

Dedicated to Prof. dr. LJUDEVIT ILIJANIĆ on the occasion of his 70th birthday.

Some aspects of the chasmophytic vegetation in the Cilento – Vallo di Diano National Park (Campania – Italy)

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Within a wide area of research relating to the Cilento National Park, several aspects of the chasmophytic vegetation have been analyzed. Two calcareous substrata areas have been studied: one on the coast and one inland. Three plant communities corresponding to three different associations have been recognized: *Crithmo-Limonietum remotispiculi* (*Crithmo-Limonion*), *Centaureo-Campanuletum fragilis primuletosum palinuri* and *Campanulo fragilis-Portenschlagiellum ramosissimae* (*Dianthion rupicolae*). For the last, a new sub-association named *Phagnalonetosum rupestris* is proposed.

Key words: Chasmophytic, vegetation, plant, communities, calcareous rocks, Cilento, Italy.

Introduction

The importance and peculiarity of rocky environments as bio-diversity reserves have been recognized by UE Directive 92/43 concerning the preservation of the most significant natural habitats in Europe; thus, rocky slopes are among those of prior interest. Along the Italian territory and particularly along the central-southern Apennine chain, the rocky environment differs depending on the nature of the substratum, exposure, humidity and altitude. For the central and southern Apennines the alliance *Saxifragion australis* (*Potentilletalia caulescentis*, *Asplenietea trichomanis*) characterized by the endemic *Saxifraga australis*, *Trisetum bertolonii* and *Campanula tanfanii* was proposed for the rocky environment (BIONDI and BALLELLI 1982). Much more complex is the situation in southern Italy where the floristic differentiation between the coastal rocky en-

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vironment and the inner valleys, especially in the sub-mountain areas, is less marked because of a higher number of thermophilic species. In the Puglia region and especially in the Gargano area, the endemic species play a fundamental role in the characterization of the rocky environment. In fact, both the coastal and inland chasmophytic communities have been classified (BIANCO et al. 1988) as the endemic alliance *Asperulion garganicae* characterized by *Asperula garganica*, *Dianthus garganicus* and *Leontodon apulus*, all of which are endemic. This alliance is referred to the *Centaureo-Campanuletalia* order, which has an amphiadriatic distribution and to the *Asplenietea trichomanis* class. The authors mentioned above have furthermore studied the rocky plant communities of the Murge and the Salento areas (Puglia) with reference to the *Campanulion versicoloris* alliance and to the *Onosmetalia frutescentis* order. These are mostly distributed along the Balkan Peninsula and Greece, testifying to the ancient connections between central-southern Puglia and the so called »Egeide« (FRANCINI-CORTI 1966). In the Cilento National Park (Campania), the high altitude chasmophytic vegetation of the Cervati chain is described by CORBETTA et al. (1988) while the cliff vegetation of Mount Alpi in the Lucania area is described by CORBETTA and PRONE (1981); in both areas, *Saxifragion australis* has been recognized. Besides the Gargano area, the vegetation of the central-southern coast cliffs with appearances extending inland has also been investigated by BRULLO and MARCENÒ (1979) along the southern Tyrrhenian area. Those rocky communities have been ascribed to the *Dianthion rupicolae* alliance that describes the low altitude cliff vegetation of the central Mediterranean area, the *Asplenietalia glandulosi* order and *Asplenietea trichomanis* class. Recently, MAIORCA and SPAMPINATO (1999) have assigned the rocky vegetation of the Natural Reserve »Valley of the Argentino River« in the northern-western part of the Calabria region to these »syntaxa«. The aspects of perennial hallophilic vegetation characterized by species of the *Limonium* genus are strongly connected to the rocky wave-cut cliffs. These have been described by a large number of authors and classified by BARTOLO et al. (1989) into two alliances: *Crithmo-Limonion* and *Plantagini-Thymelaion hirsutae*, *Crithmo-Limonietalia* order and *Crithmo-Limonietea* class. This study analyses coastal and inland rocky communities of some areas of the Cilento National Park that show a well-defined structure and flora.

Study area

The Cilento National Park is situated in the Campania region within the Salerno Province and it includes a large area of the southern Campania Apennines. The geomorphology of the area is characterized by a series of high isolated massifs interposed by lower peaks and often situated near the coastline. The higher altitudes are located towards the Tyrrhenian Sea. Other than just characterizing the structure of this area of the Apennine, they also strongly influence the climate (ABBATE et al. 1996). The study encloses a coastal and an inland area (Fig. 1). The former includes the wide wave-cut cliff known as »Costa degli Infreschi«, located between Marina di Camerota and Scario, the »Capo Palinuro« promontory and a limited number of rocky coast segments near Marina di Ascea. The latter, less wide, includes the large bastion of calcareous rocky slopes near the gorge of

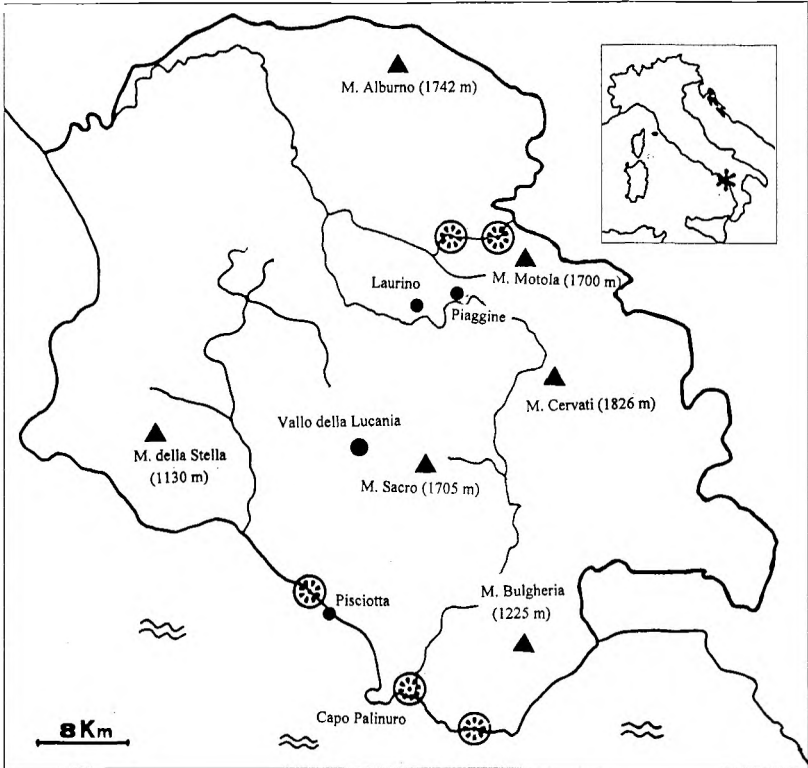


Fig. 1. Study area.

the Sammaro torrent, between Sacco and Roscigno. From a geological point of view, we are dealing with tectonic units resulting from a deformation of external Apennine domains. Furthermore, the coastal cliffs consist of dolomites of the Lower Liassic and Upper Triassic while the inner cliffs consist of platform limestones, local calcareous re-sediments of the Upper Cretaceous and Middle Liassic (AA.VV. 1988). According to the phytoclimatic division of the Campania region (BLASI et al. 1988), the studied area is included in two sectors referred as to coastal and mountain Mediterranean. The coastal area is characterized by moderate rainfalls (1100 mm) and by average monthly temperatures that never fall below 0°C. The rain gauge regime is typically Mediterranean. The sub-mountain and hill area is typical of the inner parts of the region and shows less rainfall than the coast (900 mm); the lowest temperatures never fall below 0°C, but, unlike the coastal area, it has been noted that highest temperatures lower than 10°C are present for 5 months a year.

Materials and Methods

This study is part of a larger research programme into the Cilento National Park conducted by the present authors and other scientists. Vegetation surveys according to Braun-Blanquet (1964) were carried out between 1993 and 1999.

The data collected from the rocky communities of *Dianthion rupicolae* have given rise to a matrix which also includes comparable relevés of the northern Calabria community (MAIORCA and SPAMPINATO 1999). In order to detect distinct clusters, the matrix obtained (species x relevés dimensions 65 x 51) has been elaborated through the multi-variable analysis programs of the »SYNTAX V« package, (PODANI 1993). For the elaboration of the data, the distance of the rope has been used as similarity coefficient, and the average link between the clusters as algorithm of the clustering. The abundance and dominance indexes have been transformed according to the VAN DER MAAREL scale (1979). The nomenclature of species refers to »Flora d'Italia« (PIGNATTI 1982)

Results

The relevé classification has highlighted four main groups (Fig. 2). Groups **a** and **b** refer to rocky coastal communities. Particularly, group **a** refers to coastal communities with *Limonium remotispiculum*, group **b** to those with *Primula palinuri*. Group **c** refers to inland communities. Lastly, group **d** refers to those of Northern Calabria with *Portenschlagiella ramosissima*.

Syntaxonomical scheme

Crithmo-Limonietea Br.-Bl. 1947

Crithmo-Limonietalia Molinier 1934

Crithmo-Limonion Molinier 1934

Crithmo-Limonietum remotispiculi Bartolo et al. 1989

Asplenietea-trichomanis Br.-Bl. in Meier et Br.-Bl. 1934 corr. Oberd. 1977

Asplenietalia glandulosi Br.-Bl. et Meier 1934

Dianthion rupicolae Brullo et Marcenò 1979

Centaureo-Campanuletum fragilis Brullo et Marcenò 1979

primuletosum palinuri Brullo et Marcenò 1979

Campanulo fragilis-Portenschlagiellietum ramosissimae Maiorca et Spampinato 1999

phagnalonetosum rupestris subass. nova

Coastal rocky communities

The Cilento coast, although suffering from anthropic transformations in sandy areas, presents some of the most interesting areas of the whole Mediterranean basin, especially those characterized by vertical inaccessible cliffs. We can refer to famous areas such as the calcareous Cape Palinuro promontory and the »Infreschi coast«. Two aspects connected to the cliff exposure have been identified: the first (Tab. 1) refers to halophilic communities present mainly on cliffs with southern and eastern exposures. The surveys carried out allow us easily to point out these communities within the association *Crithmo-Limonietum remotispiculi* described by BARTOLO et al. (1989) for Campania and Calabria. The association, characterized by the Campania-Calabria-Basilicata endemism *Limo-*

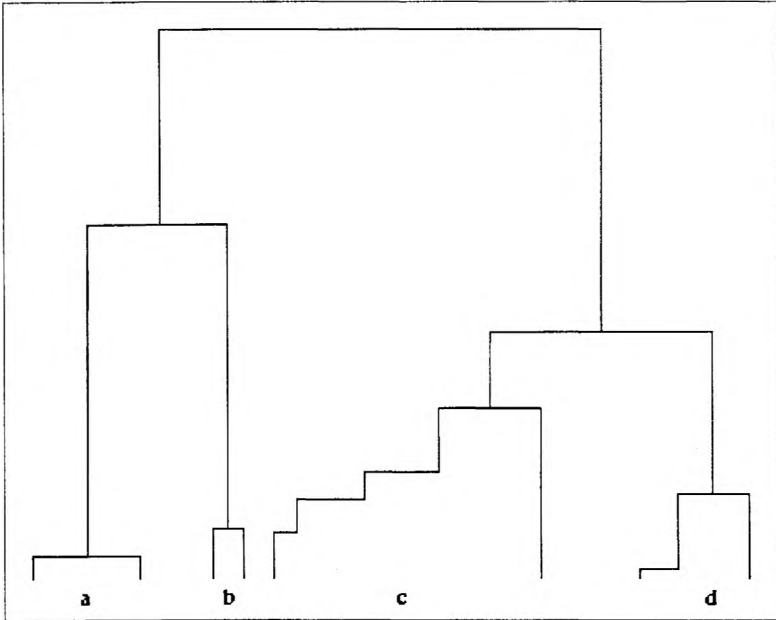


Fig. 2. Dendrogram of the reléve groups:

- a: *Crithmo-Limonietum*;
- b: *Centaureo-Campanuletum primuletosum*;
- c: *Campanulo-Portenschlagiellum phagnalonetosum*;
- d: *Campanulo-Portenschlagiellum* (Maiorca et Spampinato 1999).

nium remotispiculum, is identified in the *Crithmo-Limonion* alliance. *Crithmo-Limonietalia* order, *Crithmo-Limonietea* class. The second aspect (Tab. 2), referring to northern exposed rocks, can be ascribed to the sub-association *primuletosum palinuri* of the *Centaureo-Campanuletum fragilis* association, described by BRULLO and MARCENÒ (1979) and characterized by the endemic *Primula palinuri*, present along the rocky coast from Lazio to Calabria. As observed by PIZZOLONGO (1963), this species settles especially on vertical wall rocks with northern exposures. This community is referred to the endemic alliance *Dianthion rupicolae* and to the *Asplenietalia glandulosi* distributed along the western Mediterranean region. Due to the presence of halophilic species, releves no. 4 and no. 5 of Table 2, represent aspects of transition towards rock communities of *Crithmo-Limonietum*.

Inland rocky communities

In the inner areas of the Cilento National Park (Alburni Mountains, Mingardo, Sammaro. and Calore gorges), the rocky environments of many gorges that are typical of the territory give rise to peculiar aspects of chasmophytic vegetation. On walls of calcareous rocks, often perfectly vertical, especially in southern exposures, typical elements of coastal environments can be found, such as *Euphorbia dendroides*, *Brassica incana* and *Cymbopogon hirtus*, in spite of the

Tab.1. *Critihmo-Limonietum remotispiculi* Bartolo et Al. 1989. Sites and dates of the relevés: rel. 1–10: 1–6–1993, Baia degli Infreschi; rel. 11–15, 14–6–1999, Marina di Ascea.

Relevé N°	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aspect	E	ESE	ESE	SE	S	E	NE	E	S	W	N	N	N	NNW	NNW
Slope (°)	1	1	1	1	1	1	1	1	1	1	1	1	1	40	1
Vegetation cover (%)	30	50	50	40	40	30	40	50	40	40	30	30	50	60	30
Surface (sq. m)	20	20	20	20	16	20	20	40	12	50	9	8	8	15	10
Charact. species of ass.															
Endemic	Ch suffr	1.2	1.2	2.3	2.2	2.2	1.2	1.2	1.2	2.2	+2	+2	1.2	2.3	1.2
	<i>Limonium remotispiculum</i>														
	<i>Critihmo-Limonion, Critihmo-Limonetalia, Critihmo-Limonietea</i>														
Euromedit	Ch suffr	1.2	2.2	1.2	1.2	1.2	1.2	1.2	1.2	2.2	+2	1.2	1.2	+	1.2
	<i>Critihnum maximum</i>														
Steno-medit	Ch suffr	1.2	1.2	2.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	<i>Lotus cyfissoides</i>														
Submedit.-Subatl.	H bienn	+	+	1.2	+	1.2	+	+2	1.2	1.2	1.2	1.2	1.1	1.2	1.1
	<i>Daucus gingidium</i>														
Stenomedit	H scap	.	.	.	.	.	.	.	.	.	1.2	+2	1.2	+	2.2
	<i>Reichardia picroides</i> var. <i>maritima</i>														
	Other species														
SW-Europ	Ch suffr	1.2	2.2	2.2	1.2	2.2	2.3	1.2	2.3	2.2	+2	+2	1.2	3.3	1.2
	<i>Inula crithmoides</i>														
Subndem	Ch suffr	1.2	1.2	1.2	1.2	1.2	1.2	2.2	1.2	+2	.	.	.	.	.
	<i>Dianthus rupicola</i>														
SW-Europ	Ch suffr	.	+	.	.	+	.	+2	.	.	.	.	.	.	.
	<i>Juniperus phoenicea</i>														
Medit-Atlan	T scap	.	.	.	.	.	.	1.2	.	+2	.	.	+2	.	+2
	<i>Catapodium maritimum</i>														
S-Europ	Ch suffr	.	.	.	.	.	.	1.2	.	+2	.	.	.	.	.
	<i>Helichysum italicum</i>														
Euromedit-Iuran	T scap	.	.	.	.	.	.	.	1.2	.	.	.	.	.	.
	<i>Brachypodium distachyum</i>														
Euromedit-Iuran	T scap	.	.	.	.	.	.	.	1.2	.	.	.	.	.	.
	<i>Pistacia lentiscus</i>														
Steno-medit	H caesp	.	.	.	.	.	.	.	.	.	+2	.	.	.	.
	<i>Dactylis hispanica</i>														
W-Steno-medit.	H caesp	.	.	.	.	.	.	.	.	.	1.2	.	.	.	.
	<i>Brachypodium ramosum</i>														

Tab. 2. *Centaureo-Campanuletum fragilis* Brullo et Marcenò 1979 subass. *primuletosum palinuri* Brullo et Marcenò 1979. Sites and dates of the relevés: 1, 2: 31–5–1993, Arco Naturale Foce del Mingardo; rel. 3, 4, 5: 31–5–1993 Palinuro-Marina di Camerota road.

		Releve N°	1	2	3	4	5
		Aspect	ENE	ENE	NW	N	NNW
		Slope (°)	70	1	1	1	1
		Vegetation cover (%)	30	50	25	35	50
		Surface (sq m)	20	40	20	40	50
Charact. species of association							
Endemic	Ch suffr	<i>Centaurea cineraria</i> subsp. <i>cineraria</i>	1.2	1.2	+2	1.2	1.2
Diff. species of subassociation							
Endemic	H ros	<i>Primula palinuri</i>	2.3	2.3	2.2	1.2	2.2
<i>Dianthion rupicolae, Asplenietalia glandulosi, Asplenietea trichomanis</i>							
Subendemic	Ch suffr	<i>Dianthus rupicola</i>	1.2	2.2	+2	1.2	1.2
Subendemic	Ch suffr	<i>Brassica incana</i>	+	+	.	.	.
Other species							
SW-Europ	Ch suffr	<i>Juniperus phoenicea</i>	+	+2	1.2	1.2	2.2
Eurimedit	Ch suffr	<i>Crithmum maritimum</i>	+	1.2	.	.	.
Endemic	Ch suffr	<i>Limonium remotispiculum</i>	.	.	.	1.2	1.2
SW-Europ	Ch suffr	<i>Inula crithmoides</i>	.	.	.	1.2	.
Submedit-Subatl	H bienn	<i>Daucus gingidium</i>	.	.	.	+2	+2
S-Europ	Ch suffr	<i>Helichrysum italicum</i>	.	.	.	.	1.2
Eurimedit	G bulb	<i>Allium ampeloprasum</i>	+2	.	+	.	.
Stenomedit	P caesp	<i>Rhamnus alaternus</i>	.	1.2	.	.	.
Stenomedit	H caesp	<i>Ampelodesmos mauritanicus</i>	.	+2	.	.	.
Stenomedit	NP	<i>Rasmarinus officinalis</i>	.	.	.	1.1	.
Eurimedit-Turan	T scop	<i>Pistacia lentiscus</i>	.	.	.	+2	.
Eurimedit-Turan	T scop	<i>Brachypodium distachyum</i>	.	.	.	1.2	.

distance from the coast and the altitude superior to 600 m a.s.l. (Tab. 3). These are usually found on the most exposed walls of the Sammaro Gorge. The chasmophytic vegetation assumes a peculiar connotation due to the presence of the chasmophytic *Portenschlagiella ramosissima*. It is a very rare species with an Illyrian-Apennine distribution and is listed in the Italian 'Red List' of species in danger (CONTI et al. 1997); it can be found only in a few rocky areas of Campania, Basilicata and Calabria Apennine. This vegetation is referred to the *Campanulo fragilis-Portenschlagiellietum ramosissimae*, an association recently described by MAIORCA and SPAMPINATO (1999) for northern Calabria, *Portenschlagiella ramosissima* being indicated as characteristic. The association is enclosed in the *Dianthion rupicolae*. Besides the clear separation between two associations of the *Dianthion* (*Centaureo-Campanuletum* and *Campanulo-Portenschlagiellietum*), the data (Fig. 2) highlight the floristic autonomy of the Cilento communities with *Portenschlagiella* compared to that from the Calabria region.

The first are characterized by chasmophytic species of high floristic interest, absent in those from the Calabria region: *Phagnalon rupestre*, a chamaephyte within the Tyrrhenian area at a southern center of gravity; *Athamanta sicula*, another rare rocky umbelliferous plant from southern Italy, *Seseli polyphyllum*, an endemic of the sea cliffs of Campania which also makes appearances inland. We think it appropriate to propose for Cilento cliffs communities, characterized by the relatively abundant presence of chasmophytes, a new sub-association of the *Campanulo-Portenschlagiellietum* named *phagnalonetosum rupestris* (holotype: relevè n.7 of Table 3). *Phagnalon rupestre*, *Athamanta sicula* and *Seseli polyphyllum* are proposed as differential species of the new sub-association.

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