	.	2	1	III	
P caesp	submedit-subatl	<i>Ilex aquifolium</i> L.	.	2	1	2	.	III	
P N	S-Medit-Subatl	<i>Rosa arvensis</i> Huds.	1	.	.	1	+	III	
H caesp	Paleotemp	<i>Melica uniflora</i> Retz.	1	.	1	1	.	III	
G rhiz	S-Europ-S-Siber	<i>Lathyrus venetus</i> (L.) Wohlf.	.	+	.	+	+	III	
P scap	Eurosib	<i>Populus tremula</i> L.	+	.	.	1	.	II	
Loncomelos pyrenaicus (L.) Hrouda ex J. Holub ssp.									
G bulb	Eurimedit	pyrenaicus	.	+	.	.	1	II	
P N	N-Eurimedit	<i>Rubus hirtus</i> Waldst. & Kit.	2	.	.	.	1	II	
H scap	Europ-Caucas	<i>Ranunculus lanuginosus</i> L.	.	+	.	.	.	I	
Ch suff	Europ-Caucas	<i>Euphorbia amygdaloides</i> L. ssp. amygdaloides	1	.	.	.	.	I	
P scap	Europ-Caucas	<i>Acer pseudoplatanus</i> L.	1	.	.	.	.	I	
H caesp	Endem	<i>Luzula sicula</i> Parl.	+	.	.	.	.	I	
G rhiz	Europ-Caucas	<i>Mercurialis perennis</i> L.	.	+	.	.	.	I	
P scap	Europ-Caucas	<i>Tilia platyphyllos</i> Scop. ssp. platyphyllos	.	.	.	1	.	I	
char. and diff. species of <i>Quercetalia pubescenti-petraeae</i> and <i>Quercio-Fagetea</i>									
H scap	S-Europ-Pont	<i>Buglossoides purpureo-aerulea</i> (L.) I.M. Johnst.	.	+	+	+	1	IV	
NP	N-Eurimedit	<i>Lonicera caprifolium</i> L.	1	1	.	+	1	IV	
P caesp	SW-Europ	<i>Cytisophyllum sessilifolium</i> (L.) O. Lang	1	.	1	+	.	III	
P scap	S-Europ-S-Siber	<i>Fraxinus ornus</i> L. ssp. ornus	1	.	2	1	.	III	
P scap	Circumbor	<i>Ostrya carpinifolia</i> Scop.	.	1	1	.	1	III	
H scap	Circumbor	<i>Geum urbanum</i> L.	+	.	+	.	+	III	
H caesp	Europ-Caucas	<i>Festuca heterophylla</i> L.	.	.	1	+	2	III	
H rept	Eurosiber	<i>Fragaria vesca</i> L. ssp. vesca	1	.	.	+	1	III	
P caesp	Eurasiat	<i>Euonymus europaeus</i> L.	.	.	1	+	1	III	
P caesp	Paleotemp	<i>Sorbus torminalis</i> (L.) Crantz	1	+	.	.	.	II	
H scap	NE-Medit-Mont	<i>Scutellaria columnae</i> All. ssp. columnae	.	+	.	+	.	II	
H scap	W-Europ	<i>Digitalis lutea</i> L. ssp. australis (Ten.) Arcang.	+	.	.	+	.	II	
P scap	Europ-Caucas	<i>Acer campestre</i> L.	+	1	.	.	.	II	
P lian	Eurimedit	<i>Hedera helix</i> L. ssp. helix	.	1	.	1	.	II	
G bulb	Paleotemp	<i>Platanthera bifolia</i> (L.) Rich.	.	.	+	.	+	II	
P N	Subatl	<i>Daphne laureola</i> L.	1	.	+	.	.	II	
H ros	Eurimedit	<i>Potentilla micrantha</i> Raimond ex DC.	.	.	+	+	.	II	
P scap	C-Europ-Caucas	<i>Malus sylvestris</i> Miller	+	.	.	.	.	I	
P caesp	W-C-Medit	<i>Cytisus villosus</i> Pourret	+	.	.	.	.	I	
H scap	Eurosib	<i>Veronica chamaedrys</i> L. ssp. chamaedrys	+	.	.	.	.	I	
H ros	Medit-mont	<i>Viola alba</i> Besser ssp. dehnhardtii (Ten.) W. Becker	+	.	.	.	.	I	
<i>Brachypodium sylvaticum</i> (Huds.) Beauv. ssp.									
H scap	Circumbor	sylvaticum	3	.	.	.	.	I	
H caesp	Paleotemp	<i>Euonymus verrucosus</i> Scop.	2	.	.	.	.	I	
G rad	Eurimedit	<i>Tamus communis</i> L.	1	.	.	.	.	I	
G bulb	Orof-C-Europ	<i>Lilium bulbiferum</i> L. ssp. croceum (Chaix) Baker	+	.	.	.	.	I	
P scap	SE-Europ	<i>Castanea sativa</i> Mill.	2	.	.	.	.	I	
H scap	Eurosib	<i>Vicia sepium</i> L.	1	.	.	.	.	I	
H scap	Eurosib	<i>Stachys sylvatica</i> L.	.	+	.	.	.	I	
H scap	Medit-Atl	<i>Oenanthe pimpinelloides</i> L.	.	.	+	.	.	I	
H scap	Europ-Caucas	<i>Stachys officinalis</i> (L.) Trevis.	.	.	1	.	.	I	

H scap	Circumbor	Primula vulgaris Huds. ssp. vulgaris	.	.	.	+	.	I
H scap	Circumbor	Clinopodium vulgare L. ssp. vulgare	.	.	.	.	+	I
		others						
G rhiz	Eurimedit	Ruscus aculeatus L.	.	+	+	1	.	III
P N	Eurimedit	Rubus ulmifolius Schott	+	.	+	.	+	III
P caesp	Paleotemp	Crataegus monogyna Jacq.	1	.	.	.	1	II
P lian	Europ-Caucas	Clematis vitalba L.	.	.	.	+	+	II
		sporadic species	7	3	1	.	.	

**Characteristic taxa of subassociation:** *Pulmonaria apennina*, *Sanicula europaea*.

**High frequency taxa:** *Quercus cerris*, *Pulmonaria apennina*, *Buglossoides purpureocaerulea*, *Lonicera caprifolium*.

**Syntaxonomy:** according to floristic composition and structure these forests have been referred to the subassociation pulmonarietosum apenninae of *Physospermo verticillati-Quercetum cerridis* (Aita *et al.*, 1977; Zannotti *et al.*, 1994), belonging to the the alliance *Physospermo verticillati-Quercion cerridis*, which includes the mesophilous turkey oak woods on the upper mesotemperate/lower supratemperate bioclimatic belt of the southern Apennines, as proposed by Biondi *et al.* (2008). This alliance has to be considered as a vicariant of the Balkan syntaxon *Erythronio-Carpinion betuli* (Košir *et al.*, 2013) In particular, these Turkey oak woods are characterized by the presence of several transgressive species from the beech woods, similar to the findings for Lucanian Apennines (Aita *et al.*, 1977), Cilento (Rosati *et al.*, 2005; 2010) and Gargano (Biondi *et al.*, 2008).

**Dynamic:** turkey oak woods are dynamically linked to shrublands dominated by *Spartium junceum* (*Spartium juncei-Cytisetum sessilifolii*) and to mesophilous meadows and pastures.

**Corology:** the dominant component is the European-

Caucasian (21%), followed by the Eurimediterranean (19%). Particularly interesting is the Western Suboceanic component (14%) with species as *Rosa arvensis*, *Cytisus villosus*, *Ilex aquifolium* and the Central-Southern Apennine component (8.5%) with *Festuca exaltata*, *Pulmonaria apennina*, *Teucrium siculum* ssp. *siculum*, *Acer cappadocicum* ssp. *lobelii*, *Luzula sicula* testifying the floristic continuity with the turkey oak woods of Molise (Blasi *et al.*, 2005) and Cilento (Rosati *et al.*, 2005).

**Catenal contact:** in this Apennine's sector Turkey oak woods are in contact with beech woods (*Anemone apenninae-Fagetum*) as a response to morphology (thermal inversion) and substratum variations. At lower altitude and on the warm slopes they are replaced by more thermophilous oak forests with *Q. virgiliana* or *Q. dalechampii*.

#### HOP HORNBEAM FORESTS

*SESLERIO AUTUMNALIS-ACERETUM OBTUSATI* Corbetta & Ubaldi in Corbetta *et al.* 2004 (Tab. 3)

**Distribution:** forests dominated by *Ostrya carpinifolia* were found on northern slopes with high inclination (from 20° to 40°), ranging between 700 and 1100 m a.s.l., in the meso and supratemperate belts on limesto-

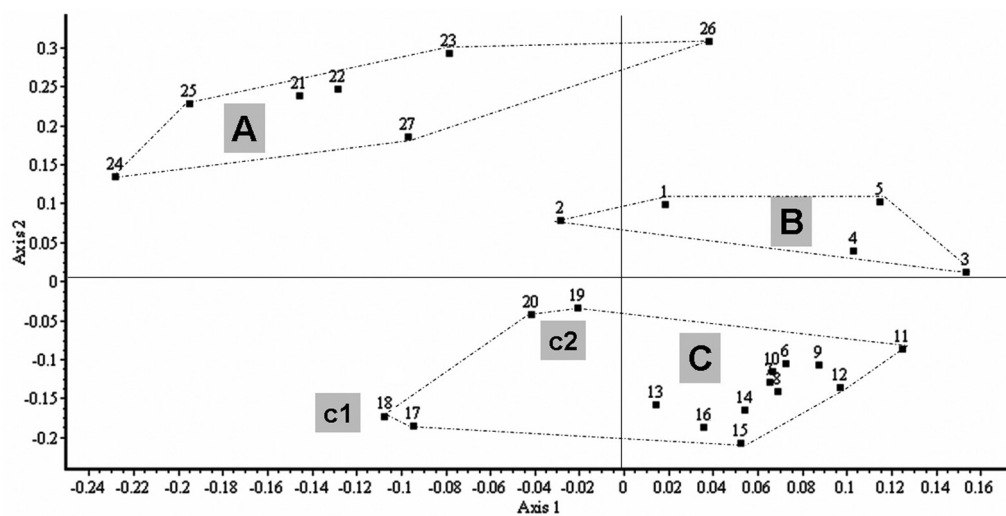


Fig. 5 - Non Metric Multidimensional Scaling (NMDS) of chamaephytic and herbaceous communities carried out on ordinal data using the Goodman-Kruskal lambda algorithm. A: *Potentilla recta-Asphodelus macrocarpus* community; B: dry grasslands (*Anthemido creticae-Stipetum austroitalicae* ass. nova); C: garrigues (*Onosmo lucanae-Lomelosietum crenatae* ass. nova, c1: variant with *Euphorbia spinosa*; c2 variant with *Achnatherum calamagrostis*).

Tab. 3 - *Sesleria autumnalis-Aceretum obtusati* Corbetta & Ubaldi 2004

		Relevé number													
		1	2	3	4	5	6	7	8	9	10	11	12		13
		Altitude (m a.s.l.)												presence	
		1020	1020	970	1014	1110	1099	991	776	800	744	750	700		670
		Aspect													
		NNW	NW	N	N	ENE	N	NE	N	NNE	NE	N	N		N
		Slope (°)													
		20	20	20	30	30	35	30	35	35	40	20	30		20
		Trees height (m)													
		90	70	70	70	95	80	70	80	80	80	80	90		90
		Trees cover (%)													
		10	8	8	15	8	10	10	8	10	8	8	8		8
		Shrubs height (m)													
		70	40	30	30	5	70	40	60	40	20	70	30		40
		Shrubs cover (%)													
		3	3	2	2	1	2	2	3	2	2	1,5	1,5		1,5
		Herb layer cover (%)													
		70	50	80	70	80	80	60	90	70	80	40	40	80	
		Area (m <sup>2</sup> )													
		120	120	150	100	150	100	80	100	100	100	100	100	80	
		species richness													
		32	41	32	37	38	33	30	24	42	37	31	29	25	
		char. and diff. species of <i>Sesleria autumnalis-Aceretum obtusati</i>													
H caesp	SE-Europ	Sesleria autumnalis (Scop.) Schultz												V	
P scap	N-Eurimedit	Quercus cerris L.												V	
G bulb	Orof-C-Europ	Lilium bulbiferum L. ssp. croceum (Chaix) Jan												III	
H ros	S-Europ-Mont	Silene italica (L.) Pers. italica												III	
H scap	SE-Europ	Ptilostemon strictus (Ten.) Greuter												II	
H scap	SE-Europ	Cnidium silaifolium (Jacq.) Simonk. Ssp. silaifolium												II	
G bulb	Medit-Macaron	Aristolochia lutea Desf.												I	
		char. and diff. species of <i>Festuca exaltatae-Ostryenion carpinifoliae</i>													
G rhiz	Endem	Festuca exaltata C. Presl.												III	
H scap	NE-Medit-Mont	Melittis melissophyllum L. ssp. albida Guss.												III	
P scap	Endem	Alnus cordata (Loisel.) Loisel.												II	
Ch rept	C-Europ-Caucas	Vinca minor L.												II	
G rhiz	Endem	Lathyrus jordani (Ten.) Ces., Pass. et Gib.												I	
		char. and diff. species of <i>Carpinion orientalis</i>													
P scap	Pontica	Ostrya carpinifolia Scop.												V	
P scap	Endem	Acer obtusatum W. et K. ssp. neapolitanum (Ten.) Pax												III	
P n	E-Medit-Pont	Emerus majus Mill. s.l.												III	
P scap	Eurimedit	Acer monspessulanum L. ssp. monspessulanum												III	
P caesp	Pont	Carpinus orientalis Mill. ssp. orientalis												II	
P caesp	S-Europ	Laburnum anagyroides Medicus												II	
		char. and diff. species of <i>Quercetalia pubescenti-petraeae</i>													
P scap	S-Europ-S-Siber	Fraxinus ornus L. ssp. ornus												V	
H ros	Eurimedit	Viola alba Besser ssp. dehnardtii (Ten.) W. Becker												IV	
H scap	Endem	Teucrium siculum (Rafn.) Guss. ssp. siculum												IV	
P caesp	Eurimedit	Sorbus domestica L.												III	
H scap	Pont	Buglossoides purpuracaerulea (L.) I.M. Johnst												III	
H scap	W-Europ	Digitalis lutea L. ssp. australis (Ten.) Arcang.												III	
P caesp	Orof-SW-Europ	Cytisophyllum sessilifolium (L.) O. Lang												II	
P caesp	Eurasiat	Pyrus communis L.												II	
H scap	Europ-Caucas	Stachys officinalis (L.) Trevis.												II	
H scap	NE-Medit-Mont	Scutellaria columnae All.												II	
P caesp	Paleotemp	Sorbus torminalis (L.) Crantz												II	
H scap	Circumbor	Clinopodium vulgare L. ssp. vulgare												II	
G rhiz	Eurimedit	Luzula forsteri (Sm.) DC.												II	
G bulb	Eurosib	Platanthera clorantha (Custer) Rchb.												I	
P scap	SE-Europ	Quercus virgiliana Ten.												I	
		char. and diff. species of <i>Fagetalia sylvaticae</i>													
H scap	Europ-Caucas	Primula vulgaris Huds. ssp. vulgaris												IV	
P n	Subatl	Daphne laureola L.												III	
G rhiz	Circumbor	Hepatica nobilis Schreb.												III	
Ch suff	Europ-Caucas	Euphorbia amygdaloides L. ssp. amygdaloides												III	
H scap	S-Medit-Subatl	Viola reichenbachiana Jord. ex Boreau												II	
G rhiz	C-Europ	Campanula trachelium L. ssp. trachelium												II	
G rhiz	Endem	Epipactis meridionalis H. Baumann & R. Lopez												II	
P caesp	Eurimedit	Ilex aquifolium L.												II	
P n	N-Eurimedit	Rubus hirtus Waldst. et Kit.												II	
T scap	N-Medit	Cardamine graeca L.												II	
H scap	Europ-Caucas	Lactuca muralis (L.) Gaertn.												II	
H scap	Europ-Caucas	Hieracium lachenali Gmelin												II	
H scap	Eurosib	Thalictrum aquilegifolium L. ssp. aquilegifolium												I	
H scap	NW-Medit-Mont	Lamium flexuosum Ten.												I	
G rhiz	Eurasiat	Polygonatum multiflorum (L.) All.												I	
H scap	Endem	Pulmonaria apennina Cristof. & Puppi												I	
P scap	C-Europ	Fagus sylvatica L. ssp. sylvatica												I	
G rhiz	Endem	Arum cylindraceum Gasp.												I	
G bulb	W-Stenomedit	Allium pendulinum Ten.												I	
P n	S-Medit-Subatl	Rosa arvensis Huds.												I	
G rhiz	C-Europ	Cardamine bulbifera (L.) Crantz												I	
P scap	Endem	Acer cappadocicum Gled. ssp. lobelii (Ten.) Murray												I	
		char. and diff. species of <i>Quercus Fagetia</i>													
H caesp	Paleotemp	Brachypodium sylvaticum (Huds.) Beauv. ssp. sylvaticum												V	
H rept	Eurosib	Fragaria vesca L. ssp. vesca												V	
P lian	Eurimedit	Hedera helix L. ssp. helix												IV	



H ros	Orof-NE-Medit	Aremonia agrimonioides (L.) DC. ssp. agrimonoides	+	+	+	1	1	1	+	.	.	+	.	+	.	IV
G rhiz	S-Europ-S-Siber	Lathyrus venetus (Mill.) Wohlf.	.	1	+	+	+	+	+	.	.	+	.	.	.	IV
G bulb	NW-Stenomedit	Cyclamen hederifolium Aiton ssp. hederifolium	.	.	.	.	.	2	.	.	.	1	+	+	+	III
G rhiz	Eurimedit	Ruscus aculeatus L.	.	.	.	.	.	.	.	1	+	+	1	2	+	III
G rhiz	SE-Europ	Anemone apennina L. apennina	.	+	.	1	+	1	.	.	.	1	1	.	.	III
G rad	Eurimedit	Tamus communis L.	.	.	+	.	.	2	.	.	.	+	.	.	+	III
P caesp	S-Europ-S-Siber	Cornus mas L.	1	1	1	.	.	1	.	.	.	1	.	.	.	II
H caesp	Europ-Caucas	Festuca heterophylla Lam.	+	.	.	.	1	+	.	+	1	.	.	.	.	II
P lian	S-Europ-S-Siber	Lonicera caprifolium L.	+	.	.	.	.	+	.	.	.	.	.	.	.	II
G rhiz	Subatl	Helleborus foetidus L.	.	.	.	.	.	+	.	+	.	.	1	+	1	II
P caesp	SE-Europ-Pont	Euonymus verrucosus Scop.	.	.	.	.	.	.	.	.	.	.	+	+	.	II
G rhiz	SE-Europ	Symphytum tuberosum L. ssp. angustifolium (A.	.	.	.	.	.	.	.	.	.	.	+	+	.	II
H rept	S-Europ-S-Siber	Astragalus glycyphyllos L.	.	.	.	.	.	.	.	.	.	.	.	.	.	II
P caesp	Europ-Caucas	Corylus avellana L.	3	1	.	.	.	.	.	.	.	.	.	.	.	I
P lian	Eurimedit	Lonicera etrusca Santi	.	.	.	.	.	1	.	.	.	.	.	.	.	I
H scap	Circumbor	Geum urbanum L.	.	.	.	.	.	.	.	.	.	.	.	+	.	I
H scap	Eurosib	Veronica chamaedrys L. ssp. chamaedrys	.	.	.	.	.	.	.	+	.	.	.	.	.	I
others																
P caesp	Paleotemp	Crataegus monogyna Jacq.	.	.	.	.	.	.	+	1	+	+	.	+	+	III
P n	Eurimedit	Rubus ulmifolius Schott	1	.	.	.	1	.	.	.	.	1	+	+	1	III
H scap	Europ-Caucas	Geranium sanguineum L.	1	.	+	.	.	.	.	+	+	.	.	.	+	II
T scap	Subcosmopol	Geranium robertianum L.	.	.	.	.	.	.	.	.	.	.	+	+	+	II
G rhiz	Stenomedit	Asparagus acutifolius L.	.	.	.	.	.	.	.	.	.	.	.	.	+	II
P lian	Europ-Caucas	Clematis vitalba L.	.	.	.	.	.	.	.	.	.	.	1	1	.	II
P caesp	W-C-Medit	Cytisus villosus Pourret	.	.	.	.	.	.	.	1	.	.	.	.	.	II
H rept	Europ-Caucas	Ajuga reptans L.	.	.	.	.	.	.	.	.	.	.	.	.	.	II
P n	Paleotemp	Rosa canina L.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Laserpitium garganicum (Ten.) Bertol. ssp. siculum (Sprengel) Pign.			+	.	.	.	.	.	.	.	.	.	.	.	.	I
P caesp	Stenomedit	Quercus ilex L. (arb.)	.	.	.	.	.	.	.	.	.	.	.	+	.	I
sporadic species			2	.	.	.	.	.	.	.	.	.	.	.	.	

ne substrata and shallow soils.

**Structure and synecology:** these communities result mainly by secondary colonization after forest exploitation of mesophilous oak; the coppices of hop hornbeam are made up of young trees (10-20 years) and show high levels of tree and shrub layer coverage. *Ostrya carpinifolia*, *Quercus cerris*, *Fraxinus ornus* ssp. *ornus*, *Acer obtusatum* ssp. *neapolitanum* and rarely *Alnus cordata* are present in the canopy. The shrub layer covers between 5% and 70% and is composed of *Cytisophyllum sessilifolium*, *Cornus mas*, *Pyrus pyra-ster*, *Daphne laureola*, *Emerus majus*, *Hedera helix*. In the herbaceous layer there are common dense carpets of *Sesleria autumnalis*. Hop hornbeam woods found in the Maddalena Mountains present two different features: the first one has an edapho-mesophilous aspect growing at higher altitude (900-1100 m a.s.l.) characterized by *Alnus cordata* and *Ilex aquifolium* together with several species of *Fagetalia sylvaticae* (rel. 2-4, 6). This community shows some affinities with the warm-humid deciduous mixed woods with *Ostrya carpinifolia*, of the Tyrrhenian geographical sectors of Campania, Basilicata and Calabria (Bonin, 1980; Majorca & Spampinato, 1999; Blasi *et al.*, 2006). The second one is a more termoxerophilous facies found at lower altitudes (600-800 m a.s.l.) and is characterized by the presence of *Carpinus orientalis* and *Acer monspessulanum* ssp. *monspessulanum* (rel. 8-12).

**Characteristic taxa of association:** *Sesleria autumnalis*, *Quercus cerris*, *Lilium bulbiferum* ssp. *croceum*, *Silene italica* ssp. *italica*, *Ptilostemon strictus*, *Cnidium silaifolium*, *Aristolochia lutea*.

**High frequency taxa:** *Sesleria autumnalis*, *Quercus*

*cerris*, *Ostrya carpinifolia*, *Brachypodium sylvaticum*, *Fraxinus ornus* ssp. *ornus*, *Fragraria vesca*.

**Syntaxonomy:** the mixed forests dominated by *Ostrya carpinifolia* have been referred to *Seslerio autumnalis-Aceretum obtusati*, an association described in the Cilento region (Corbetta *et al.*, 2004) and attributed to *Festuco exaltatae-Ostryenion carpinifoliae*, a Southern Apennine suballiance of *Carpinion orientalis* (Blasi *et al.*, 2006).

**Dynamic and catenal contact:** *Seslerio autumnalis-Aceretum obtusati* was found in catenal contact with mesophilous Turkey oak forests of *Physospermo verticillati-Quercetum cerridis*, and rarely with *Anemone apenninae-Fagetum sylvaticae*. On the northern slopes steep and rocky the *Seslerio autumnalis-Aceretum obtusati* communities could replace the mixed thermophilous oaks woods of *Aceri neapolitani-Quercetum virgiliana* or represent frequent post-cutting recolonization stages.

#### THERMOPHILOUS FORESTS DOMINATED BY VIRGILIAN OAK AND NEAPOLITAN MAPLE

91AA\* Eastern white oak woods

*ACERI NEAPOLITANI-QUERCETUM VIRGILIA-NAE* ass. nova hoc loco (holotypus rel. 1, Tab. 4)

**Distribution:** this thermophilous oak wood is widely distributed on the reliefs of Vallo di Diano, Val d'Agri and Lucanian Apennines at altitudes between 750 and 1100m. It is localized on carbonatic substrata, along rocky and steep slopes with mainly southwestern aspects in supra and mesomediterranean belts.

Tab. 4 - *Aceri neapolitani-Quercetum virgiliana* ass.nova

			Relevè number	1	2	3	4	5	6		
			Altitude (m a.s.l.)	1020	750	766	950	700	800		
			Aspect	SSW	SSE	ESE	SSW	S	SW		
			Slope (°)	30	10	30	10	30	30	presence	
			Trees height (m)	60	70	60	80	70	70		
			Trees cover (%)	8	15	10	9	8	8		
			Shrubs height (m)	40	30	50	30	40	40		
			Shrubs cover (%)	2	-	2	2	2	2		
			Herb layer cover (%)	50	60	40	40	50	50		
			Area (m <sup>2</sup> )	300	300	100	200	150	100		
			species richness	33	32	42	24	36	38		
char. and diff. species of <i>Aceri neapolitani-Quercetum virgiliana</i> ass.nova											
P scap	SE-Europ	<i>Quercus virgiliana</i> (Ten.) Ten.		3	3	4	4	4	4		V
		<i>Acer obtusatum</i> W. et K. ssp. <i>neapolitanum</i> (Ten.)									
P scap	Endem	Pax		2	2	3	1	2	3	V	
H caesp	Medit-Turan	<i>Silene coronaria</i> (L.) Clairv.		+		+	.	.	+	III	
G rhiz	Eurimedit	<i>Limodorum abortivum</i> (L.) Sw.		+	+	+	.	.	.	III	
Ch suff	Europ-S-Siber	<i>Dictamnus albus</i> L.		+	.	.	+	.	.	II	
char. and diff. species of <i>Lauro nobili-Quercenion pubescentis</i>											
G rhiz	Stenomedit	<i>Asparagus acutifolius</i> L.		+	+	.	.	+	+	V	
G rhiz	Eurimedit	<i>Ruscus aculeatus</i> L.		.	.	+	.	1	1	III	
P N	Eurimedit	<i>Pistacia terebinthus</i> L. ssp. <i>terebinthus</i>		.	.	+	.	+	+	III	
char. and diff. species of <i>Carpinion orientalis</i>											
P N	E-Medit-Pont	<i>Emerus majus</i> Mill. ssp. <i>emeroides</i> (Boiss. & Spruner) Soldano & Conti		.	1	1	1	1	1	V	
P caesp	Pont	<i>Carpinus orientalis</i> Mill. ssp. <i>orientalis</i>		.	1		+	+	1	IV	
P caesp	Circumbor	<i>Ostrya carpinifolia</i> Scop.		+	1	1	.	.	1	IV	
P caesp	Eurimedit	<i>Colutea arborescens</i> L.		+	.	.	.	+	+	III	
P scap	Eurimedit	<i>Acer monspessulanum</i> L. ssp. <i>monspessulanum</i>		.	.	1	.	1	1	III	
H caesp	SE-Europ	<i>Sesleria autumnalis</i> (Scop.) Schultz		+	.	+	.	.	.	II	
char. and diff. species of <i>Quercetalia pubescenti-petrae</i>											
P scap	S-Eur-S-Siber	<i>Fraxinus ornus</i> L. ssp. <i>ornus</i>		4	3	4	1	3	3	V	
H scap	Pont	<i>Buglossoides purpureoaeerulea</i> (L.) I.M. Johnst		+	+	+	+	+	+	V	
H ros	Eurimedit	<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker		+	+	1	1	+	+	V	
P caesp	Eurasiat	<i>Pyrus communis</i> L.		2	1	.	1	1	1	V	
P caesp	Paleotemp	<i>Sorbus torminalis</i> (L.) Crantz		1	.	+	.	+	+	IV	
H scap	Medit-Atl	<i>Oenanthe pimpinelloides</i> L.		.	+	+	.	+	+	IV	
G rhiz	Subatl	<i>Helleborus foetidus</i> L.		+			+	+	+	IV	
P caesp	S-Eur-S-Siber	<i>Cornus mas</i> L.		.	+	1	.	1	1	IV	
P caesp	Orof-SW-Europ	<i>Cytisophyllum sessilifolius</i> (L.) O. Lang		.	+	+	.	+	+	IV	
G bulb	Orof-C-Europ	<i>Lilium bulbiferum</i> L. ssp. <i>croceum</i> (Chaix) Jan		.	+	+	.	+	+	IV	
P caesp	Eurimedit	<i>Sorbus domestica</i> L.		1	1	.	1	.	.	III	
P scap	N-Eurimedit	<i>Quercus cerris</i> L.		.	1	1	.	.	.	II	
H scap	Circumbor	<i>Clinopodium vulgare</i> L. ssp. <i>vulgare</i>		.	+	.	.	+	.	II	
char. and diff. species of <i>Quercro-Fagetia</i>											
G bulb	NW-Stenomedit	<i>Cyclamen hederifolium</i> Aiton ssp. <i>hederifolium</i>		+	+	.	1	1	1	V	
		<i>Brachypodium sylvaticum</i> (Huds.) Beauv. ssp. <i>sylvaticum</i>		.	+	1	1	+	+	V	
H caesp	Paleotemp			.	+	1	1	+	+	V	
G rhiz	S-Eur-S-Siber	<i>Lathyrus venetus</i> (Mill.) Wohlf.		+	.	.	.	+	+	III	
G rhiz	Eurimedit	<i>Cephalanthera damasonium</i> (Mill.) Druce		.	.	+	.	+	+	III	
H ros	Orof-NE-Medit	<i>Aremonia agrimonoides</i> (L.) DC. ssp. <i>agrimonoides</i>		.	+	.	.	+	+	III	
G bulb	Paleotemp	<i>Platanthera bifolia</i> (L.) Rchb.		.	.	1	.	+	+	III	
P lian	Eurimedit	<i>Hedera helix</i> L. ssp. <i>helix</i>		.	.	.	.	.	+	I	
P scap	Europ-Caucas	<i>Acer campestre</i> L.		.	.	.	.	1	.	I	
others											
P caesp	Paleotemp	<i>Crataegus monogyna</i> Jacq.		+	.	1	1	1	1	V	
Ch suff	Eurimedit	<i>Teucrium chamaedrys</i> L. ssp. <i>chamaedrys</i>		1	.	1	.	1	1	IV	
H scap	Stenomedit	<i>Elaeoselinum asclepium</i> (L.) Bertol. ssp. <i>asclepium</i>		+	.	+	.	+	+	IV	
H scap	Europ-Caucas	<i>Geranium sanguineum</i> L.		1	.	+	.	+	+	IV	
H caesp	Eurasiat	<i>Anthoxanthum odoratum</i> L. ssp. <i>odoratum</i>		.	.	+	1	+	+	IV	
P caesp	Circumbor	<i>Juniperus communis</i> L.		+	+	.	+	.	.	III	
P N	Eurimedit	<i>Rubus ulmifolius</i> Schott		2	.	.	.	+	+	III	
		<i>Acinos alpinus</i> (L.) Moench meridionalis (Nyman)		.	.	.	.	.	.		
Ch suff	Orof-S-Europ	P.W.Ball		+	.	+	+	.	.	III	
H bienn	Paleotemp	<i>Centaurium erythraea</i> Rafn. ssp. <i>erythraea</i>		+	.	+	+	.	.	III	

T scap	Eurimedit	Cynosurus echinatus L.	1	.	.	1	.	.	III
H scap	Subcosmopol	Hypericum perforatum L.	1	.	.	1	.	.	III
G bulb	Europ-Caucas	Orchis morio L.	1	.	.	1	.	.	III
G bulb	Eurimedit	Orchis simia Lam.	1	.	.	1	.	.	III
P lian	Europ-Caucas	Clematis vitalba L.	.	+	.	.	+	+	III
		Origanum vulgare L. ssp. viridulum (Martin-Dolos)							
H scap	Eurasiat	Nyman	.	+	.	.	+	+	III
H scap	Endem	Linaria purpurea (L.) Mill.	.	+	.	.	+	+	III
P caesp	Eurimedit	Spartium junceum L.	+	.	+	.	.	.	II
Ch suff	Eurimedit	Thymus longicaulis C. Presl ssp. longicaulis	1	.	.	1	.	.	II
H scap	Subcosmopol	Silene vulgaris (Moench) Garke ssp. vulgaris	+	+	.	.	.	.	II
H scap	Subcosmopol	Bellis perennis L.	.	.	+	1	.	.	II
sporadic species			8	2	.	1	.	.	

**Structure and synecology:** physiognomy and structure are characterized by young and poorly shaded coppices with low sized trees; understorey is characterized by heliophilous shrubs and herbaceous species such as *Emerus majus* ssp. *emeroides*, *Colutea arborescens*, *Elaeoselinum asclepium* ssp. *asclepium*. The canopy layer is dominated by *Quercus virgiliana* and *Acer obtusatum* ssp. *neapolitanum*. In the Basilicata region *Quercus virgiliana* shows considerable ecological amplitude: ranging from 500 to 1200 m, from supramediterranean to sub-humid mesotemperate bioclimate belts. On the contrary, along the Tyrrhenian coast *Quercus virgiliana* can be found around sea level, where high atmospheric humidity and favourable morphological conditions exist (Caneva *et al.*, 1994). It is present in the deciduous forests with *Carpinus orientalis*, *Quercus frainetto*, *Quercus congesta*, *Quercus cerris*, *Ostrya carpinifolia*, *Acer* sp. pl. and could be considered indifferent to pH. The potential distribution of *Quercus virgiliana* can be reconstructed by the presence of residual formations and isolated trees, sometimes monumental, in the agricultural landscape, preserved for nut production used as food for animals. Neapolitan maple is an endemic species of Central Southern Apennine forests found in moderately thermophilous supramediterranean and submontane communities, developed on well-drained soils, from neutral to moderately acidophilous, as pointed out also for other territories (Mazzoleni & Ricciardi, 1995; Maiorca & Spampinato, 1999; Brullo *et al.*, 2001; Corbetta *et al.*, 2004; Biondi *et al.*, 2008). Its taxonomic status is still quite debated and in some recent check-lists it was included in *Acer opalus* ssp. *obtusatum* (e.g. Conti *et al.* 2005). As a consequence, contrasting taxonomic evaluation of “*Acer obtusatum*” group lead to variation in syntaxonomy nomenclature of these forests produced by several authors (e.g. Mazzoleni & Ricciardi, 1995; Corbetta *et al.*, 2004). However our data, confirmed by exsiccata stored in HLUC, indicate that the populations from Maddalena Mountains have to be referred to *Acer obtusatum* ssp. *neapolitanum*.

**Characteristic taxa of association:** *Quercus virgiliana*, *Acer obtusatum* ssp. *neapolitanum*, *Limodorum abortivum*, *Silene coronaria*, *Dictamnus albus*.

**High frequency taxa:** *Quercus virgiliana*, *Acer obtu-*

*atum* ssp. *neapolitanum*, *Fraxinus ornus* ssp. *ornus*, *Asparagus acutifolius*, *Emerus majus* ssp. *emeroides*, *Buglossoides purpureo-caerulea*, *Viola alba* ssp. *dehnhardtii*.

**Syntaxonomy:** this community is described as the new association *Aceri neapolitani-Quercetum virgilianae* (holotypus Table 4, ril. 1) belonging to *Lauro nobilis-Quercenion pubescentis* (*Carpinion orientalis*), a syntaxon including the Apennines thermophilous mixed forests with white oaks (Blasi *et al.*, 2004). Chorology and floristic composition differentiate the association *Aceri-Quercetum virgilianae* respect to the *Quercus virgiliana* forest communities already described for the neighbouring territories (e.g. Rosati *et al.*, 2010). In particular, the absence of evergreen mediterranean species points out the difference with the coenoses reported for Gargano by Biondi *et al.* (2004), and for northern Calabria by Maiorca & Spampinato (1999).

**Catenal and serial contacts:** *Aceri neapolitani-Quercetum virgilianae* represents the zonal vegetation of the supramediterranean belt on calcareous substrates. It is replaced by *Lathyro digitati-Quercetum cerridis* or *Physospermo-Quercetum cerridis* on sub-acid substrates and by forests with *Ostrya carpinifolia* dominance in the northern calcareous slopes. It is also dynamically related to thermophilous shrubs of *Roso squarrosae-Rubetum ulmifoliae* ass. nova (tab. 9) described below.

#### OROXEROPHILOUS FORESTS DOMINATED BY DALECHAMP'S OAK

91AA\* Eastern white oak woods

*ROSO SPINOSISSIMAE-QUERCETUM DALECHAMPPII* ass. nova hoc loco (holotypus 1, rél. Tab. 5)

**Distribution:** extra-zonal, fragmented forests dominated by *Quercus dalechampii*, located above 900 m a.s.l., between the actual upper limit of mesophilous woods due to deforestation processes and the secondary grassland widely spread on the summit of the reliefs.

**Structure and synecology:** as pointed out for the other *Quercus dalechampii*-dominated associations in South and Central Apennines (Biondi *et al.*, 2002; Biondi *et*

Tab. 5 - *Rosa spinosissima-Quercetum dalechampii* ass.nova

		Relevè number	2	1*	4	3	5	6	7		
		Altitude (m a.s.l.)	1200	1150	1200	1080	1200	1300	1200		
		Aspect	E	NNE	E	NE	ESE	E	NW		
		Slope (°)	10	5	10	10	25	15	20		
		Trees cover (%)	60	50	60	40	30	30	20	presence	
		Trees height (m)	9	8	7	7	7	9	8		
		Shrubs cover (%)	70	60	70	50	60	60	50		
		Shrubs height (m)	1	1	1	1	2	1	2		
		Herb layer cover (%)	90	80	80	70	80	80	60		
		Rocks (%)	10	30	10	30	20	10	30		
		Area (m <sup>2</sup> )	100	150	100	80	70	80	50		
		species richness	30	36	33	26	28	23	23		
char. and diff. species of <i>Rosa spinosissima-Quercetum dalechampii</i>											
P caesp	SE-Europ	<i>Quercus dalechampii</i> Ten.	4	3	1	2	2	3	4		V
P N	Eurasiat	<i>Rosa spinosissima</i> L.	2	2	2	1	+	3	.	V	
P caesp	Eurasiat	<i>Pyrus pyrastrer</i> Burgsd.	.	1	+	+	1	1	+	V	
P caesp	SE-Eur-Pont	<i>Sorbus aria</i> (L.) Crantz ssp. cretica (Lindl.) Homboe	+	1	.	.	.	1	1	III	
H caesp	Endem	<i>Luzula sicula</i> Parl.	+	+	.	.	.	1	+	III	
G rhiz	Pont	<i>Lathyrus digitatus</i> (M.Bieb.) Fiori	.	.	.	.	+	.	1	II	
char. and diff. species of <i>Cytiso sessilifolii-Quercenion pubescentis</i> and upper syntaxa											
<i>Helianthemum nummularium</i> (L.) Mill. ssp. obscurum											
Ch suff	Europ	(Celak) Holub	1	+	+	1	1	+	+	V	
Ch suff	Subendem	<i>Cytisus spinescens</i> C. Presl	.	+	1	1	1	+	+	V	
P scap	N-Eurimedit	<i>Quercus cerris</i> L.	1	1	.	+	2	.	.	III	
H scap	E-Medit	<i>Polygala major</i> Jacq.	1	.	.	+	+	+	.	III	
G rhiz	Subatl	<i>Helleborus foetidus</i> L.	.	+	.	.	1	+	+	III	
H caesp	Subatl	<i>Brachypodium rupestre</i> (Host) Roem. & Shult.	.	.	1	.	2	1	1	III	
Ch suff	Europ	<i>Cytisus hirsutus</i> L.	+	.	+	.	+	.	.	III	
Ch suff	Eurimedit	<i>Teucrium chamaedrys</i> L. ssp. chamaedrys	.	.	+	+	+	.	.	II	
H caesp	Paleotemp	<i>Brachypodium sylvaticum</i> (Huds.) Beauv. ssp. sylvaticum	+	.	.	3	.	.	.	II	
P caesp	S-Eur-S-Siber	<i>Cornus mas</i> L.	1	2	.	.	.	.	.	II	
P lian	Eurimedit	<i>Hedera helix</i> L. ssp. helix	+	1	.	.	.	.	.	II	
G rhiz	SE-Europ	<i>Anemone apennina</i> L. ssp. apennina	+	.	.	.	.	.	.	I	
H ros	Eurimedit	<i>Potentilla micrantha</i> Ramond ex DC.	.	+	.	.	.	.	.	I	
char. and diff. species of <i>Prunetalia spinosae, Rhamno-Prunetea</i>											
P caesp	Europ-Caucas	<i>Prunus spinosa</i> L. ssp. spinosa	1	1	1	+	+	+	.	V	
P caesp	Paleotemp	<i>Crataegus monogyna</i> Jacq.	1	1	.	+	1	1	1	V	
P caesp	Circumbor	<i>Juniperus communis</i> L.	1	+	1	2	.	.	.	III	
others											
H scap	NE-Medit	<i>Eryngium amethystinum</i> L.	+	1	1	1	+	1	+	V	
Ch suff	Eurimedit	<i>Thymus longicaulis</i> C. Presl ssp. longicaulis	2	1	+	1	1	1	1	V	
H scap	Subcosmopol	<i>Sanguisorba minor</i> Scop.	+	+	+	+	1	1	+	V	
H caesp	Endem	<i>Phleum hirsutum</i> Honk. ssp. ambiguum (Ten.) Tzvelv	1	1	1	1	1	1	1	V	
H caesp	Eurasiat	<i>Anthoxanthum odoratum</i> L. ssp. odoratum	2	1	1	1	1	2	+	V	
T caesp	C-Europ	<i>Rhinanthus alectorolophus</i> (Scop.) Pollich	+	+	1	+	+	1	.	V	
<i>Helianthemum oelandicum</i> (L.) Dum. Cours.ssp. incanum											
Ch suff	Orof-S-Europ	(Willk.) G.Lopez	1	+	+	1	1	.	1	V	
H scap	Eurimedit	<i>Galium lucidum</i> All.	.	+	+	+	+	+	+	V	
H caesp	Paleotemp	<i>Bromus erectus</i> Huds. ssp. erectus	+	1	1	.	1	1	1	V	
G rhiz	Eurimedit	<i>Asphodelus macrocarpus</i> Parl. ssp. macrocarpus	+	+	+	+	.	2	.	IV	
Ch suff	Medit-Mont	<i>Anthyllis montana</i> L. subsp. atropurpurea (Vuk.) Pignatti	1	1	+	+	+	.	.	IV	
T caesp	S-Europ-Pont	<i>Xeranthemum inapertum</i> (L.) Mill.	.	+	+	+	.	1	1	IV	
Ch succ	Stenomedit	<i>Sedum amplexicaule</i> ssp. tenuifolium	1	2	.	2	+	.	1	IV	
Ch suff	SW-Europ	<i>Helianthemum apenninum</i> (L.) Miller ssp. apenninum	+	.	+	+	+	.	1	IV	
Ch suff	Medit-Mont	<i>Dianthus sylvestris</i> ssp. longicaulis	.	+	1	.	1	.	1	III	
H scap	C-Eur-S-Siber	<i>Filipendula vulgaris</i> Moench	+	+	+	.	.	+	.	III	
H caesp	Subcosmopol	<i>Dactylis glomerata</i> L.	+	+	+	+	.	.	.	III	
H scap	Eurasiat	<i>Origanum vulgare</i> L. ssp. viridulum (Martin-Dolos) Nyman	.	1	+	.	+	.	.	III	
H scap	Endem	<i>Crepis lacera</i> Ten.	.	.	+	.	1	.	+	III	
H scap	SW-Europ	<i>Cephalaria leucantha</i> (L.) Schrader	.	+	+	.	.	.	.	II	
H scap	Stenomedit	<i>Elaeostelinum asclepium</i> (L.) Bertol. ssp. asclepium	+	+	.	.	.	.	.	II	
sporadic species											
			.	2	5	.	.	.	.		

al., 2004; Biondi *et al.*, 2010), the structural analysis highlights a tree layer 5-7 m high and a relevant shrubby component consisting of several heliophilous species such as *Juniperus communis*, *Chamaecytisus hirsutus*, *Sorbus aria* ssp. *cretica*, *Prunus spinosa* ssp. *spinosa* and *Rosa spinosissima*. The latter species is a typical component of oro-mediterranean shrublands and grasslands of the summit of mountain ridges, recently recorded also for being found in the Cilento National Park (Lattanzi *et al.*, 2012). A common feature for these stands is also the presence of a group of xerophilous species shared with the contiguous secondary

pastures and garrigues. Eurasian and Eurimediterranean species are the dominant in the chorological spectrum.

**Characteristic taxa of association:** *Quercus dalechampii*, *Rosa spinosissima*, *Sorbus aria* ssp. *cretica*, *Luzula sicula*.

**High frequency taxa:** *Quercus dalechampii*, *Helianthemum nummularium* ssp. *obscurum*, *Eryngium amethystinum*, *Thymus longicaulis* ssp. *longicaulis*, *Sanguisorba minor*, *Phleum hirsutum* ssp. *ambiguum*, *Anthoxanthum odoratum* ssp. *odoratum*.

**Syntaxonomy:** this community has been referred to a

new association *Roso spinosissimae-Quercetum dalechampii* (holotypus Tab. 5, rel. 1). The association is part of the *Cytiso sessilifolii-Quercenion pubescentis* sub-alliance of *Carpinion orientalis*, describing the white oak dominated forests in the continental areas on the Apennine mountains (Blasi *et al.*, 2004).

**Catenal and serial contacts:** secondary edaphoclimatic community, influenced by edaphic drought on windy slopes and rocky edges; it could be considered as an indicator of gradual recovery of the deciduous forest starting from secondary xerophilous pastures (*Phleo ambiguus-Bromion erecti*, *Anthemido cretici-Stipetum austroitalicae*) along summit and ridges slopes. Catenal contacts are with mesophilous woods (*Anemone apenninae-Fagetum sylvaticae*, *Physospermo verticillati-Quercetum cerridis*).

**Remarks:** *Quercus dalechampii* is morphologically similar to *Quercus pubescens*, rare but widely distributed in the Southern Italy (Biondi *et al.*, 2004, Brullo *et al.*, 2001), in Sicily (Brullo *et al.*, 1999) and in Sardinia (Mossa *et al.*, 1998). It is characterized by a considerable ecological plasticity and by pioneer behaviour, growing mainly on sub-acid substrates (schists, sandstones, marly limestones) and on soils poor in organic matter. In Basilicata it was found along the Tyrrhenian coast (Lucchese *et al.*, 2004) and in Lucanian Apennines up to 1400 m, where it frequently fringes beech and turkey oak woods, mainly on ridges and dry slopes (Fascetti & Lapenna, 2006).

#### BROAD LEAVED RAVINE FORESTS WITH LINDEN AND LOBELIUS MAPLE

9180\* *Tilio-Acerion* forests of slopes, screes and ravines

ARO LUCANI-ACERETUM LOBELII Paura & Cutini 2006 (Tab. 6)

**Distribution:** mesophilous forests with prevalence of Lobelius maple and linden, founded between 800 and 1300 m, in the meso and supratemperate belts, at the foot of slopes and crevices on deep, well drained, eutrophic soils resulting from debris accumulation of organic matter.

**Structure and synecology:** the tree layer is formed by mesophilous deciduous species as *Tilia platyphyllos* ssp. *platyphyllos*, *Acer pseudoplatanus*, *Acer obtusatum* ssp. *neapolitanum*, *Acer cappadocicum* ssp. *lobelii*, *Ulmus glabra* and *Fagus sylvatica* ssp. *sylvatica*. The understorey shows a floristic composition that reflects the marked mesohygrophilic characteristic of the sites with several typical beech wood species (*Galium odoratum*, *Lamium flexuosum*, *Actaea spicata*, *Viola reichenbachiana*, *Polystichum aculeatum*, *Polygonatum multiflorum*, *Neottia nidus-avis*, etc.).

**Characteristic taxa of association:** *Acer cappadoci-*

*cum* ssp. *lobelii*, *Arum cylindraceum*, *Ilex aquifolium* and *Lamium flexuosum*.

**High frequency taxa:** *Acer cappadocicum* ssp. *lobelii*, *Tilia platyphyllos* ssp. *platyphyllos*, *Ulmus glabra*, *Actaea spicata*, *Lamium flexuosum*.

**Syntaxonomy:** we referred this community to *Aro lucani-Aceretum lobelii*, an association described for the Matese Mountains in Molise region (Paura & Cutini, 2006) as they share a similar specific composition with a significant endemic (7.4%) and Illyrian (29.2%) component. These forests have been attributed to *Tilio platyphylli-Acerion pseudoplatani*, an alliance at West-central European distribution, which describes the mesophilous deciduous mixed forests typical of wet canyons and gorges of the hilly and mountainous belt (Mucina *et al.*, 1993). In Italy, the alliance is well documented in the Alps and Apennines where it is reported for the Marche (Taffetani, 2000, Biondi *et al.*, 2002; Allegrezza, 2003; Angiolini *et al.*, 2005), Tuscany (Angiolini *et al.*, 2005), Abruzzo (Pirone, 1998; Pirone *et al.*, 2005), Molise (Paura & Cutini, 2006). According to Biondi *et al.*, 2008, these woods are included in *Ostryo carpiniifoliae-Tilienion platyphylli* (Košir *et al.*, 2008), a syntaxon with Apennine-Balkan distribution. Therefore the woods of ravines founded in the Lucanian Apennines show marked differences with the communities of *Lauro nobilis-Tilion platyphylli* described for the Gargano (Biondi *et al.*, 2008), due to the location in the submontane and montane belts and the consequent absence of evergreen Mediterranean species.

**Catenal contacts:** on the southern slopes it is in contact with turkey oak forests (*Physospermo verticillati-Quercetum cerridis*) and with Virgilian oak woods (*Quercetum virgiliana-Aceretum neapolitani*); along the northern slopes they are surrounded by beech woods (*Anemone apenninae-Fagetum sylvaticae*).

#### ASPEN FORESTS

GERANIO VERSICOLORIS-POPULETUM TREMULAE ass. nova hoc loco (holotypus rél. 1, Tab. 7)

**Distribution:** stands of limited extension of *Populus tremula* are localized above 700 m in the mesotemperate humid and sub-humid belt, mainly within the beech woods of Val d'Agri, Lucanian Apennines and in the neighbouring Cilento mountains.

**Structure and synecology:** the tree layer is dominated by *Populus tremula* with *Acer obtusatum* ssp. *neapolitanum*. In the shrub layer, mesophilous and pioneer species (e.g. *Rubus hirtus*, *Daphne laureola*, *Corylus avellana*) are common as well as species that are frequently dominant also in the forest mantles (*Rosa arvensis*, *R. agrestis*, *Rubus canescens*, *Cytisophyllum sessilifolius*). The understorey is characterized by spe-

Tab. 6 - *Aro lucani-Aceretum lobelii* Paura & Cutini 2006

			1	2	3	
			1000	990	995	
			N	NNE	N	
		Relevè number				
		Altitude (m a.s.l.)				
		Aspect				
		Slope (°)	25	25	35	
		Trees cover (%)	95	100	95	presence
		Trees height (m)	25	20	18	
		Shrubs cover (%)	60	50	40	
		Shrubs height (m)	1,5	2	1,5	
		Herb layer cover (%)	30	50	40	
		Rocks (%)	10	30	45	
		Area (m <sup>2</sup> )	200	200	200	
		species richness	27	25	34	
char. and diff. species of <i>Aro lucani-Aceretum lobelii</i>						
P scap	Endem	<i>Acer cappadocicum</i> Gled. ssp. <i>lobelii</i> (Ten.) Murray	4	3	3	V
H scap	NW-Medit-Mont	<i>Lamium flexuosum</i> Ten.	1	1	1	V
G rhiz	Endem	<i>Arum cylindraceum</i> Gasparr.	+	+	.	IV
P caesp	Submedit-Subatl	<i>Ilex aquifolium</i> L.	.	3	3	IV
char. and diff. sp. of <i>Ostrya carpinifoliae-Tilenion platyphylli</i> and <i>Tilio platyphylli-Acerion pseudoplatani</i>						
P scap	Europ-Caucas	<i>Tilia platyphyllos</i> Scop. ssp. <i>platyphyllos</i>	1	1	1	V
P scap	Europ-Caucas	<i>Ulmus glabra</i> Hudson	+	+	1	V
G rhiz	Eurasiat	<i>Actaea spicata</i> (L.) Moench	+	+	+	V
G rhiz	Eurasiat	<i>Polystichum aculeatum</i> (L.) Roth	+	1	.	IV
P scap	Europ-Caucas	<i>Acer pseudoplatanus</i> L.	1	.	.	II
G rhiz	Europ-Caucas	<i>Mercurialis perennis</i> L.	.	+	.	II
char. and diff. species of <i>Fagetalia sylvaticae</i>						
H scap	S-Medit-Subatl	<i>Viola reichenbachiana</i> Jord. Ex Boreau	3	+	+	V
G rhiz	C-Europ	<i>Cardamine bulbifera</i> (L.) Crantz	2	+	.	IV
H ros	Orof-NE-Medit	<i>Aremonia agrimonoides</i> (L.) DC. ssp. <i>agrimonoides</i>	1	+	.	IV
P scap	C-Europ	<i>Fagus sylvatica</i> L. ssp. <i>sylvatica</i>	1	1	.	IV
G rhiz	Europ-Caucas	<i>Galium odoratum</i> (L.) Scop.	.	1	1	IV
P caesp	Europ-Caucas	<i>Corylus avellana</i> L.	.	3	2	IV
P scap	C-Europ-Caucas	<i>Carpinus betulus</i> L.	1	2	.	IV
H scap	Europ-Caucas	<i>Lactuca muralis</i> (L.) Gaertn.	.	+	+	IV
P n	S-Medit-Subatl	<i>Rosa arvensis</i> Huds.	1	.	+	IV
P n	N-Eurimedit	<i>Rubus hirtus</i> Waldst. & Kit.	2	.	1	IV
H scap	Orof-Medit	<i>Calamintha grandiflora</i> (L.) Moench	2	.	+	IV
T scap	N-Medit	<i>Cardamine graeca</i> L.	+	.	+	IV
T scap	Eurasiat	<i>Chaerophyllum temulum</i> L.	+	.	+	IV
G rhiz	Paleotemp	<i>Epipactis helleborine</i> (L.) Crantz (s.l.)	+	.	+	IV
G rhiz	Eurasiat	<i>Neottia nidus-avis</i> (L.) Rich.	+	.	+	IV
H scap	Endem	<i>Pulmonaria apennina</i> Cristof. & Puppi	1	.	+	IV
P n	Subatl	<i>Daphne laureola</i> L.	1	.	.	II
H caesp	Paleotemp	<i>Melica uniflora</i> Retz.	1	.	.	II
G rhiz	SE-Europ	<i>Anemone apennina</i> L. ssp. <i>apennina</i>	.	.	+	II
H scap	Paleotemp	<i>Campanula trachelium</i> L. ssp. <i>trachelium</i>	.	.	+	II
G rhiz	NE-Medit-Mont	<i>Geranium versicolor</i> L.	.	.	1	II
G rhiz	Eurasiat	<i>Polygonatum multiflorum</i> (L.) All.	.	.	+	II
G rhiz	S-Europ-S-Siber	<i>Lathyrus venetus</i> (Mill.) Wölhf.	.	.	+	II
G bulb	Eurimedit	<i>Loncomelos pyrenaicus</i> ssp. <i>pyrenaicus</i>	.	.	+	II
char. and diff. species of <i>Quercus-Fagetea</i>						
H ros	Eurimedit	<i>Viola odorata</i> L.	+	1	+	V
P scap	N-Eurimedit	<i>Quercus cerris</i> L.	+	1	+	V
H caesp	Paleotemp	<i>Brachypodium sylvaticum</i> (Huds.) Beauv. ssp. <i>sylvaticum</i>	3	.	+	IV
G rad	Eurimedit	<i>Tamus communis</i> L.	+	.	1	IV
H scap	SE-Europ	<i>Ptilostemon strictus</i> (Ten.) Greuter	.	+	+	IV
P caesp	S-Europ-S-Siber	<i>Cornus mas</i> L.	.	2	1	IV
P caesp	SE-Europ-Pont	<i>Euonymus verrucosus</i> Scop.	.	1	1	IV
P lian	Eurimedit	<i>Hedera helix</i> L. ssp. <i>helix</i>	.	1	+	IV
P lian	S-Europ-S-Siber	<i>Lonicera caprifolium</i> L.	.	1	+	IV
others						
G rhiz	Eurimedit	<i>Ruscus aculeatus</i> L.	.	+	2	IV
sporadic species						
			2	10	4	.

cies shared with the surrounding mesophilous forest (*Anemone-Fagetum*, *Physospermo-Quercetum*) as *Polygonatum multiflorum*, *Geranium versicolor*, *Scutellaria columnae*, *Festuca heterophylla*, *Lathyrus venetus*, *Satureja grandiflora*, indicating slightly sub-acid, deep and well drained soils with mesic features.

**Syntaxonomy:** These woods could be referred to the alliance *Corylo-Populion tremuli*, sub-alliance *Aceri obtusati-Populion tremulae* bringing together pre-

forest and forest formations of the Central-Southern Apennines dominated by *Populus tremula* (Taffetani, 2000). Otherwise, a different classification scheme was proposed by Rives-Martinez *et al.* (2002) where aspen formations are referred to a specific order (*Betulo pendulae-Populetalia tremulae*) of *Quercus-Fagetea* class. However, the presence of several species belonging to *Fagetalia sylvaticae* and endemics of the forests of Southern Italy (e.g. *Acer cappadocicum* ssp.

*lobelii*, *Euphorbia corallioides*, *Epipactis meridionalis*, *Alnus cordata*), contributes to the characterization of the new association *Geranium versicoloris*-*Populetum tremulae* with respect to the *Fraxino orni-Populetum tremulae* communities of Central Apennines. In particular the new association can be considered a mesophilous counterpart of *Holco molli-Populetum tremulae*, recently described at lower altitude in the Cilento region (Rosati *et al.* 2010).

**Characteristic taxa of association:** *Populus tremula*, *Acer obtusatum* ssp. *neapolitanum*, *Polygonatum multiflorum*, *Geranium versicolor*.

**High frequency taxa:** *Populus tremula*, *Acer obtusatum* ssp. *neapolitanum*, *Polygonatum multiflorum*, *Tamus communis*, *Daphne laureola*, *Fraxinus ornus* ssp. *ornus*.

**Catena and serial contacts:** Aspen formations can be found as pre-forestry stands mainly in the vegetation series of *Anemone-Fagetum* and *Physospermo-Quercetum cerridis*.

#### SHRUBBY VEGETATION AND FOREST EDGES

Secondary communities dominated by shrubby species are spread over large areas from the hilly to submontane belt and dynamically related to termophilous and mesophilous broad leaves woods. The floristic composition is remarkably conditioned by the surrounding forest vegetation and by the altitude.

5130 *Juniperus communis* formations on heaths or calcareous grasslands

*SPARTIO JUNCEI-CYTISETUM SESSILIFOLII* Biondi, Allegrezza & Guitian 1988 (Tab. 8)

**Distribution:** they are mainly located on gentle slopes, foothills and forest clearings in correspondence with fresh and deep soils, at altitudes between 800 and 1100 m a.s.l.

**Structure and synecology:** they are mostly communities of forest edges, moderately mesophilous with a prevalence of *Cytisophyllum sessilifolium*, while heliophilous shrubs such as *Spartium junceum* and *Juniperus communis* ssp. *communis* are seldom prevalent. The grass layer is characterized by the presence of many transgressive species from the woods such as: *Oenanthe pimpinelloides*, *Buglossoides purpureocoe-rulea*, *Aremonia agrimonioides*, *Ptilostemon strictus*, *Festuca heterophylla*, *Fragraria vesca* and species frequently found in *Quercetalia pubescentis* communities as *Helleborus foetidus*, *Teucrium chamaedrys*, *Rosa arvensis*, *Laburnum anagyroides*.

**Characteristic taxa of association:** *Cytisus sessilifolius*, *Spartium junceum*.

**High frequency taxa:** *Cytisus sessilifolius*, *Spartium junceum*, *Crataegus monogyna*.

**Syntaxonomy:** the association *Spartio juncei-Cytisetum sessilifolii* belongs to the alliance *Cytisium sessilifolii* (Biondi *et al.*, 1988).

**Syncorology:** the chorological spectrum shows the prevalence of Eurimediterranean (31.9%) and Eastern (24%) elements that confirms the phytogeographic affinities with the Southeastern European formations as already pointed out for Central Apennines (Blasi & Cutini, 2002).

**Dynamic:** these shrublands are mainly linked to mesophilous mixed oak woods (*Physospermo verticillati-Quercetum cerridis*) and to hornbeam woods (*Seslerio autumnalis-Aceretum obtusati*); rarely they are linked to *Anemone apenninae-Fagetum sylvaticae*.

*ROSO SQUARROSAE-RUBETUM ULMIFOLII* ass. nova hoc loco (holotypus: rel. 1, Tab.9)

**Distribution:** between 600 and 800 m, these are shrubland and forest hedges occurring on lands once grazed, abandoned crops or along secondary pathways and trails.

**Structure and synecology:** the physiognomy is characterized by *Rosa squarrosa* and *Rubus ulmifolius* with several pre-forest heliophilous and moderately termophilous species like *Spartium junceum*, *Pistacia terebinthus* and *Clematis vitalba*. Small sized trees such as *Ulmus minor*, *Carpinus orientalis*, *Cercis siliquastrum*, *Acer campestre*, *Sorbus domestica* are very frequent, meanwhile forest species such as *Quercus virgiliana*, *Acer obtusatum* ssp. *neapolitanum*, *Fraxinus ornus* ssp. *ornus* are not frequent.

**Characteristic taxa of association:** *Rosa squarrosa*, *Rubus ulmifolius*, *Clematis vitalba*, *Pistacia terebinthus*. *Rosa squarrosa* is a species similar to *Rosa canina* and widely spread in the hilly and mountainous areas of the Cilento and Calabro-Lucanian Apennine (Lattanzi *et al.*, 2006; Lattanzi *et al.*, 2012).

**High frequency taxa:** *Rosa squarrosa*, *Rubus ulmifolius*, *Clematis vitalba*, *Prunus spinosa*, *Spartium junceum*, *Carpinus orientalis*.

**Syntaxonomy:** these communities are herein described as a new association *Rosa squarrosae-Rubetum ulmifolii* belonging to the *Pruno spinosae-Rubion ulmifoliae* sub-alliance. This association can be considered a mesophilous community replacing, in the study area, the more termo-xerophyllous and sub-coastal vegetation types already described as *Pistacio terebinthi-Paliuretum spina-christi* Blasi & Di Pietro 2001 and *Rosa sempervirentis-Rubetum ulmifoliae* Blasi, Di Pietro & Fortini 2002 (Blasi & Di Pietro, 2002).

**Syncorology:** the Mediterranean component is the dominant (46,5%) and widely prevalent in respect to the other forest and shrubby vegetation types observed in the study area. The Eastern elements (27,9%) testify to a dynamic link with the *Carpinion orientalis* forests.





H scap	SE-Europ	Ptilostemon strictus (Ten.) Greuter	.	1	.	.	+	+	.	.	.	.	.	II
P lian	Europ-Caucas	Lonicera caprifolium L.	.	.	1	.	.	.	+	1	.	.	.	II
Ch suff	Eurimedit	Teucrium chamaedrys L. ssp. chamaedrys	.	+	.	.	+	.	.	.	.	.	+	II
P caesp	Orof-SW-Europ	Cytisophyllum sessilifolius (L.) O. Lang	1	.	.	.	.	+	+	.	.	.	.	II
H rept	Europ-Caucas	Ajuga reptans L.	.	+	.	+	.	.	1	.	.	.	.	II
P caesp	Paleotemp	Crataegus monogyna Jacq.	+	.	.	.	.	.	.	2	.	.	2	II
G bulb	Orof-C-Europ	Lilium bulbiferum L. ssp. croceum (Chaix) Baker	+	+	.	.	.	.	+	.	.	.	.	I
P caesp	Eurasiat	Pyrus communis L.	.	.	.	.	.	.	.	1	.	+	.	I
P n	S-Medit-Subatl	Rosa arvensis Huds.	.	.	.	+	1	.	.	.	.	.	.	I
P scap	C-Europ-Caucas	Malus sylvestris Miller	.	.	.	.	.	.	.	1	.	.	+	I
H scap	W-Europ	Digitalis lutea L. ssp. australis (Ten.) Arcang.	.	+	.	.	.	.	.	.	.	.	+	I
H rept	Endem	Silene viridiflora L.	.	.	.	.	.	.	.	.	.	+	+	I
H scap	Medit-Atl	Oenanthe pimpinelloides L.	+	.	.	.	.	.	.	.	.	.	.	I
Ch suff	Eurosib	Chamaecytisus hirsutus (L.) Llnk ssp. hirsutus	1	.	.	.	.	.	.	.	.	.	.	I
H scap	Europ-Caucas	Stachys officinalis (L.) Trevis.	1	.	.	.	.	.	.	.	.	.	.	I
H ros	Eurimedit	Potentilla micrantha Ramond ex DC.	.	+	.	.	.	.	.	.	.	.	.	I
		Emerus majus Mill. ssp. emeroides (Boiss. & Spruner) Soldano & Conti	.	+	.	.	.	.	.	.	.	.	.	I
P n	Orof-S-Europ	Melittis melissophyllum L. ssp. albida Guss.	.	1	.	.	.	.	.	.	.	.	.	I
H scap	NE-Medit-Mont	Sesleria autumnalis (Scop.) F. W. Schulz	.	1	.	.	.	.	.	.	.	.	.	I
H caesp	SE-Europ	Silene italica(L.) Pers. ssp. italica	.	+	.	.	.	.	.	.	.	.	.	I
H ros	S-Europ-Mont	Cephalanthera damasonium (Mill.) Druce	.	+	.	.	.	.	.	.	.	.	.	I
G rhiz	Eurimedit	Euonymus verrucosus Scop.	.	3	.	.	.	.	.	.	.	.	.	I
P caesp	SE-Europ-Pont	Epipactis meridionalis H. Baumann & R. Lopez	.	.	.	+	.	.	.	.	.	.	.	I
G rhiz	Endem	Bromus ramosus Hudson	.	.	.	.	.	.	.	.	.	.	.	I
H caesp	Eurasiat	Cruciata glabra (L.) Ehrend. ssp. glabra	.	.	.	.	.	+	.	.	.	.	.	I
H scap	Eurimedit	Cephalanthera rubra (L.) Richb.	.	.	.	.	.	.	+	.	.	.	.	I
G rhiz	Eurasiat	Anemone apennina L. ssp. apennina	.	.	.	.	.	.	+	.	.	.	.	I
G rhiz	E-Medit-Pont	Achillea ligustica All.	.	.	.	.	.	.	.	+	.	.	.	I
H scap	W-Stenomedit	Aristolochia lutea Desf.	.	.	.	.	.	.	.	+	.	.	.	I
G bulb	Medit-Macaron	Luzula forsteri (Sm.) DC.	.	.	.	.	.	.	.	+	.	.	.	I
G rhiz	Eurimedit	Viola alba Besser ssp. dehnhardtii (Ten.) W. Becker	.	.	.	.	.	.	.	+	.	.	.	I
H ros	Eurimedit	Euonymus europaeus L.	.	.	.	.	.	.	.	+	.	.	.	I
P caesp	Eurasiat	Polygonatum odoratum (Miller) Druce	.	.	.	.	.	.	.	1	.	.	.	I
G rhiz	Circumbor	Arabis turrita L.	.	.	.	.	.	.	.	.	.	.	+	I
H bienn	S-Europ-S-Siber	Lonicera etrusca Santi	.	.	.	.	.	.	.	.	.	.	+	I
P lian	Eurimedit	Platanthera clorantha (Custer) Rchb.	.	.	.	.	.	.	.	.	.	.	+	I
G bulb	Eurosib	others	.	.	.	.	.	.	.	.	.	.	+	I
G rhiz	Cosmopol	Pteridium aquilinum (L.) Kuhn ssp. aquilinum	+	1	.	.	2	+	.	1	2	3	3	IV
T scap	Paleotemp	Lapsana communis L.	.	.	.	.	+	+	.	.	.	+	+	III
H scap	Europ	Valeriana officinalis L.	.	.	.	1	1	.	.	.	.	.	1	II
P n	Paleotemp	Rosa canina L.	.	.	.	.	.	.	.	.	2	+	+	II
H scap	Subcosmopol	Trifolium pratense L.	.	.	.	.	.	.	.	+	.	.	1	II
P lian	Europ-Caucas	Clematis vitalba L.	.	.	.	2	+	.	.	+	.	.	.	II
T scap	Eurasiat	Galium aparine L.	.	.	.	.	+	+	.	.	.	.	.	II
H caesp	Paleotemp	Dactylis glomerata L. ssp. glomerata	.	.	.	.	+	1	.	.	.	.	.	II
T scap	Subcosmopol	Torilis arvensis (Huson) Link	.	.	.	.	.	.	.	.	.	.	+	II
T scap	Subcosmopol	Vicia sativa L.	.	.	.	.	.	.	.	.	.	.	+	II
H scap	Circumbor	Rumex acetosa L. ssp. acetosa	.	.	.	.	.	.	.	.	.	.	+	II
H scap	Stenomedit	Elaeostelinum asclepium (L.) Bertol. ssp. asclepium	.	.	.	.	.	.	.	.	.	.	.	I
P caesp	Circumbor	Juniperus communis L. ssp. communis	1	+	.	.	.	.	.	.	.	.	.	I
		Laserpitium garganicum (Ten.) Bertol. ssp. siculum (Sprengel) Pign.	.	.	.	.	.	.	.	.	.	.	.	I
H scap	Endem	Urtica dioica L. ssp. dioica	1	+	.	.	.	.	.	.	.	.	.	I
H scap	Subcosmopol	Rubus ulmifolius Schott	.	.	.	.	.	.	.	.	.	.	.	I
P n	Eurimedit	Poa trivialis L.	.	.	.	.	2	.	.	2	.	.	.	I
H caesp	Eurasiat	Chaerophyllum temulum L.	.	.	.	.	.	.	.	.	.	.	+	I
T scap	Eurasiat	Cytisus scoparius (L.) Link ssp. scoparius	.	.	.	.	.	.	.	.	.	.	+	I
P caesp	Europ-Subatl	Rubus idaeus L.	.	.	.	.	.	.	.	.	.	.	+	I
Pn	Circumbor	sporadic species	.	.	.	.	.	.	.	.	.	.	+	I
			1	.	5	.	13	7	.	.	5	3	.	

**Dynamic:** this plant community belongs to the vegetation series of termophilous virgilian oak woods (*Aceri neapolitani-Quercetum virgilianae*).

**Remarks:** *Roso squarrosae-Rubetum ulmifolii* is a frequent community where traditional farming activities are still practiced or they were present in the recent past. In fact, several cultivated species such as *Ficus carica* and *Sorbus domestica* together with archaeophytes like *Rhus coriaria* (Celesti-Grapow *et al.*, 2009; Fascetti, 2010), once used for the tannin extraction, have been found in the hedges of farmland that is no longer cultivated.

## GARRIGUES

Chamaephytic vegetation within the Southern Apennine territories is widespread in the hilly and submountaine belts, where it is often found in a mosaic with hemicyptophytic grasslands. Garrigues are mainly developed in southern slopes as open stands on thin rocky soils with huge acting erosive processes, resulting from woodland cutting and grazing.

*ONOSMO LUCANAE-LOMELOSIIETUM CRENATAE* ass. nova hoc loco (holotypus: rel. 5, Tab.10)

Tab. 8 - *Spartio juncei-Cytisetum sessilifolii* Biondi, Allegrezza & Guitian 1988

		Relevé number	1	2	3	4	5	Presences
		Altitude (m a.s.l.)	950	1090	1095	800	1080	
		Aspect	S	ENE	SSW	WSW	ENE	
		Slope (°)	20	30	30	30	35	
		Shrubs height (m)	1,5	1,5	1,8	1,8	1,6	
		Shrubs cover (%)	85	80	90	90	80	
		Herb layer cover (%)	30	50	65	60	50	
		Area (m <sup>2</sup> )	100	20	25	20	30	
		species richness	24	31	30	31	30	
		char. and diff. species of <i>Spartio juncei-Cytisetum sessilifolii</i> and <i>Cytisium sessilifolii</i>						
Pcaesp	Orof-SW-Europ	<i>Cytisium sessilifolium</i> (L.) O. Lang	2	3	3	3	3	V
Pcaesp	Eurimedit	<i>Spartium junceum</i> L.	1	2	1	1	2	V
Pcaesp	Circumbor	<i>Juniperus communis</i> L. ssp. <i>communis</i>	1	3	4	.	.	III
Plian	Eurimedit	<i>Lonicera etrusca</i> Santi	1	+	.	+	.	III
NP	E-Medit-Mont	<i>Emerus majus</i> Mill. Ssp. <i>emeroides</i> (Boiss. & Spruner) Soldano & F. Conti	1	.	.	.	+	II
		char. and diff. species of <i>Prunetalia spinosae</i> and <i>Rhamno-Prunetea</i>						
Pcaesp	Paleotemp	<i>Crataegus monogyna</i> Jacq.	1	2	1	1	1	V
NP	N-Eurimedit	<i>Rubus canescens</i> DC.	+	2	2	1	+	IV
Plian	Europ-Caucas	<i>Clematis vitalba</i> L.	1	.	+	.	1	IV
Pcaesp	Europ-Caucas	<i>Prunus spinosa</i> L. ssp. <i>spinosae</i>	1	+	.	1	.	III
NP	Paleotemp	<i>Rosa canina</i> L.	1	.	2	2	.	III
Plian	SE-Europ-Pontico	<i>Lonicera caprifolium</i> L.	.	1	1	.	+	III
NP	Eurimedit	<i>Rubus ulmifolius</i> Schott	.	.	.	2	1	II
		char. and diff. species of <i>Quercus-Fagetea</i>						
Plian	Eurimedit	<i>Hedera helix</i> L. <i>helix</i>	1	+	+	.	+	IV
Pcaesp	SE-Europ-S-Siber	<i>Fraxinus ornus</i> L. <i>ornus</i>	.	1	1	+	.	III
Hscap	Submedit-Subatl	<i>Viola reichenbachiana</i> Jord. ex Boreau	+	+	.	.	+	III
Pcaesp	S-Europ	<i>Laburnum anagyroides</i> Medik.	1	.	1	.	1	III
Pcaesp	Endem	<i>Acer obtusatum</i> W. et K. ssp. <i>neapolitanum</i> (Ten.) Pax	+	+	+	.	.	III
Hcaesp	Paleotemp	<i>Brachypodium sylvaticum</i> (Huds.) Beauv. ssp. <i>sylvaticum</i>	1	.	1	.	1	III
Pcaesp	Submedit-Subatl	<i>Rosa arvensis</i> Huds.	+	.	.	+	+	III
Pcaesp	Circumbor	<i>Ostrya carpinifolia</i> Scop.	.	1	+	.	1	III
Pcaesp	Eurosib	<i>Populus tremula</i> L.	.	+	1	.	.	II
Hscap	SE-Europ	<i>Ptilostemon strictus</i> (Ten.) Greuter	.	+	.	.	1	II
Pcaesp	SE-Europ	<i>Quercus cerris</i> Mill.	.	+	.	+	.	II
Pcaesp	SE-Europ	<i>Quercus virgiliana</i> Ten.	.	+	.	+	.	II
Hrept	Eurosib	<i>Fragaria vesca</i> L.	.	.	1	.	1	II
Pcaesp	Endem	<i>Alnus cordata</i> Loisel	1	.	.	.	.	I
Pcaesp	Eurasiat	<i>Pyrus communis</i> L.	1	.	.	.	.	I
NP	Subatl	<i>Daphne laureola</i> L.	.	+	.	.	.	I
Pcaesp	Europ	<i>Sorbus aucuparia</i> L.	.	.	+	.	.	I
Hscap	NE-Medit-Mont	<i>Scutellaria columnae</i> All. ssp. <i>columnae</i>	.	.	.	.	1	I
Hscap	Endem	<i>Teucrium siculum</i> (Raf.) Guss.	.	1	.	.	.	I
Hscap	NE-Medit-Mont	<i>Melittis melissophyllum</i> L. ssp. <i>albida</i> (Guss.) P. W. Ball	.	.	.	.	+	I
		others						
Hscap	Europ-Caucas	<i>Geranium sanguineum</i> L.	.	1	+	+	+	IV
Chsuff	Eurasiat	<i>Genista tinctoria</i> L.	1	.	2	+	.	III
Hcaesp	Paleotemp	<i>Dactylis glomerata</i> L.	.	1	1	.	3	III
Hscap	NE-Medit	<i>Eryngium amethystinum</i> L.	+	.	.	+	.	II
Hscap	Circumbor	<i>Prunella vulgaris</i> L. <i>vulgaris</i>	1	.	1	.	.	II
NP	Eurimedit ?	<i>Rosa squarrosa</i> (Rau) Boreau	.	+	.	+	.	II
Grad	Eurimedit	<i>Tamus communis</i> L.	.	+	.	.	1	II
Gbulb	Orof-C-Europ	<i>Lilium bulbiferum</i> L. ssp. <i>croceum</i> (Chaix) Jan	.	+	.	.	+	II
Grhiz	Endem	<i>Phleum hirsutum</i> Honck. Ssp. <i>ambiguum</i> (Ten.) Tzvelev	.	+	.	1	.	II
Chsuff	Eurimedit	<i>Thymus longicaulis</i> C. Presl ssp. <i>longicaulis</i>	.	1	.	1	.	II
Hscap	Eurimedit	<i>Polygala nicaeensis</i> W.D.J. Koch ssp. <i>mediterranea</i> Chodat	.	.	1	+	.	II
Chsuff	Eurimedit	<i>Teucrium chamaedrys</i> L. <i>chamaedrys</i>	.	.	+	1	.	II
Hscap	S-Medit	<i>Thapsia garganica</i> L.	+	.	.	+	.	II
Grhiz	NE-Medit-Mont	<i>Iris lorea</i> Janka	+	.	+	.	.	II
		sporadic species						
			1	5	8	9	6	

**Distribution:** this community occurs on eroded limestone substrates with southern slopes, between 800 and 1200 m a.s.l. in the hilly and submontane belt.

**Structure and synecology:** this community is featured by sparse plant cover (30-70 %) due to the presence of eroded soils or rocky outcrops; physiognomy is dominated by pillow and carpeting chamaephytes such *Lomelosia crenata* ssp. *crenata*, *Thymus striatus*, *Globularia meridionalis* and the rare *Onosma helvetica* ssp. *lucana*; the life form spectrum (Fig. 6) shows that the structure of the community includes a large hemicryptophytic component (42,1%) with species as *Bromus erectus*, *Koeleria lobata*, *Carex macrolepis*, *Brachypodium rupestre*.

**Characteristic taxa of association:** *Lomelosia crenata* ssp. *crenata*, *Onosma helvetica* ssp. *lucana*, *Polygala nicaeensis* ssp. *mediterranea*, *Plantago holosteum*.

**High frequency taxa:** *Lomelosia crenata* ssp. *crenata*, *Onosma helvetica* ssp. *lucana*, *Polygala nicaeensis* ssp. *mediterranea*, *Helianthemum oelandicum* ssp. *canum*, *Teucrium montanum*.

**Syntaxonomy:** The particular floristic composition of these garrigues allows us to describe a new association *Onosma lucanae-Lomelosietum crenatae* ass. nova hoc loco which is widespread along the carbonatic ridge of higher Val d'Agri basin and in some neighbouring mountain areas such as the Gallipoli-Cognato and Dolomiti Lucane Regional Park. The association is

Tab. 9 - *Roso squarrosae-Rubetum ulmifolii* ass. nova

		Relevé number	1*	2	3	4	5		
		Altitude (m a.s.l.)	650	780	700	750	800		
		Aspect	S	W	SW	WSW	SSW		
		Slope (°)	10	10	20	20	10		
		Shrubs height (m)	2	3	2	4	6		
		Shrubs cover (%)	80	90	90	90	80		
		Herb layer cover (%)	10	20	20	40	20		
		Area (m <sup>2</sup> )	70	50	100	70	100		
		species richness	17	18	23	37	18	Presences	
char. and diff. species of <i>Roso squarrosae-Rubetum ulmifolii</i> ass. nova									
NP	Eurimedit	<i>Rosa squarrosa</i> (Rau) Boreau	+	+	1	1	1	V	
NP	Eurimedit	<i>Rubus ulmifolius</i> Schott	1	1	+	2	1	V	
Plian	Europ-Caucas	<i>Clematis vitalba</i> L.	1	1	+	2	1	V	
Pcaesp	Eurimedit	<i>Pistacia terebinthus</i> L.	2	1	1	.	.	III	
char. and diff. species of <i>Pruno-Rubion ulmifolii</i> and <i>Pruno-Rubenion ulmifolii</i>									
NP	N-Eurimedit	<i>Rubus canescens</i> DC.	2	1	1	2	1	III	
Grhiz	Stenomedit	<i>Asparagus acutifolius</i> L.	+	.	.	+	+	III	
NP	Illirico	<i>Euphorbia characias</i> L.	1	.	.	+	.	II	
Grad	Eurimedit	<i>Tamus communis</i> L.	.	.	+	+	.	II	
char. and diff. species of <i>Prunetalia spinosae</i> and <i>Rhamno-Prunetea</i>									
Pcaesp	Europ-Caucas	<i>Prunus spinosa</i> L. ssp. <i>spinosae</i>	+	1	1	2	1	V	
Pcaesp	Eurimedit	<i>Spartium junceum</i> L.	+	.	1	1	1	IV	
NP	Eurasiat	<i>Ligustrum vulgare</i> L.	.	.	1	1	+	III	
Pcaesp	Eurasiat	<i>Cornus sanguinea</i> L.	.	+	+	1	.	III	
Plian	Eurimedit	<i>Lonicera etrusca</i> Santi	.	.	1	1	1	III	
Pcaesp	Eurasiat	<i>Ulmus minor</i> Mill.	.	.	1	1	1	III	
NP	E-Medit-Mont	<i>Emerus majus</i> Mill. <i>emeroides</i> (Boiss. & S)	.	2	.	1	+	III	
Pcaesp	Paleotemp	<i>Crataegus monogyna</i> Jacq.	1	.	1	2	.	III	
NP	Eurimedit	<i>Rosa micrantha</i> Borrer ex Sm.	.	.	.	1	.	I	
Plian	SE-Europ	<i>Lonicera caprifolium</i> L.	.	.	+	.	.	I	
char. and diff. species of <i>Quercus-Fagetea</i>									
Pcaesp	Pont	<i>Carpinus orientalis</i> Mill. ssp. <i>orientalis</i>	+	.	1	1	+	IV	
Pcaesp	S-Europ.W-Asiat	<i>Cercis siliquastrum</i> L. ssp. <i>siliquastrum</i>	.	1	.	1	+	III	
Plian	Eurimedit	<i>Hedera helix</i> L. ssp. <i>helix</i>	.	+	+	+	.	III	
Pcaesp	SE-Europ	<i>Quercus virgiliana</i> Ten.	.	1	1	1	.	III	
Pcaesp	SE-Eur-S-Siber	<i>Fraxinus ornus</i> L. <i>ornus</i>	.	.	1	1	1	III	
Pcaesp	Europ-Caucas	<i>Acer campestre</i> L.	.	1	1	1	.	III	
Acer obtusatum W. et K. ssp. neapolitanum (Ten.) Pax									
Pcaesp	Endem	<i>Sorbus domestica</i> L.	.	+	.	+	.	II	
Pcaesp	Paleotemp	<i>Viola alba</i> Besser <i>dehnhardtii</i> (Ten.) W.	.	1	.	+	.	II	
Hcaesp	Eurimedit	Becker	.	.	+	1	.	II	
Brachypodium sylvaticum (Huds.) Beauv.									
Hcaesp	Paleotemp	ssp. <i>sylvaticum</i>	.	.	.	+	.	I	
Hscap	Subcosmopol	<i>Agrimonia eupatoria</i> L. ssp. <i>eupatoria</i>	.	.	.	+	.	I	
Hscap	Endem	<i>Teucrium siculum</i> (Raf.) Guss.	.	.	.	+	.	I	
others									
Hcaesp	Eurasiat	<i>Anthoxanthum odoratum</i> L.	1	.	1	1	.	III	
Pcaesp	S-Medit	<i>Rhus coriaria</i> L.	.	+	.	1	+	III	
Hscap	Eurimedit-Mont	<i>Calamintha nepeta</i> (L.) Savi ssp. <i>nepeta</i>	.	.	.	1	+	II	
<i>Carlina vulgaris</i> L. ssp. <i>spinosae</i> (Velen.)									
Hscap	Europ	Vandas	.	+	.	1	.	II	
Hcaesp	Paleotemp	<i>Dactylis glomerata</i> L. ssp. <i>glomerata</i>	.	+	.	1	.	II	
<i>Micromeria graeca</i> (L.) Benth. ex Rchb.									
Chsuff	Stenomedit	ssp. <i>graeca</i>	+	.	.	+	.	II	
Hscap	Eurimedit	<i>Pulicaria odora</i> (L.) Rchb.	+	.	.	.	+	II	
Chsuff	Eurimedit	<i>Teucrium chamaedrys</i> L. <i>chamaedrys</i>	.	.	+	+	.	II	
Hscap	S-Medit	<i>Foeniculum vulgare</i> Mill.	+	.	+	.	.	II	
sporadic species									
			2	1	.	5	2		

characterized by the following entities: *Lomelosia crenata* ssp. *crenata*, a S-Mediterranean mountain entity present in the Central-Southern Apennines and Sicily (Conti *et al.*, 2005, Di Pietro *et al.*, 2008; Wagensommer & Di Pietro, 2008; Wagensommer *et al.*, 2010), *Onosma helvetica* ssp. *lucana*, a schizo-endemism of Basilicata and Calabria regions (Peruzzi *et al.*, 2004), and *Plantago holostium* Scop., a sub-montane xerophyte species with SE-European distribution.

In relation to the different local morphological characteristics of the substrate, three main aspects can be recognized:

*pimpinellosum tragi* subass. nova (Tab. 10.; rel. 1-9 holotypus rel. 5) localized on macro-detritus rocky

outcrops; differential species are *Pimpinella tragi*, *Dianthus sylvestris* ssp. *longicaulis*, *Stachys recta* ssp. *longiflora*; this is the typical subassociation;

*Euphorbia spinosa* variant (Tab. 10: rel. 10-11), is characteristic of the rocky edges on the graded slopes; differential species are *Euphorbia spinosa*, *Laserpitium siler* ssp. *siculum*, *Aurinaria saxatilis* ssp. *megalocarpa* and *Cephalaria leucantha*;

*Achnatherum calamagrostis* variant can be found on the strongly dissected slopes with incoherent dolomitic sandstones substrata and is characterized by *Achnatherum calamagrostis* and *Iberis carnosa* ssp. *carnosa*. **Chorology:** the Euromediterranean (26,2%) and Oriental (24,2%) species are largely dominant (Fig. 7).

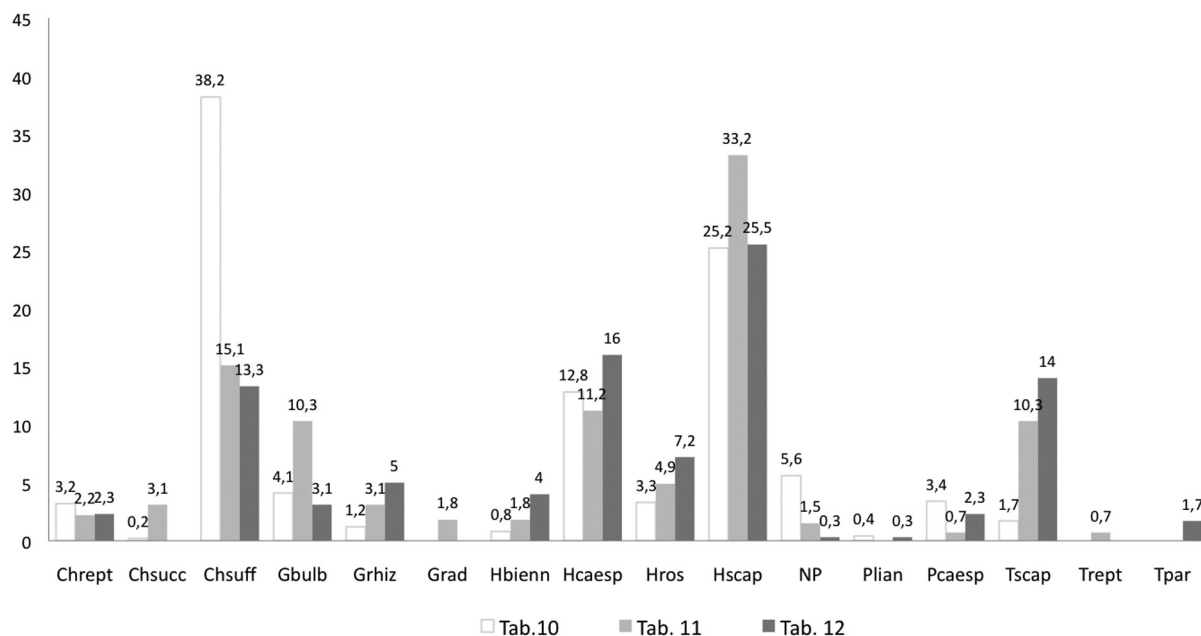


Fig. 6 - Life forms comparison between garrigues and grasslands in the study area.

Moreover, the association is marked by a significant number of mediterranean-montane (11,3%) and endemic species (10,1%).

**Dynamic:** the presence of young individuals of phanerophytes (NP 5,6%, Pcaesp 3,4%) such as *Quercus virgiliana*, *Fraxinus ornus*, *Cistus creticus* ssp. *eriocephalus*, *Cytisophyllum sessilifolium*, *Spartium junceum* highlights that this garrigue is related to dynamic stages with *Quercus virgiliana* and *Acer neapolitanus* deciduous thermophilous woods (*Aceri neapolitani-Quercetum virgilianae*).

**Syntaxonomical discussion:** at the higher syntaxa level *Onosmo lucanae-Lomelosietum crenatae* does not find a clear reference within the framework that currently describes the supramediterranean and hilly garrigues of the Southern Apennines. In fact, the vegetation classification of the Apenninic submontane and montane garrigues has been longly debated. In particular at class level two different points of view were opposed. The first one lead to the inclusion of these vegetation types in *Rosmarinetea officinalis*, a class of thermo-oromediterranean secondary scrub communities developed on calcareous soils in Western Mediterranean area. The second one, highlighting the role of the oriental species in the floristic composition, referred the garrigues Apennine's vegetation to *Cisto-Micromerietea*, a Central-Eastern Mediterranean syntaxon, including both calcicolous and silicicolous communities. In particular, in Central Italy at the first, the garrigues have been described in an endemic alliance (*Cytiso-Saturejion*) within the *Cisto cretici-Micromerietea julianae* class (Pirone & Tammamo, 1997. Pirone et al., 2004); this alliance was later pro parte considered as synonymous of *Cisto cretici-Ericion manipuliflorae* (Biondi

et al. 2000). In addition, at class level the difficulties in disentangling the syntaxonomy are also due to a large overlap of characteristic taxa between the two classes above mentioned. Indeed, in our community the two components are quite equal. However, considering the results of chorological analyses, that revealed a marked oriental component together with the lack of a specific Western component, we retain that the classification in *Cisto-Micromerietea* is more appropriate, even if the other chamaephytic communities with *Lomelosia crenata* ssp. *crenata* known for Basilicata Region have been classified, until now, in the class *Rosmarinetea officinalis* (Biondi, 1997). In particular, the association *Putorio calabricae-Scabiosetum crenatae*, founded on flyschoid and marly-arenaceous substrates (Biondi et al., 1992), was previously referred to *Cisto eriocephali-Ericion multiflorae*, an alliance that includes the coastal and sub-coastal coenoses of the thermo-mesomediterranean belt, and the association *Saturejo montanae-Scabiosetum crenatae*, growing on incoherent soils with calcareous outcrops of Monte Alpi (Corbetta e Pirone, 1981) was referred to *Artemisia albae-Saturejion montanae* alliance (Biondi, 2000), diffused in the meso-supratemperate oceanic and submediterranean belt.

Recently, regarding the Murgia territory (South-East regions of Apulia and Basilicata) a suballiance of *Cisto-Ericion* (*Cisto-Micromerietea*) named *Thymo capitati-Helianthemenion jonii* (Di Pietro & Misano, 2010) has been described highlighting the strong links with the analogous vegetation of SE-Europe. In our opinion and according to Corbetta et al. (1984), this biogeographical influence reaches, from the Ionian Sea area along the river valleys, the Maddalena Mountains.

Meanwhile, the Cilento and W-Calabrian Apennines constitute an orographic barrier to the eastward spread of the Tyrrhenian biochora limiting the *Rosmarinetea officinalis* coenoses along the Tyrrhenian border.

As a consequence we considered appropriate the inclusion of *Onosmo lucanae-Lomelosietum crenatae* in *Cisto-Micromerietea/Cisto-Ericetalia* and provisionally placed our community in *Cisto-Ericion* alliance. Due to the complete lack of characteristic species of *Thymo capitati-Helianthemion jonii*, we are not able to indicate the suballiance level, highlighting the necessity of further studies to provide a consistent syntaxonomical scheme for the Apennines' garrigues.

## GRASSLANDS

In the vegetational mosaic of the Monti della Maddalena the herbaceous formations are represented by plant communities having a secondary origin, resulting from the cutting of the forest and the subsequent extensive use of lands for grazing.

6210\*Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (\*important orchid sites)

**ANTHEMIDO CRETICI-STIPETUM AUSTRITALICAE** ass. nova hoc loco (holotypus rél. 1 Tab. 11)

**Distribution:** these grasslands are found at altitudes between 900 and 1200 m, on calcareous rocky substrate mainly with southern exposure and medium-high slopes (about 20°).

**Structure and synecology:** these communities are marked by not complete plant cover (60-90%) high species richness (36-56 species for sample) and the presence of several rare and endemic species (12,8%). The physiognomy is due to *Stipa austroitalica* ssp. *au-*

*stroitalica*, a Southern Italian endemism, found both in the dry grassland of the Apennine uplands and along the Mediterranean coast of Southern Peninsula (Molise, Campania, Puglia, Basilicata e Calabria, see e.g. Moraldo, 1986; Moraldo & Ricceri, 2003; Brullo *et al.*, 2001; Fanelli *et al.*, 2001; Forte *et al.*, 2005). The existence of populations of *Stipa austroitalica* in inland submontane areas confirms the particular adaptive character of this xerophilous species whose germination of seeds requires relatively cold winters (Forte *et al.*, 2007). The floristic feature of this community is the presence of *Anthemis cretica* ssp. *columnae*, growing on rocky slopes and cliffs on different substrates. Its distribution in Italy stretches discontinuously from the Sibillini Mountains to Mt. Sirino at the south (Conti *et al.* 2005; Selvi, 2009).

The hemicryptophytes (51,1%) prevail in the floristic composition including many xerophilous grasses such as *Koeleria lobata*, *Avenula praetutiana*, *Bromus erectus*, *Phleum ambiguum*, *Festuca circummediterranea*. Among the chamaephytes (28,5%) some have a high frequency such as *Teucrium capitatum*, *Thymus striatus*, *Aethionema saxatile*, highlighting the dynamic links with the garrigue communities (Fig. 6).

**Characteristic taxa:** *Stipa austroitalica* ssp. *austroitalica*, *Anthemis cretica* ssp. *columnae*, *Phlomis herba-venti*, *Onobrychis alba*.

**High frequency taxa:** *Anthemis cretica* ssp. *columnae*, *Stipa austroitalica* ssp. *austroitalica*, *Petrorhagia saxifraga*, *Thymus striatus*, *Bromus erectus*, *Teucrium montanum*, *Koeleria lobata*, *Anthyllis vulneraria* ssp. *rubriflora*, *Aethionema saxatile*.

**Syntaxonomy:** some associations dominated by *Stipa austroitalica* ssp. *austroitalica* have been described in Central and Southern Italy, but they are ecologically different from those found in this area in regards to altitude and bioclimate characteristics. A marked dif-

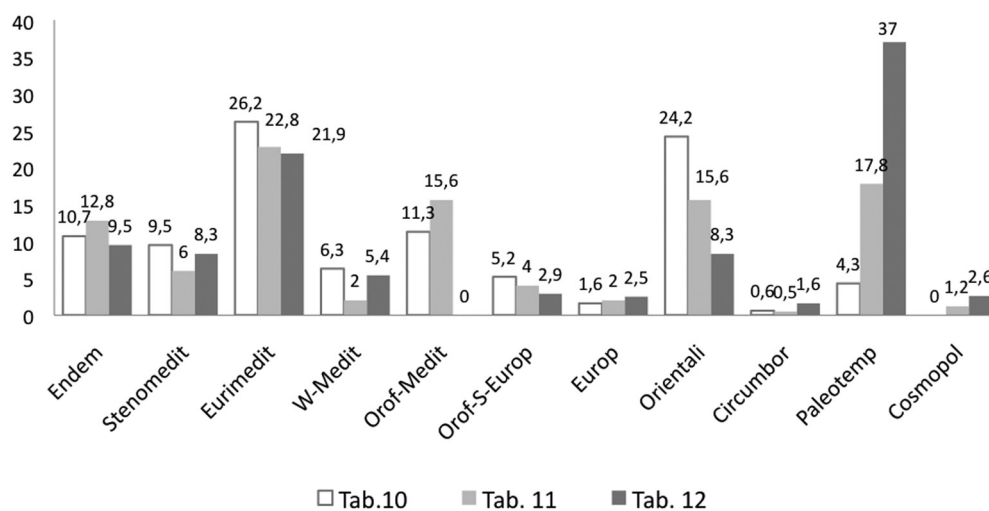


Fig. 7 - Chorological comparison between garrigues and grasslands in the study area

Tab.10 - *Onosmo lucanae-Lomelosietum crenatae* ass.nova

	1	2	3	4	5*	6	7	11	12	13	14	15		
Relevé number	1010	1010	1030	1025	1010	1030	1015	1020	1020	880	1100	1150		
Altitude (m a.s.l.)	SSE	SSE	SSW	S	SSW	SW	SW	S	SW	SSE	SSE	SE		
Aspect	45	45	60	45	35	30	40	20	30	35	30	30		
Slope (°)	50	70	40	60	60	50	45	70	60	60	70	60		
Cover (%)	30	60	20	60	70	40	20	20	20	65	70	30		
Rock debris (%)	50	10	80	20	20	30	60	10	50	5	5	10		
Rocky outcrops (%)	12	15	20	40	25	20	15	100	60	40	20	40		
Area (m <sup>2</sup> )	21	28	30	36	33	27	30	44	45	19	17	13		
species richness														
char. and diff. species of <i>Onosmo lucanae-Lomelosietum crenatae</i> ass.nova														
Ch suff	Orof-S-Medit	3	2	3	3	3	3	1	+	2	3	2	1	V
Ch suff	Endem	1	2	+	1	1	2	1	1	+	+	+	+	V
H scap	Eurimedit	1	+	1	+	1	+	+	+	+	+	+	+	V
Ch suff	SE-Europ.	.	1	.	1	1	1	.	.	1	2	1	1	IV
H scap	Medit-Mont	.	+	1	+	+	+	+	+	+	+	+	+	III
H scap	Medit-Mont	.	+	+	.	1	1	+	.	.	.	.	.	II
Ch suff	Medit-Turan	.	.	.	.	1	1	1	.	.	.	.	.	I
H caesp	Orof S-Europ	.	.	.	.	.	.	.	.	1	1	1	3	II
H scap	Paleotemp	.	2	1	.	.	+	.	.	.	.	.	3	II
Ch suff	NE-Medit-Mont	.	.	.	.	.	.	.	+	.	.	.	+	II
H scap	Endem	+	.	.	.	.	.	.	.	.	.	.	1	I
Ch suff	N-Medit	.	.	.	.	.	.	.	.	.	.	.	2	I
char. and diff. species of <i>Cisto-Ericion, Cisto-Ericetalia</i> and <i>Cisto-Micromerietea</i>														
Ch suff	Europ-Caucas	2	2	2	2	2	2	2	.	1	1	1	1	+
Ch suff	Orof S-Europ	1	1	1	1	2	2	2	3	1	1	1	1	V
NP	Stenomedit	2	3	+	1	1	2	1	1	.	.	.	.	IV
Ch suff	Stenomedit	2	1	1	+	1	+	1	.	.	.	.	.	III
Ch rept	Eurimedit	.	1	1	2	2	2	.	.	.	.	2	1	III
H scap	Eurimedit	.	.	+	+	+	+	+	+	+	+	+	+	III
H scap	Eurimedit	1	+	1	+	1	+	1	+	+	+	+	+	III
Ch suff	Medit-Mont	+	.	.	+	+	+	+	+	.	.	.	1	III
Ch suff	Eurimedit	.	.	1	1	1	2	2	+	.	.	.	.	II
Ch suff	S-Europ	.	.	.	+	+	.	1	+	+	+	+	+	II
Ch suff	Subendem	.	.	.	.	.	.	2	1	+	+	+	+	II
H scap	Stenomedit	.	.	+	.	.	.	.	.	.	.	.	.	II
Ch suff	Medit-Mont	.	.	+	.	.	.	.	.	.	.	.	.	I
Ch suff	Medit-Mont	.	.	+	.	.	.	.	.	.	.	.	.	I
H scap	Medit-Mont	.	.	.	.	.	.	.	.	.	.	.	.	I
transgr. species from <i>Scorzonero-Chrysopogonetalia</i> and <i>Festuco-Brometeta</i>														
H scap	SE-Europ.	+	+	1	1	1	1	.	+	.	.	.	1	+

ference is evident respect to the communities of *Chamaeleono gummiferis-Stipetum austroitalicae*, steppe grasslands of the Ionian coast of southern Calabria (Brullo et al., 2001), placed in the *Saturejo-Hyparrhenion hirtae* (*Lygeo-Stipetea*). In addition, our community also differs from *Syderitido syriacae-Stipetum austroitalicae* (Fanelli et al., 2001), found in Molise and Gargano and from *Acino suaveolentis-Stipetum austroitalicae* and *Chamaecytiso spinescentis-Stipetum austroitalicae* (Forte et al., 2005) of the Murgia territory (Apulia and Basilicata), because they are lo-

cated at lower altitude between 100 and 700 m a.s.l., in a different phytoclimatic belt (upper mesomediterranean, ombrotype, dry-lower subhumid). These associations are referred to *Hippocrepido glaucae-Stipion austroitalicae* (*Scorzonero-Chrysopogonetalia*), an alliance that brings together the grasslands on calcareous substrates of Southern and Eastern Europe in semicontinental bioclimatic conditions. (Forte et al. 2005). In this framework, we highlight that *Stipa austroitalica* community found in the Maddalena Mountains, shows a considerable autonomy compared to those above



Tab. 11 - *Anthemido cretici-Stipetum austroitalicae* ass. nova

	Relevè number	1*	2	3	4	5		
	Altitude (m a.s.l.)	1260	1180	1027	950	1180		
	Aspect	W	ENE	S	S	WSW	Presences	
	Slope (°)	10	35	20	20	25		
	Cover (%)	60	75	80	90	80		
	Rock debris (%)	60	20	5	10	30		
	Rocky outcrops (%)	10	20	40	20	15		
	Area (m <sup>2</sup> )	20	40	100	100	50		
	species richness	36	56	47	56	42		
char. and diff. species of <i>Anthemido cretici-Stipetum austroitalicae</i> ass. nova								
Endem.	<i>Stipa austroitalica</i> Martinovský	1	2	2	1	1		V
Orof. S-Eur.-W As.	<i>Anthemis cretica</i> L. ssp. <i>columnae</i> (Ten.) Franzén	+	+	1	+	+		V
Stenomedit	<i>Phlomis herba-venti</i> L.	1	+	+	1	+	IV	
Eurimedit.	<i>Onobrychis alba</i> (Waldst. & Kit.) Desv. ssp. <i>alba</i>	1	+	+	.	+	IV	
Endem	<i>Asperula calabra</i> (Fiori) Ehrend. & Krendl		+		+	+	III	
<i>Phleo ambiguus-Bromion erecti e Sideritidenion italicae</i>								
Medit.-Mont.	<i>Koeleria lobata</i> (M. Bieb.) Roem. & Schult.	1	3	1	1	3	V	
Eurimedit	<i>Thymus striatus</i> Vahl	3	1	1	2	3	V	
Endem	<i>Galium lucidum</i> All. ssp. <i>venustum</i> (Jord.) Arcang.	1	1	1	.	1	IV	
Endem.	<i>Avenula praetutiana</i> (Parl. ex Arcang.) Pignatti	+	1	.	+	+	IV	
Endem	<i>Crepis lacera</i> Ten.	+	1	.	.	+	III	
	<i>Helianthemum oelandicum</i> (L.) Dum. Cours. ssp. <i>incanum</i> (Willk.) G. López	2	1	.	.	2	III	
Europ.-Caucas.	<i>Phleum hirsutum</i> Honck. ssp. <i>ambiguum</i> (Ten.) Tzvelev	1	.	1	+	.	III	
Endem.	<i>Festuca circummediterranea</i> Patzke	.	2	+	+	.	III	
Eurasiat	<i>Silene otites</i> (L.) Wibel	+	+	.	+	.	III	
Eurimedit	<i>Muscari neglectum</i> Guss. ex Ten.	1	+	.	.	.	II	
Subendem.	<i>Carex macrolepis</i> DC.	.	.	+	+	.	II	
Endem	<i>Centaurea deusta</i> Ten. ssp. <i>deusta</i>	.	.	.	1	1	II	
N-Medit-Mont	<i>Stachys recta</i> L. ssp. <i>grandiflora</i> (Caruel) Arcang.	.	.	+	+	.	II	
Subendem.	<i>Cytisus spinescens</i> C. Presl	.	.	.	1	+	II	
Medit	<i>Potentilla recta</i> L. ssp. <i>recta</i>	.	.	+	.	.	I	
char. and diff. species of <i>Scorzonero villosae-Chrysopogonetalia grylli</i> and <i>Festuco-Brometea</i>								
Paleotemp	<i>Bromus erectus</i> Huds.	1	3	3	2	3	V	
Medit.-Mont.	<i>Aethionema saxatile</i> (L.) R. Br.	+	+	+	+	+	V	
Stenomedit.-Turan.	<i>Teucrium capitatum</i>	+	+	1	1	+	V	
Eurimedit.	<i>Petrohragia saxifraga</i> (L.) Link	1	1	+	+	1	V	
Eurimedit	<i>Anthyllis vulneraria</i> L. ssp. <i>rubriflora</i> (DC.) Arcang.	1	2	+	+	2	V	
Paleotemp	<i>Sanguisorba minor</i> Scop.	1	1	+	+	.	IV	
Paleotemp	<i>Allium sphaerocephalon</i> L.	+	+	.	+	+	IV	
Europ.-Caucas.	<i>Orchis morio</i> L.	+	+	+	1	.	IV	
	<i>Dianthus sylvestris</i> Wulfen ssp. <i>longicaulis</i> (Ten.) Greuter & Burdet	+	+	+	.	+	IV	
Medit-Mont	<i>Eryngium amethystinum</i> L.	.	+	1	+	+	IV	
NE-Medit	<i>Scorzonera villosa</i> Scop. ssp. <i>columnae</i> (Guss.) Nyman	+	+	1	.	+	IV	
Anfiadriat	<i>Teucrium chamaedrys</i> L. ssp. <i>chamaedrys</i>	.	.	+	+	+	III	
Eurimedit	<i>Anthericum liliago</i> L.	+	+	.	.	+	III	
Submedit.-Subatl.	<i>Anthyllis montana</i> L. ssp. <i>atropurpurea</i> (Vuk.) Pignatti	+	+	.	.	1	III	
Medit.-Mont.	<i>Centaurium erythraea</i> Rafn ssp. <i>erythraea</i>	.	+	.	+	+	III	
Paleotemp	<i>Polygala nicaeensis</i> W.D.J. Koch ssp. <i>mediterranea</i> Chodat	.	1	+	+	+	III	
Eurimedit	<i>Pimpinella saxifraga</i> L.	.	2	.	+	1	III	
Europ.-Caucas.	<i>Leontodon crispus</i> Vill. ssp. <i>crispus</i>	1	.	.	.	1	II	
S-Europ	<i>Asphodeline lutea</i> (L.) Rchb.	1	+	.	.	.	II	
E-Medit	<i>Gymnadenia conopsea</i> (L.) R. Br.	+	.	+	.	.	II	
Eurasiat.	<i>Carlina vulgaris</i> L.	.	.	+	+	.	II	
Eurosib	<i>Linum tenuifolium</i> L.	.	+	.	.	+	II	
Submedit	<i>Plantago holostium</i> Scop.	1	.	.	.	1	II	
SE-Europ	<i>Cephalaria leucantha</i> (L.) Roem. & Schult.	.	+	.	.	.	I	
Orof. S-Europ.	<i>Acinos alpinus</i> (L.) Moench ssp. <i>alpinus</i>	.	+	.	.	.	I	
SW-Europ	<i>Helianthemum apenninum</i> (L.) Mill. ssp. <i>apenninum</i>	.	2	.	.	.	I	
Eurimedit	<i>Convolvulus cantabrica</i> L.	.	.	+	.	.	I	
S-Europ	<i>Helichrysum italicum</i> (Roth) G. Don ssp. <i>italicum</i>	.	.	.	1	.	I	
Europ.-Caucas.	<i>Hieracium pilosella</i> L.	.	.	.	+	.	I	
Eurasiat.	<i>Plantago lanceolata</i> L.	.	.	.	+	.	I	
Eurasiat.	<i>Plantago media</i> L.	.	.	.	+	.	I	
Eurasiat.	<i>Scabiosa columbaria</i> L.	.	.	.	.	+	I	
Eurasiat	<i>Carex caryophyllea</i> Latourr.	.	.	.	.	+	I	
char. and diff. species of <i>Cisto Micromerietea</i>								
Orof-S-Europ	<i>Teucrium montanum</i> L.	1	1	+	+	1	V	
	<i>Lomelosia crenata</i> (Cirillo) Greuter & Burdet ssp. <i>crenata</i>	.	.	1	+	.	II	
S-Medit-Mont	<i>Cistus creticus</i> L. <i>eriocephalus</i> (Viv.) Greuter & Burdet	.	.	+	+	.	II	
Stenomedit	<i>Sedum rupestre</i> L.	.	1	.	.	.	I	
C-Europ	others							
Eurimedit	<i>Sedum album</i> L.	2	+	1	1	.	IV	
SE-Europ	<i>Thesium linophyllum</i> L.	.	1	1	+	1	IV	
NE-Stenomedit	<i>Crepis rubra</i> L.	+	.	+	.	1	III	



Tscap	Asiat	Crupina vulgaris Cass.	.	1	1	+	.	III
Hcaesp	Paleotemp	Poa bulbosa L.	.	2	.	+	+	III
Hscap	Medit-Mont	Seseli peucedanoides (M. Bieb.) Koso-Pol.	1	.	1	+	.	III
Chsuff	Centro-Eur.-Pontico	Alyssum montanum L. ssp. montanum	.	1	+	.	1	III
Gbulb	Endem.	Bunium petraeum Ten.	+	2	.	.	.	II
Hscap	Eurasiat.	Bupleurum falcatum L.	.	.	.	+	+	II
Hscap	Stenomedit	Elaeoselinum asclepium (L.) Bertol. ssp. asclepium	.	.	1	+	.	II
Tscap	Eurasiat	Cerastium semidecandrum L.	+	+	.	.	.	II
Hcaesp	Subcosmop	Dactylis glomerata L.	.	+	.	+	.	II
Hscap	Paleotemp	Hypericum perforatum	.	.	+	+	.	II
Tscap	Stenomedit	Linum strictum L.	.	.	+	+	.	II
Tscap	Paleotemp.	Medicago lupulina L.	.	+	.	+	.	II
Ch suff	Eurasiat	Minuartia verna (L.) Hiern	.	+	.	.	+	II
Gbulb	Eurimedit	Muscari comosum (L.) Mill.	.	.	+	+	.	II
		Sedum amplexicaule DC. ssp. tenuifolium (Sm. in	.	1	.	1	.	II
Chsucc	Stenomedit	Sibth. & Sm.) Greuter	.	.	.	.	.	II
Tscap	Eurimedit	Trifolium stellatum L.	.	.	+	+	.	II
Tscap	Stenomedit.-Turan.	Triticum ovatum (L.) Raspail	.	.	1	+	.	II
Hscap	Eurasiat	Vincetoxicum hirundinaria Medik. ssp. hirundinaria	.	+	.	.	+	II
Gbulb	SE-Europ	Himantoglossum adriaticum H. Baumann	+	.	.	.	+	II
Hscap	Endem	Laserpitium siler L. ssp. gargaricum (Ten.) Arcang.	.	+	.	.	1	II
Tscap	Eurimedit	Aira caryophyllea L.	.	+	.	+	.	II
		sporadic species	.	6	4	6	.	

### POTENTILLA ERECTA-ASPHODELUS MACRO-CARPUS COMMUNITY (Tab. 12)

**Distribution:** these grasslands are localized between 1000 and 1100 m, in karst basin on gentle slopes (<10°) or in the beech forest clearings, where organic matter accumulation and substrate humidity are considerable compared to the other grasslands herein analysed.

**Structure and synecology:** the association shows high herb coverage; emicriptophytes are dominant (52%) with an amount of therophytes (18,7 %) and chamaephytes that is not negligible (15,6 %). It is characterized by the presence of *Asphodelus macrocarpus* ssp. *macrocarpus* and *Potentilla erecta*. The association appears as a vicariant of *Anthemido creticae-Stipetum austroitalicae* on the substrate with more mesophilous conditions as highlighted by the presence of *Anthoxanthum odoratum*, *Briza media*, *Dactylis glomerata* ssp. *glomerata*, *Prunella vulgaris* ssp. *vulgaris*, *Plantago media*, *Rhinanthus alectorolophus*, in particular within relevès 1-4. On the contrary, relevès 5-7 could be considered as a transition towards drier grassland communities.

**High frequent taxa:** *Asphodelus macrocarpus* ssp. *macrocarpus*, *Potentilla erecta*, *Crepis lacera*, *Anthyllis vulneraria* ssp. *rubriflora*, *Teucrium chamaedrys*, *Sanguisorba minor* ssp. *minor*, *Eryngium amethystinum*, *Sedum amplexicaule* ssp. *tenuifolium*, *Petrorhagia saxifraga*, *Aethionema saxatile*.

**Syntaxonomy:** there is not an evident syntaxonomical reference for this community; in particular is not possible to use as a reference *Filipendulo vulgaris-Asphodeletum albi*, an association described for the neighbouring mountain reliefs of the upper Val d'Agri (Corbetta *et al.*, 1984) because it is different regarding floristic composition and ecology, in particular higher altitude). Provisionally we retain as appropriate classify this community as a semi-mesophilous aspect, characterized by *Asphodelus macrocarpus*, within the

framework of Apenninic *Phleo-Bromion erecti* dry grasslands.

**Dynamic:** From a dynamical point of view this community is related to termophilous beech forests of *Geranio versicoloris-Fagion* at higher altitudes and to the *Ostrya capinifolia* woods at lower altitudes.

### Conclusion

Due to the geomorphological conformation of the area, we detected several vegetation types according to the characteristic of substrata, slopes and aspect rather than altitude. The description of several new syntaxa testifies the importance of setting up regional vegetation database for scientific and conservation issues and the biodiversity value of the territory that was not previously surveyed. In fact the results of our investigations remarkably improved the botanical knowledge of the flora and vegetation of the Maddalena Mountains and confirm the special interest of this biotope for the presence of many habitats of conservation concern sensu EU Habitat Directive. Furthermore, as revealed by the phytogeographic analysis, the position of the Maddalena mountains determines, together with the semi-continental supramediterranean phytoclimatic features of large part of the territory, a particular species assemblage within the vegetation communities. In particular the edaphoxerophilous communities resulted quite different by the phytosociological findings of the neighbouring territory along the Tyrrhenian coast of Southern Peninsula (e.g. Caneva *et al.* 1994; Maiorca & Spampinato 1999, Corbetta *et al.* 2004, Rosati *et al.* 2010). As a consequence, the floristic and phytosociological analysis revealed the presence of a strong endemic and oriental component, together with the lack of a specific western component; the vegetation classification at higher syntaxonomic level highlighted that these inner ridges of the campano-lucanian Apennines are characterized by the presence of Apenninic

Tab. 12 - *Potentilla erecta-Asphodelus macrocarpus* community

		Relevé number	1	2	3	4	5	6	7	Presences	
		Altitude (m a.s.l.)	1040	1040	1030	1040	1040	1000	1040		
		Aspect	SW	SW	NNW	SW	SW	S	SW		
		Slope (°)	3	10	-	3	-	10	10		
		Cover (%)	70	70	70	50	60	50	70		
		Rock debris (%)	10	-	-	50	20	10	10		
		Area (m2)	100	80	150	50	50	100	100		
		species richness	38	40	29	40	39	18	41		
<i>Potentilla erecta-Asphodelus macrocarpus</i> community											
H scap	Eurasiat	<i>Potentilla erecta</i> (L.) Raeusch.	+	1	+	1	+	1	.		V
G rhiz	W-Medit-Mont	<i>Asphodelus macrocarpus</i> Parl. ssp. <i>macrocarpus</i>	+	2	1	+	.	.	+	IV	
char. and diff. species of <i>Phleo ambigu-Bromion erecti</i>											
H scap	NE-Medit	<i>Eryngium amethystinum</i> L.	1	2	1	+	+	1	+	V	
H ros	Endem	<i>Crepis lacera</i> Ten	1	+	+	1	1	.	1	V	
H caesp	Eurimedit	<i>Petrorhagia saxifraga</i> (L.) Link	1	1	+	+	1	.	+	V	
H caesp	Paleotemp	<i>Bromus erectus</i> Huds. ssp. <i>erectus</i>	1	1	2	.	.	2	2	IV	
G rhiz	Endem	<i>Phleum hirsutum</i> Honck. ssp. <i>ambiguum</i> (Ten.) Tzvelev	1	2	.	2	.	1	2	IV	
H caesp	Endem	<i>Centaurea deusta</i> Ten.	1	1	1	.	1	.	.	III	
H caesp	Endem	<i>Carex macrolepis</i> DC.	+	+	.	.	.	.	.	II	
char. and diff. species of <i>Scorzonero-Chrysopogonetalia and Festuco-Brometea</i>											
H scap	Paleotemp	<i>Sanguisorba minor</i> Scop. ssp. <i>minor</i>	+	1	1	+	1	1	1	V	
H scap	Eurimedit	<i>Anthyllis vulneraria</i> L. ssp. <i>rubriflora</i> (DC.) Arcang.	1	1	1	1	+	.	+	V	
Ch suff	Eurimedit	<i>Teucrium chamaedrys</i> L.	1	1	+	+	+	.	+	V	
Ch suff	Medit-Mont	<i>Aethionema saxatile</i> (L.) R. Br.	+	+	+	1	1	.	+	V	
Ch rept	Eurimedit	<i>Thymus longicaulis</i> C. Presl ssp. <i>longicaulis</i>	+	+	.	1	+	.	1	IV	
G bulb	Endem	<i>Bunium petraeum</i> Ten.	+	1	.	.	1	.	1	III	
H scap	Stenomedit	<i>Elaeoselinum asclepium</i> (L.) Bertol.	+	.	.	1	1	.	1	III	
Ch suff	Orof-S-Europ	<i>Acinos alpinus</i> (L.) Moench	1	+	.	+	+	.	.	III	
H ros	Eurasiat	<i>Hieracium pilosella</i> L. ssp. <i>pilosella</i>	+	.	.	+	+	.	.	III	
H bienn	Subatl	<i>Linum bienne</i> L.	.	+	+	.	.	.	+	III	
H scap	Medit-Mont	<i>Iberis carnosa</i> Willd. <i>carnosa</i>	.	.	.	1	+	.	+	III	
<i>Helianthemum nummularium</i> (L.) Mill. ssp. <i>obscurum</i>											
Ch suff	Europ-caucas	(Celak.) Holub	1	+	.	.	.	.	1	III	
H bienn	Stenomedit	<i>Sisylx atropurpurea</i> (L.) Greuter & Burdet	+	1	.	+	.	.	.	III	
H ros	Eurasiat	<i>Plantago lanceolata</i> L.	.	+	.	.	.	1	+	III	
H scap	Eurosib	<i>Filipendula vulgaris</i> Moench	+	1	1	.	.	.	.	II	
G rad	SE-Mont	<i>Thesium linophyllum</i> L.	.	.	1	.	.	.	+	II	
Ch suff	SW-Europ	<i>Helianthemum apenninum</i> (L.) Mill. ssp. <i>apenninum</i>	.	.	.	1	.	+	.	II	
H bienn	Paleotemp	<i>Centaurium erythraea</i> Rafn. ssp. <i>erythraea</i>	.	.	+	.	.	+	.	II	
H scap	Eurimedit	<i>Convolvulus cantabrica</i> L.	.	+	.	.	.	.	+	II	
H scap	Medit-Mont	<i>Asperula aristata</i> L. f. ssp. <i>longiflora</i> (Waldst. & Kit.) Hayek	.	.	.	.	+	.	+	II	
G bulb	Eurimedit	<i>Muscari comosum</i> (L.) Mill.	.	+	.	.	.	.	+	II	
H ros	Orof-S-Europ	<i>Armeria canescens</i> (Host) Ebel	+	+	.	.	.	.	.	II	
H caesp	Subatl	<i>Brachypodium rupestre</i> (Host) Roem. & Schult.	+	+	.	.	.	.	.	II	
H scap	Circumbor	<i>Prunella vulgaris</i> L. ssp. <i>vulgaris</i>	+	1	.	.	.	.	.	II	
H scap	E-Medit	<i>Polygala major</i> Jacq.	.	.	.	1	.	+	.	II	
H ros	Eurasiat	<i>Plantago media</i> L.	.	.	.	.	1	.	+	II	
H scap	Medit-Mont	<i>Valeriana tuberosa</i> L.	.	+	.	.	.	.	.	I	
H scap	Medit-Mont	<i>Seseli peucedanoides</i> (M. Bieb.) Koso-Pol.	.	.	.	1	.	.	.	I	
Ch rept	Europ	<i>Euphorbia myrsinites</i> L. ssp. <i>myrsinites</i>	.	.	.	.	1	.	.	I	
G rhiz	E-Medit	<i>Asphodeline lutea</i> (L.) Rchb.	.	.	.	.	+	.	.	I	
H scap	Eurimedit	<i>Prunella laciniata</i> (L.) L.	.	.	.	.	.	1	.	I	
<i>Onosma helvetica</i> Boiss. em. Teppner ssp. <i>lucana</i> (Lacaita)											
Ch suff	Endem	Peruzzi, Aquaro & Cesca	.	.	.	.	.	.	+	I	
Ch suff	Orof-S-Europ	<i>Teucrium montanum</i> L.	.	.	.	.	.	.	1	I	
others											
<i>Sedum amplexicaule</i> DC. ssp. <i>tenuifolium</i> (Sm. in Sibth. & Sm.) Greuter											
Ch suff	Stenomedit		1	1	1	1	1	1	+	V	
H caesp	Eurasiat	<i>Anthoxanthum odoratum</i> L.	1	2	1	.	1	.	1	IV	
H caesp	Eurosib	<i>Briza media</i> L.	3	2	1	.	1	.	+	IV	
T scap	Stenomedit	<i>Aira caryophylla</i> L. ssp. <i>caryophylla</i>	1	2	1	.	1	.	+	IV	
T scap	Paleotemp	<i>Trifolium campestre</i> Schreb.	1	+	+	.	+	+	.	IV	
H scap	Paleotemp	<i>Hypericum perforatum</i>	1	+	1	.	+	.	+	IV	
Ch suff	Eurimedit	<i>Sedum album</i> L.	+	.	.	1	1	.	+	III	
T scap	Eurimedit	<i>Linum strictum</i> L.	+	1	.	+	.	.	+	III	
T scap	Paleotemp	<i>Trifolium arvense</i> L.	+	+	+	.	.	.	.	III	
Ch suff	Eurasiat	<i>Genista tinctoria</i> L.	+	1	.	2	+	.	.	III	
T scap	Eurasiat	<i>Cerastium semidecandrum</i> L.	+	.	.	1	1	.	+	III	
H scap	Paleotemp	<i>Hypericum tetrapterum</i> Fr.	+	1	.	.	1	.	.	III	
H caesp	Paleotemp	<i>Dactylis glomerata</i> L. ssp. <i>glomerata</i>	1	1	+	.	.	.	.	III	
T scap	Medit-Asiat	<i>Crupina vulgaris</i> Cass.	.	+	.	1	.	.	1	III	
T scap	Eurimedit	<i>Trifolium stellatum</i> L.	1	.	+	.	+	.	.	III	
T scap	Eurimedit	<i>Geranium dissectum</i> L.	+	.	.	+	.	.	+	III	
H caesp	Eurimedit	<i>Petrorhagia prolifera</i> (L.) P.W. Ball & Heywood	+	+	.	.	.	.	+	III	
T scap	C-Europ	<i>Rhinanthus alectorolophus</i> (Scop.) Pollich	+	+	.	.	1	.	.	II	
T par	Eurasiat	<i>Cuscuta epithymum</i> (L.) L.	+	.	.	.	.	.	+	II	
H bienn	Europ	<i>Echium vulgare</i> L.	+	.	.	.	.	.	+	II	
H scap	Orof-Eurasiat	<i>Delphinium fissum</i> Waldst. & Kit. <i>fissum</i>	.	.	+	.	+	.	.	II	
H caesp	C-Europ	<i>Phleum pratense</i> L.	.	.	2	.	.	1	.	II	
T scap	Medit-Atl	<i>Parentucellia viscosa</i> (L.) Caruel	.	.	.	+	.	.	+	II	
H scap	Eurimedit	<i>Galium lucidum</i> All.	.	.	.	.	+	.	+	II	
H scap	Paleotemp	<i>Poa bulbosa</i> L.	.	.	.	.	1	.	+	II	
T caesp	Subcosmopol	<i>Vulpia myuros</i> (L.) C.C. Gmel.	.	.	.	.	1	.	+	II	
sporadic species											
			.	.	3	13	1	1	.		

endemic syntaxa (e.g. *Physospermo-Quercion cerridis*, *Phleo-Bromion erecti*, *Festuco-Ostryenion*) or syntaxa with Apennine-Balkan and E-Mediterranean distribution (e.g. *Ostryo carpinifoliae-Tilienion platyphylli*, *Geranio versicoloris-Fagion*, *Cisto-Ericion*),

meanwhile, the mountain of Cilento and W-Calabrian Apennines have to be considered a not negligible orographic barrier to the eastward spread of the Tyrrhenian biochora.

### Syntaxonomic scheme

QUERCO-FAGETEA Br.-Bl. & Vlieger in Vlieger 1937

FAGETALIA SYLVATICAE Pawlowski in Pawlowski, Sokolowski & Wallisch 1928

**Geranio versicoloris-Fagion sylvaticae** Gentile 1970

*Doronicum orientalis-Fagenion sylvaticae* (Ubaldi 1985) Di Pietro, Izco & Blasi 2004

*Anemone apenninae-Fagetum sylvaticae* (Gentile 1970) Brullo 1983

**Tilio platyphylli-Acerion pseudoplatani** Klika 1955

*Ostryo carpinifoliae-Tilienion platyphylli* Košir, Čarni & Di Pietro 2008

*Aro lucani-Aceretum lobelii* Paura & Cutini 2006

**Corylo-Populion tremulae** (Br.-Bl. ex O. Bolos 1973) Riv.-Mart. & Costa 1998

*Aceri obtusati-Populion tremulae* Taffetani 2000

*Geranio versicoloris-Populetum tremulae* ass. nova hoc loco

QUERCETALIA PUBESCENTI-PETRAEAE Klika 1933

**Carpinion orientalis** Horvat 1958

*Lauro nobilis-Quercenion pubescentis* Ubaldi 1995

*Aceri neapolitani-Quercetum virgiliana* ass. nova hoc loco

*Cytiso sessilifolii-Quercenion pubescentis* Ubaldi 1995

*Roso spinosissimae-Quercetum dalechampii* ass. nova hoc loco

*Festuco exaltatae-Ostryenion carpinifoliae* Blasi, Filibeck & Rosati 2006

*Sesleria autumnalis-Aceretum obtusati* Corbetta & Ubaldi in Corbetta et al. 2004

**Physospermo verticillati-Quercion cerridis** Biondi et al. ex Biondi, Casavecchia & Biscotti 2013 in Biondi, Allegrezza, Casavecchia, Galdenzi, Gigante & Pesaresi 2013

*Physospermo verticillati-Quercetum cerridis* Aita, Corbetta & Orsino 1977

*pulmonarietosum* Zanotti, Ubaldi, Corbetta & Pirone 1993

RHAMNO CATHARTICI-PRUNETEA SPINOSAE Rivas-Goday & Borja-Carbonell 1961 ex Tuxen 1962

PRUNETALIA SPINOSAE Tuxen 1952

**Cytision sessilifolii** Biondi in Biondi, Allegrezza & Guitian 1988

*Spartium juncei-Cytisetum sessilifolii* Biondi, Allegrezza & Guitian 1988

**Pruno-Rubion ulmifolii** O. de Bolòs 1954

*Pruno-Rubenion ulmifolii* O. de Bolòs 1954

*Roso squarrosae-Rubetum ulmifoliae* ass. nova

CISTO CRETICI-MICROMERIETEA JULIANAE Oberdorfer. 1954

CISTO-ERICETALIA MANIPULIFLORAE Horvatić

**Cisto-Ericion manipuliflorae** Horvatić

*Onosmo lucanae-Lomelosietum crenatae* ass. nova hoc loco

*pimpinellatosum tragi* subass. nova hoc loco

FESTUCO-BROMETEA Br.-Bl. & Tx. 1943 ex Br.-Bl. 1949

SCORZONERO VILLOSAE-CHRYSOPOGONETALIA GRYPILLI Horvatić & Horvat in Horvatić 1963

**Phleo ambiguus-Bromion erecti** Biondi & Blasi ex Biondi, Ballelli, Allegrezza & Zuccarello ex Biondi & Galdenzi 2012

*Sideritidenion italicae* Biondi, Ballelli, Allegrezza & Zuccarello 1995 corr. Biondi, Allegrezza, Zuccarello 2005 ex Biondi & Galdenzi 2012

*Anthemido cretici-Stipetum austroitalicae* ass. nova hoc loco

*Potentilla erecta-Aphodelus macrocarpus* community

## Others syntaxa quoted in the text

- Acino suaveolentis-Stipetum austroitalicae* Forte & Terzi in Forte, Perrino & Terzi 2005  
*Artemisio albae-Saturejion montanae* Allegrezza, Biondi, Formica & Ballelli 1997  
*Betulo pendulae-Populetales tremulae* Rivas-Martínez & Costa 2002  
*Chamaecytiso spinescentis-Stipetum austroitalicae* Forte & Terzi in Forte, Perrino & Terzi 2005  
*Chamaeleono gummiferis-Stipetum austroitalicae* Brullo, Scelsi & Spampinato 2001  
*Cisto cretici-Ericion manipuliflorae* Horvatić 1958  
*Cytiso spinescentis-Saturejion montanae* Pirone & Tammaro 1997  
*Erythronio dentis-canis-Carpinion betuli* (Horvat 1958) Marinček in Wallnöfer, Mucina & Grass 1993  
*Asphodelo albi-Filipenduletum vulgaris* Corbetta et al. ex Biondi, Ballelli, Allegrezza et Zuccarello 1995 nom. invers. propos. Terzi 2011  
*Fraxino orni-Populetales tremulae* Taffetani 2000  
*Hippocrepido glaucae-Stipion austroitalicae* Biondi & Galdenzi 2012  
*Hippocrepido glaucae-Stipion austroitalicae* Forte & Terzi in Forte, Perrino & Terzi 2005  
*Holco molli-Populetales tremulae* Rosati, Filibeck, De Lorenzis, Lattanzi, Surbera, Fascetti, & Blasi 2012  
*Lathyro digitati-Quercetum cerridis* Bonin & Gamisans 1977  
*Lauro nobilis-Tilion platyphylli* Biondi, Casavecchia & Biscotti 2008  
*Lygeo-Stipetea* Rivas-Martínez 1978  
*Pistacio terebinthi-Paliuretum spina-christi* Blasi & Di Pietro 2001  
*Putorio calabrica-Scabiosetum crenatae* Biondi, Ballelli & Taffetani 1992  
*Rosmarinetea officinalis* Rivas-Martínez, Fernández-González, Loidi, Lousã et Penas 2001  
*Roso sempervirentis-Rubetum ulmifoliae* Blasi, Di Pietro & Fortini 2002  
*Saturejo montanae-Scabiosetum crenatae* Biondi, 2000  
*Saturejo graecae-Hyparrhenion hirtae* O.Boldòs 1962  
*Syderitido syriacae-Stipetum austroitalicae* Fanelli, Lucchese & Paura 2001  
*Coridothymo-Helianthemenion joni* Di Pietro & Misano 2013

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### Appendix 1: Localities and dates

Table 1: Rel. 1: Manca Macera (Moliterno), 18.6.1975; Rel. 2: M. Calvarosa (Moliterno), 18.6.1975; Rel. 3: M. Calvarosa (Moliterno), 25.6.2001; Rel. 4: M. Fontanalunga (Paterno), 26.7.2007; Rel. 5: M. Cavallo (Padula), 15.6.2007; Rel. 6: Manca Macera (Moliterno), 26.6.2001; Rel. 7: M. Fontanalunga (Paterno), 26.7.2007; Rel. 8: Sterraturò (Moliterno), 25.6.2001; Rel. 9: Km 24 S.S.103 (Moliterno), 08.7.2010; Rel. 10: M. dell'Aquila (Tramutola), 08.7.2010; Rel. 11: S.S. 10 Km 24-25 (Moliterno), 26.6.2001.

Table 2: Rel. 1: Manca Macera (Moliterno), 26.6.2001; Rel. 2: Bosco Petazzi (Paterno), 23.6.2010; Rel. 3: Bosco Nocera (Paterno), 23.6.2010; Rel. 4: Sterraturò

(Moliterno), 25.6.2001; Rel. 5: Petenella 26.6.2001 (Moliterno).

Table 3: Rel. 1, 2, 3, 4: M. Calvarosa (Moliterno), 25.06.01; Rel. 5: Galamberto (Moliterno), 25.05.07; Rel. 6: Valico Faggeto (Moliterno), 25.06.00; Rel. 7 Pergola (Brienza) 15.06.03; Rel. 8 Madonna di Monserrato (Grumento Nova) 25.05.00; Rel. 9: Capocavolo (Tramutola) 05.06.06; Rel. 10 Timpa d'Elce (Tramutola), 05.06.06; Rel.1 1: M. Aquila (Tramutola), 05.06.06; Rel. 12: M. delle Vigne (Grumento Nova), 05.06.06; Rel. 12: Tempa di Cono (Tramutola) 05.06.06.

Table 4: Rel. 1: Sella Cessuta, (Moliterno), 26.6.01; Rel. 2, 3: M. Calvarosa (Moliterno), 28.06.01; Rel. 4: Petenella (Moliterno), 28.06.2001; Rel. 5; Madonna di Monserrato (Grumento Nova) 25.05.00; Rel. 6: M. Aquila (Tramutola), 05.06.06.

Table 5: Rel. 1, 2, 3, 4: M. Calvarosa, 29.06.2001; Rel. 5: M. Serranetta (Pignola), 15.5.2006; Rel. 6: Serra di Calvello (Calvello), 12.07.2003; Rel. 7: M. Lama (Marsico Nuovo), 12.07.2003.

Table 6: Rel. 1, 2: Manca Macera (Moliterno), 26.6.2001; Rel. 3: Tempa d'Elce (Tramutola) 15.06.2008.

Tab. 7: Rel. 1, 5, 6: M. Calvarosa (Moliterno), 25.6.2001; Rel. 2: Bosco Garaguso (Brienza), 26.6.2007; Rel. 3, 4: Sterraturu (Moliterno), 25.6.2001; Rel. 7: M. Motola (Teggiano), 13.07.2006; Rel. 8: M. Motola (Teggiano), 11.08.2000; Rel. 9: M. Carmelo, 14.07.2006; Rel. 10: M. Carmelo, 14.07.2006.

Table 8: Rel. 1: Sella Cessuta (Moliterno), 26.6.2001; Rel.2: S.S. n. 103 Km 25 (Moliterno), 26.6.2001; Rel. 3, 4: M. Calvarosa (Moliterno) , 08.07.2007; Rel. 5: Manca Macera (Moliterno), 8.27.2007.

Table 9: Rel.1: Monticello (Tramutola), 26.6.2001; Rel. 2: Madonna di Monserrato (Grumento Nova), 26.6.2007; Rel. 3,4: Grumentum (Grumento Nova) , 08.07.2007; Rel. 5: Pozzi (Brienza), 27.04.2008.

Table 10: Rel.1, 3, 4, 5: M. Calvarosa (Moliterno), 25.6.2001; Rel. 2 ,6: Manca Macera (Moliterno), 26.6.2001; Rel. 7: Serra di Mezzo (Tramutola) 15.06.2008; Rel. 8, 9 Sella Cessuta (Moliterno), 26.6.2001; Rel. 13 Tempa d'Elce (Tramutola) 20.05.2008; Rel. 11, 12: Serra di Mezzo (Tramutola); Rel. 14, 15: Madonna di Monserrato (Grumento Nova) 08.07.2007.

Table 11: Rel. 1: M. Calvarosa, (Moliterno), 27.6.2001; Rel. 2, 3: S. Martino (Pergola), 27.6.2007; Rel. 4: M. dell'Aquila (Tramutola), 08.07.2010; Rel. 5: Curcio, 11.07.1990 (Moliterno).

Table 12: Rel. 1, 2: Faggeto (Moliterno), 26.6.2001; Rel. 3: M. Cavallo (Padula), 15.6.2007; Rel. 4: Petenella (Moliterno), 26.6.2001; Rel.5 : Sterraturu (Moliterno), 25.6.2001; Rel. 6 : Valle del Cavolo (Tramutola), 16.05.2009; Rel. 7: C.da Croce (Pergola), 16.05.2009.

## Appendix 2: Sporadic species

Tab.1: Rel. 1 *Physospermum verticillatum* (1), *Hordeymus europaeus* (+); Rel. 2 *Arum maculatum* (+); Rel. 5 *Dactylis glomerata* (+); Rel. 6 *Rosa canina* (+), *Geranium dissectum* (+), *Prunus spinosa* (+), *Silene vulgaris* (+); Rel. 8 *Bellis perennis* (+), *Laserpitium latifolium* (+), *Juniperus communis* (+), *Cytisus sessilifolius* (+); Rel. 10 *Agropyrum caninum* (+); *Dianthus barbatus* (+), *Lapsana communis* (+).

Tab. 2: Rel.1 *Anacamptis pyramidalis* (+), *Asphodelus macrocarpus* ssp. *macrocarpus* (+), *Brachypodium rupestre* (1), *Securigera varia* (+), *Origanum vulgare* ssp. *viridulum* (+), *Smyrniolum olusatrum* (+), *Aegopodium podagraria* (+); Rel. 2 - *Genista tinctoria* (+), *Sesleria autumnalis* (+), *Vincetoxicum hirundinaria* ssp. *hirundinaria*; Rel.3 *Juniperus communis* ssp. *communis* (+).

Tab. 3: Rel. 1 *Scabiosa columbaria* (1), *Stachys recta* ssp. *labiosa* (1).

Tab. 4: Rel. 1 *Thesium divaricatum* (+), *Stachys recta* ssp. *labiosa* (+), *Scabiosa columbaria* (+), *Platanthera clorantha* (+), *Leontodon hispidus* (+), *Orchis tridentata* (+), *Ophrys pollinensis* (+), *Helichrysum italicum* (1); Rel.4 *Poa bulbosa* (+); Rel. 2 *Orchis anthropophora* (+), *Laserpitium garganicum* ssp. *garganicum* (+).

Tab. 5: Rel.1 *Cerastium tomentosum* (+), *Cruciata glabra* (+); Rel.4 *Muscari comosum* (+), *Sambucus ebulus* (+), *Tragopogon crocifolius* (1), *Laserpitium siler* ssp. *siculum* (+), *Himantoglossum adriaticum* (+).

Tab. 6: Rel.1 *Clematis vitalba* (+), *Crataegus monogyna* (+); Rel. 2 *Acer obtusatum* ssp. *neapolitanum* (1), *Ajuga reptans* (+), *Arabis turrata* (+), *Carex depauperata* (+), *Geum urbanum* (+), *Helleborus foetidus* ssp. *foetidus* (+), *Potentilla micrantha* (+), *Veronica chamaedrys* ssp. *chamaedrys* (+), *Fragaria vesca* ssp. *vesca* (+), *Aegopodium podagraria* (2); Rel. 3 *Lilium bulbiferum* ssp. *croceum* (1), *Melittis melissophyllum* ssp. *albida* (1), *Smyrniolum perfoliatum* (+), *Geranium robertianum* (+).

Tab. 7: Rel. 1: *Ruscus aculeatus* (+), *Galium lucidum* (+), *Geranium purpureum* (+), *Arctium lappa* (+), *Colchicum lusitanum* (+), *Rosa villosa* (+), *Alliaria petiolata* (+); Rel. 3: *Aegopodium podagraria* (+); Rel. 6: *Coronilla varia* (+), *Geranium dissectum* (+), *Polygala nicaeensis* (+), *Thymus pulegioides* (+), *Hieracium lachenalii* (+); Rel. 4 : *Poa trivialis* (1), *Rumex* sp. (1), *Asphodelus macrocarpus* (+), *Silene alba* (+), *Opopanax chironium* (+), *Rosa agrestis* (1), *Rubus canescens* (2), *Trifolium* cfr. *montanum* (+), *Geranium sanguineum* (+), *Lathyrus pratensis* (+), *Lathyrus odoratus* (1), *Brachypodium rupestre* (+), *Peucedanum* sp.(+); Rel. 9 *Cruciata laevipes* (+), *Cystopteris fragilis* (+), *Rosa squarrosa* (1), *Lathyrus grandiflorus* (+), *Polypodium interjectum* (+); Rel.10 *Stellaria media* (+), *Vicia incana* (+); *Myosotis sylvatica* (+).

Tab. 8: Rel. 1: *Ononis spinosa* (+); Rel. 2 *Senecio eru-*



cifolius (+), Centaurium erythraea (+), Thesium divaricatum (+), Linum tenuifolium (+), Pimpinella saxifraga (+); Rel. 3: Ajuga reptans (+), Anthoxanthum odoratum (+), Asphodelus albus (1), Cytisus scoparius (+), Festuca exaltata (1), Filipendula vulgaris (1), Pteridium aquilinum (2), Tanacetum corymbosum (1); Rel. 4: Bromus erectus (1), Carlina vulgaris (1), Dorycnium pentaphyllum (+), Helianthemum nummularium ssp. obscurum (1), Micromeria graeca (+), Pulicaria odora (+), Sedum rupestre (+), Cistus creticus ssp. eriocephalus (+), Stachys recta ssp. labiosa (+); Rel. 5: Coronilla varia (+), Cytisus villosus (1), Laserpitium latifolium (+), Luzula sicula (+), Potentilla micrantha (+), Cistus creticus ssp. eriocephalus (1).

Tab. 9: Rel. 1 Cistus creticus ssp. eriocephalus (+), Stachys recta ssp. labiosa (+); Rel. 2: Ficus carica (+), Rel. 4: Geranium lucidum (+), Thapsia garganica (+), Thymus striatus (+), Ajuga reptans (+), Centaurium erythraea (+); Rel. 5: Pulicaria odora (+), Ferula communis (+).

Tab. 10: Rel. 2 Sedum album (+), Clematis vitalba (+),

Rel. 4: Quercus ilex (+); Rel. 6 Convolvulus cantabrica (+), Blackstonia perfoliata (+); Rel. 10 Genista sagittalis (+).

Tab. 11: Rel. 3 Potentilla erecta (+); Fraxinus ornus (+), Dorycnium pentaphyllum (+), Coronilla scorpioides (+), Medicago scutellata (+); Rel. 4 Lotus corniculatus (+), Plantago lagopus (+), Briza minima (+), Scrophularia nodosa (+), Trifolium angustifolium (+), Carduus nutans (+); Rel. 5 Genista tinctoria (+), Trifolium scabrum (+), Tanacetum corymbosum (+), Narcissus poeticus (+) Cynosurus echinatus (+), Asphodelus albus (+).

Tab. 12: Rel. 3 Fraxinus ornus (1), Gladiolus italicus (+), Melilotus officinalis (+); Rel. 4 Micromeria graeca (+), Clematis vitalba (+), Coronilla varia (2), Crataegus monogyna (+), Cytisus sessilifolius (1), Viola kitaibeliana (+), Linaria purpurea (+), Origanum heracleoticum (+), Populus tremula (2), Pyrus pyraster (1), Quercus cerris (1), Silene vulgaris (+); Rel. 5 Cynosurus echinatus (1); Rel.6: Dorycnium pentaphyllum (3).