

Phytosociological features of *Sesleria calabrica* (Poaceae), an endemic species to Pollino-Orsomarso mountains (southern Italy)

by Romeo Di Pietro

Department Itaca, University of Roma La Sapienza, Via Flaminia 70, I-00196, Roma; romeo.dipietro@uniroma1.it

received October 19, 2009, accepted December 30, 2009

Abstract. - *Sesleria calabrica* (Deyl) Di Pietro is a species belonging to the collective group of *S. juncifolia* s.l. which has been described recently for southern Italy where it is restricted to the Pollino-Orsomarso massifs. In this area *S. calabrica* is widespread between 1200 and 2280 m a.s.l. where it is the dominant species in two grassland types, *Jurineo mollis-Seslerietum calabricae* ass. nov. (lower montane belt) and *Anthyllido atropurpureae-Seslerietum calabricae* ass. nov. (subalpine belt) which belong respectively to *Festuco-Brometea* and *Elyno-Seslerietea* classes. The presence of a southern Italy endemic sub-alliance of *Seslerion apenninae* is hypothesised.

Key words : *Sesleria* - Poaceae - distribution - phytosociology - syntaxonomy.

Résumé. - *Sesleria calabrica* (Deyl) Di Pietro est une espèce du complexe de *S. juncifolia* s.l. récemment décrite d'Italie méridionale, où elle est localisée aux massifs du Pollino et de l'Orsomarso. Dans cette région, *S. calabrica* est répandue entre 1200 et 2280 m d'altitude et s'y montre dominante dans deux associations de pelouse, le *Jurineo mollis-Seslerietum calabricae* ass. nov. (étage montagnard) et l'*Anthyllido atropurpureae-Seslerietum calabricae* ass. nov. (étage subalpin), appartenant respectivement aux classes *Festuco-Brometea* et *Elyno-Seslerietea*. La définition d'une sous-alliance du *Seslerion apenninae* endémique d'Italie méridionale est envisagée.

Mots clés : *Sesleria* - Poaceae - distribution - phytosociologie - syntaxinomie.

I. INTRODUCTION

Among the southern European grasses, the genus *Sesleria* is one of the most important groups, especially in the mountain areas where *Sesleria* species play often a dominant role. The *Sesleria juncifolia* complex is widespread in south-eastern Europe where it exhibits a typically amphi-Adriatic distribution area ranging over the western Balkans and the Apennines (Fig. 1). As far as Italy is concerned, *Sesleria juncifolia* complex is widespread in most regions of the Peninsula, from Tuscany to Calabria, while, to the north of the



Fig. 1.- Distributional range of the species belonging to *S. juncifolia* complex in south-eastern Europe.
 Fig. 1.- Distribution des espèces du complexe de *S. juncifolia* dans le sud-est de l'Europe.

Padana Plain, it occurs only in Friuli Venezia-Giulia (Pignatti, 1982; Di Pietro *et al.*, 2004a; Conti *et al.*, 2005). Although the taxonomical debate about the number of taxa belonging to the *Sesleria juncifolia* complex occurring within the Apennine chain has still not been completely resolved (Deyl, 1946, 1980; Ujhelyi, 1959; Pignatti, 1982; Conti *et al.*, 2005; Ubaldi, 2006), more recent revisions (Di Pietro, 2007) hypothesised the occurrence of four distinct taxa for the Italian peninsula: *S. juncifolia* subsp. *juncifolia* (Friulian Carso; central-southern Apennines) *S. kalnikensis* (eastern Alps at the boundary between Italy and Slovenia), *S. apennina* Ujhelyi (Apuan Alps and northern sector of the central Apennines) and *S. calabrica* (Pollino-Orsomarso). This latter, which differs in both morphological and karyological characters from the other taxa of the *S. juncifolia* complex (e.g. *S. juncifolia*, *S. kalnikensis* and *S. apennina* which consist of octoploid plants, $2n = 56$, whereas *S. calabrica* is found to be a dodecaploid, $2n = 84$), is strictly confined to the Pollino massif (Basilicata-Calabria regions) and Orsomarso mountains (Calabria), which represent the southernmost limit of *S. juncifolia* complex distribution area both in Italy and Europe. If a quite abundant phytosociological literature is available on the *S. juncifolia* and *S. apennina* communities occurring in the central Apennines and Apuan Alps as well as in the Friulian Carso (cf. Furrer & Furnari, 1960; Furnari, 1961; Bruno & Furnari, 1966;

Barbero & Bono, 1973; Bazzichelli & Furnari, 1979; Biondi *et al.*, 1988; Poldini, 1980; Petriccione, 1993; Petriccione & Persia, 1995; Biondi *et al.*, 1999; Blasi *et al.*, 2003, 2005; Catorci *et al.*, 2007) nothing is known at present on the coenological and syntaxonomical features of *S. calabrica* communities of Pollino-Orsomarso and on their relationship with the *S. juncifolia* s.l. communities occurring in the rest of the Apennines and in the adjacent Dynarids which lie at the eastern side of the Adriatic Sea.

II. STUDY AREA

Due to a extremely high degree of environmental heterogeneity (both actual and potential) which is related to a variegated lithostratigraphical, edapho-morphological and bioclimatic pattern, the Pollino-Orsomarso range (Fig. 2) is one of the most complex and botanically interesting area of peninsular Italy. It is majorly made of limestone and it is located in the southern Apennines. It is composed of two sub-units: the Pollino massif, in the north, which lies at the boundary between Calabria and Basilicata and which includes the main peaks (M. Pollino, 2,248 m; Serra Dolcedorme, 2,267 m) and the Orsomarso massif at the south, which is completely included in Calabria region and which does not

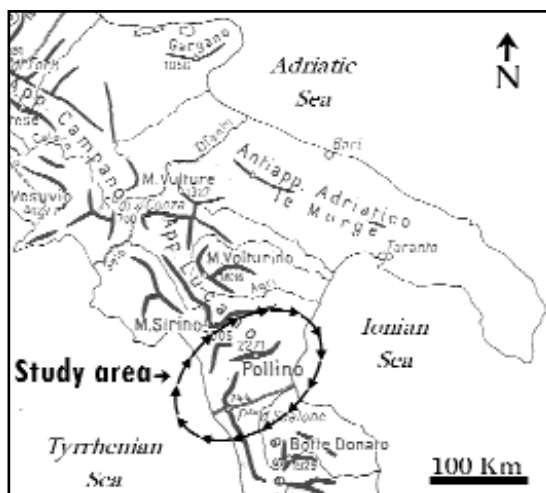


Fig. 2.- Study area.

Fig. 2.- Aire d'étude.

exceed 2000 m in altitude (Cozzo del Pellegrino, 1,937; La Mula, 1,905; M. Caramolo, 1,827; La Montea, 1,825). From a bioclimatic viewpoint the higher zones (> 1500 m a.s.l.) of the study area are characterised by a temperate-oceanic bioclimate with a orotemperate thermo-type and a hyperhumid umbro-type while the lower zoned (1100-1500 m a.s.l.) by a temperate-Mediterranean transition climate with supratemperate thermo-type and a humid umbro-type (Blasi, 2006). The montane belt is characterised by potential beech woodlands, *Anemone apenninae-Fagetum sylvaticae* in the lower montane belt and *Ranunculo brutii-Fagetum sylvaticae* in the upper montane belt (Di Pietro *et al.*, 2004b; Di Pietro & Fascetti, 2005; Di Pietro *et al.*, 2006). In scattered areas restricted stands of *Pinus nigra* subsp. *nigra* can be found. In the subalpine belt of Pollino massifs as well as within the upper montane belt of Orsomarso massif, extensive stands of *Pinus leucodermis* woodlands (*Junipero hemisphaericae-Pinetum leucodermis*; *Sorbo graecae-Pinetum leucodermis*) occur (Stanisci, 1997; Maiorca & Spampinato, 1999). The subalpine plain is mainly characterized by dry grasslands which are in turn dominated by *Carex kitaibeliana*, *Sesleria nitida*, *S. calabrica* and *Festuca bosniaca* (*Carici kitaibelianae-Seslerietum nitidae*). Mesophilous meadows are rare and located in the bottom of the tectonic basins (*Meo athamantici-Asphodeletum albi*) or in the few snow-beds (*Nardo strictae-Luzuletum pindicae*, *Bellidi pusillae-Alopecuretum gerardii*) where deeper soils occur (Bonin, 1972; Tomaselli *et al.*, 2003).

III. MATERIAL AND METHODS

The coenological field work was carried out during the years 1999-2007 where 38 relevés of vegetation were performed using the Braun-Blanquet phytosociological approach (Braun-Blanquet, 1964). For transforming the Braun-Blanquet values into numerical values reference was made to Van Der Maarel (1979). The row data were further treated with multivariate analysis procedures using the *Syntax* 5.02 software package (Podani, 1993, 2007). For the classification (Fig. 3), chord distance and the average correlation were used on the quantitative data. For the ordination (Fig. 4) a PCA was performed. Life form and chorological spectra (based on presence, frequency and specific cover index) were calculated for each community type. For life forms and chorotypes (Fig. 6, 7) reference was made to Pignatti (1982). Following the chorotype and the life form names, a sequence of three values (%) appear in the tables, corresponding, respectively, to the presence (n), the frequency (f) and the specific cover index (c) of that chorotype or life form in each phytosociological table. The specific cover index was obtained summing up each species' cover-abundance central values (e.g. 5 = 87,5; 4 = 62,5...) and multiplying this sum by the ratio 100/numbers of relevés (Braun-Blanquet, 1964). Plant nomenclature follows Tutin *et al.* (1968-1993), Pignatti (1982), Conti *et al.* (2005). The authors of plant names were checked from Brummit & Powell (1992).

IV. RESULTS

Sesleria calabrica populations were found to range in altitude between 1100 m and the summit of Pollino National Park mountains (Serra Dolcedorme 2,286 m a.s.l.). In its geographical and ecological range, *S. calabrica* forms the following community types: *Anthyllido atropurpureae-Seslerietum calabricae* and *Jurineo mollis-Seslerietum calabricae*. This syntaxonomical proposal is testified by the statistical analysis performed on the phytosociological relevés set. Indeed the dendrogram (Fig. 3) clearly shows two main clusters which are sub-divided into further two subclusters (a-b; c-d). In the left side there is *Jurineo-Seslerietum*, a community which is developed at relatively low altitude (1,100-1,600 m) and which is composed of a group of relevés (a) belonging to the typical aspect and another group of relevés (b) belonging to the altitudinal variant with *Allium flavum*. In the right side of the dendrogram there is *Anthyllido-Seslerietum*, which is divided in a subcluster typicum (c) composed of those relevés performed on the top of the highest peaks (over 2000 m), and in another subcluster

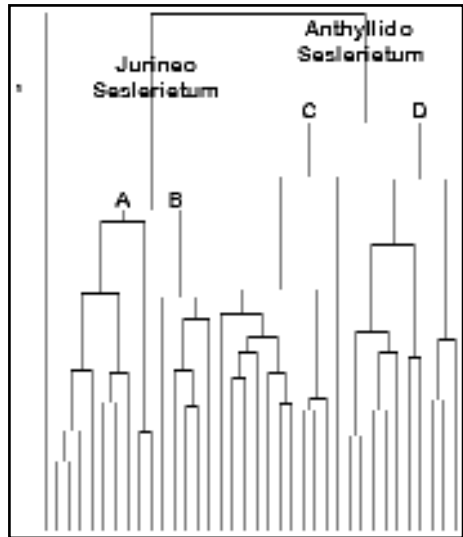


Fig. 3.- Dendrogram resulting from the cluster analysis of relevés; a: *Ju-Sesl. typicum*, b: *Ju-Sesl.* variant with *Allium flavum*, c: *An-Sesl. typicum*, d: *An-Sesl. caricetosum macrolepis*.

Fig. 3.- Dendrogramme issu de l'analyse des relevés.

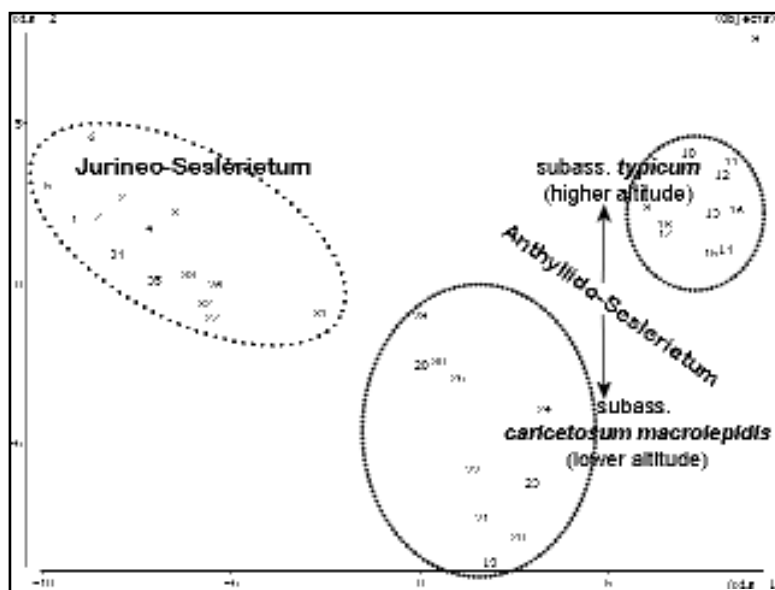


Fig. 4.- Ordination of relevés (PCA).

Fig. 4.- Ordination des relevés (PCA).

(d) referred to subass. *caricetosum macrolepidis*, which is composed of the relevés performed at lower altitude (around 1800 m). The PCA (Fig. 4) too shows a clear division between *Anthyllido-Seslerietum* (right side) and *Jurineo-Seslerietum* (left side). This distribution of the clusters along the first PCA axis is to be correlated to an altitudinal increasing gradient, moving left to right. Within this gradient *Anthyllido-Seslerietum caricetosum macrolepidis* behaves as an intermediate vegetational type between the vegetation of the top of the higher mountains and that of the altitudinal variant (with *Allium*) of *Jurineo-Seslerietum*.

Anthyllido atropurpureae-Seslerietum calabricae Di Pietro *ass. nov. hoc loco*
(holotypus: phytosociological Table I, rel. 9)

These are primary dry grasslands restricted to the summits of the main peaks of Pollino National Park (especially Serra Dolcedorme) where they mainly occur on windy ridges and on steep gravelly slopes (Fig. 5). In bioclimatic terms *Anthyllido-Seslerietum* belongs to the oro-temperate thermotype and to the upper humid-lower hyperhumid umbrotype. In this community *S. calabrica* always behaves as dominant species and is constantly joined by species such as *Carex kitaibeliana*, *Helianthemum oelandicum* subsp. *incanum*, *Dianthus sylvestris*, *Anthyllis montana* subsp. *atropurpurea*, *A. vulneraria* subsp. *pusilla*, *Festuca bosniaca*, *Onobrychis alba* subsp. *pentelica*, *Sempervivum tectorum*, *Allium flavum*. In the coenological pattern of *Anthyllido-Seslerietum*, it is possible to recognize two altitudinal aspects; the higher of these (subass. *typicum*), is restricted to the subalpine belt of Serra Dolcedorme, where in addition to the specific characteristic component typical subalpine species such as *Carex kitaibeliana* and *Festuca bosniaca* are found. To the other hand the « lower » aspect of *Anthyllido-Seslerietum* is impoverished in high-altitude species and normally falls within the open areas included in the beech forest belt, where it occupies the upper fringe. For this second aspect the new subassociation *Anthyllido-*



Fig. 5.- *Anthyllido atropurpureae-Seslerietum calabricae* communities within Serra Dolcedorme southern slopes (Calabrian side of Pollino National Park) with scattered individuals of *Pinus leucodermis*.

Fig. 5.- *Anthyllido atropurpureae-Seslerietum calabricae* sur les pentes sud de la Serra Dolcedorme (versant calabrais du Parc national du Pollino) avec individus dispersés de *Pinus leucodermis*.

Seslerietum calabricae caricetosum macrolepidis (holotypus: Table I, rel. 18) is proposed. From a chorological point of view (Fig. 6), more than fifty percent of *Anthyllido-Seslerietum* composite species are found to belong to the sum of SE-European orophytes and Italian endemics, which assume greater importance when frequency and cover spectra are considered (the percentage of endemics is, of course, boosted by the presence in the group of *S. calabrica*). The contribution of the Amphiadriatic component is also important, while, considering the high altitude, the percentage of the circumboreal chorotype is relatively low, decreasing sharply passing from normal to cover spectrum. As expected, both Eurimediterranean and Stenomediterranean species are poorly represented.

As far as life forms are concerned (Fig. 7), the community is characterised mainly by hemicryptophytes, the percentage of which are approached by chamephytes only in respect of frequency values. Apart from having a clear floristic-ecological and physiognomic-structural significance, the hemicryptophyte/chamephyte ratio can also be used in syntaxonomical terms, as it allows *Anthyllido-Seslerietum* to be included in a grassland class (*Elyno-Seslerietea*) rather than in garrigue one (*Cisto-Micromerietea/Rosmarinetea*). The contribution of geophytes and phanerophytes is negligible while therophytes are completely absent.

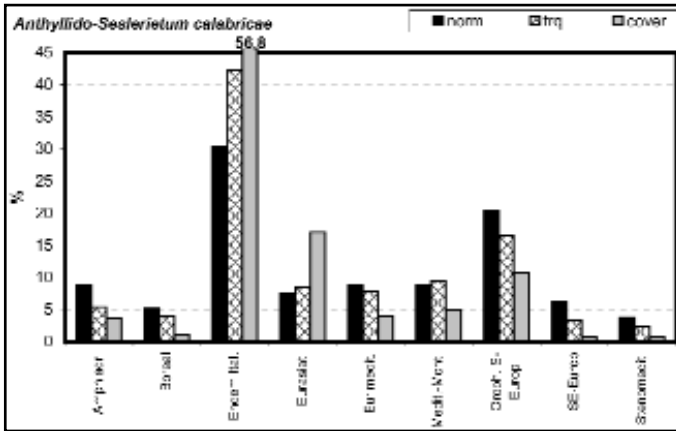


Fig. 6.- *Anthyllido atropurpureae-Seslerietum calabricae* chorological spectrum calculated on presence (norm.), frequency (frq.) and specific cover index values (cover) of the species in the relevés.

Fig. 6.- Spectres chorologiques de l'*Anthyllido atropurpureae-Seslerietum calabricae*.

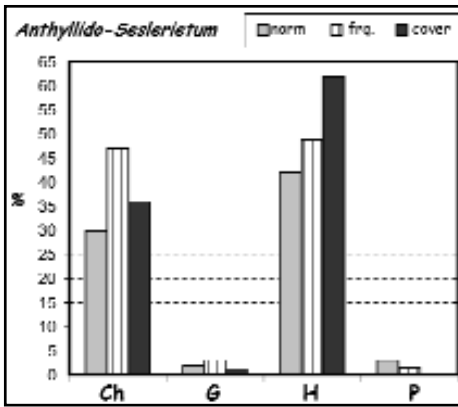


Fig. 7.- *Anthyllido atropurpureae-Seslerietum calabricae* life forms spectra calculated on presence (norm.), frequency (frq.) and specific cover index values (cover) of the species in the relevés.

Fig. 7.- Spectres biologiques de l'*Anthyllido atropurpureae-Seslerietum calabricae*.

Jurineo mollis-Seslerietum calabricae Di Pietro ass. nov. hoc loco (holotypus: phytosociological Table II, rel. 5)

Jurineo-Seslerietum communities (Fig. 8) are mainly secondary dry and discontinuous grasslands which are in syndynamical relationship with woodlands of *Fagus sylvatica*, *Pinus leucodermis* and *P. nigra* subsp. *nigra* and which are typical of rocky and stony environments. Occasionally this community can assume a primary role, especially on steep ridges where the extremely shallow soils do not allow woody species to survive in a community form. The name of this association is based on the binomial *Jurinea mollis* subsp. *mollis*. In fact, although, in *Flora d'Italia* (Pignatti, 1982), only *Jurinea mollis* subsp. *moschata* is reported for southern Italy, more recent studies (Coti, 1998) have demonstrated that this subspecies is to be assigned to the nominal subspecies. In addition to *Sesleria calabrica*, the specific characteristic component of *Jurineo-Seslerietum* includes other south-eastern European species that do not usually occur beyond the timberline, such as the same *Jurinea mollis* subsp. *mollis* itself, *Echinops ritro* subsp. *ritro*, *Scabiosa crenata* and *Euphorbia barrelieri* together with species having wider ecological amplitude such as *Carex macrolepis*, *Chamaecytisus spinescens*, *Helianthemum oelandicum* subsp. *incanum*,



Fig. 8.- *Jurineo mollis-Seslerietum calabrica*e communities nearby *Ranunculo brutii-Fagetum* (1570 m) in the Cozzo dell'Orso area (Calabrian side of Pollino National Park).
 Fig. 8.- *Jurineo mollis-Seslerietum calabrica*e à proximité du *Ranunculo brutii-Fagetum* (1570 m) dans la région de Cozzo dell'Orso (versant calabrais du Parc national du Pollino).

Asperula aristata, *Thesium divaricatum* and *Teucrium montanum*. The stands of *Jurineo-Seslerietum* located at lower altitudes (typical variant) are characterised by the presence of a variety of species coming from the oak woodlands submontane belt such as *Quercus pubescens*, *Q. ilex*, *Acer opalus* subsp. *obtusatum*. The stands located at higher altitudes (variant with *Allium flavum*) are characterised by the presence of ingressive species normally occurring in the upper montane belt (*Allium flavum*) and subalpine belt (*Edraianthus graminifolius*). In rare cases (e.g. rel. 17, Table II) the high-altitude variant of *Jurineo-Seslerietum* exhibits a typical impoverishment in the characteristic specific component of the association which testify a transitional situation towards *Anthyllido-Seslerietum* (Fig. 8).

In chorological terms (Fig. 9), the relatively low altitude is probably the reason for the significant role played by both eurasiatic and SE-European chorotypes, which are usually linked to bioclimatic belts in which the mature stages of vegetation are woodland communities. Low altitude is probably also responsible for the scant contribution of SE European orophytes and boreals species. The Mediterranean s.l. component (Stenomedit. + Eurymedit. + Medit.-Mont.) is well represented.

The life-form spectrum (Fig. 10) shows that in *Jurineo-Seslerietum* as in *Anthyllido-Seslerietum* it is the hemicryptophytic and the chamaephytic components (68% and 24%, respectively, of the entire flora) that take on a discriminating role in the structure of the community. Compared to the *Anthyllido-Seslerietum* spectrum, however, the role of geophytes and phanerophytes is more important.

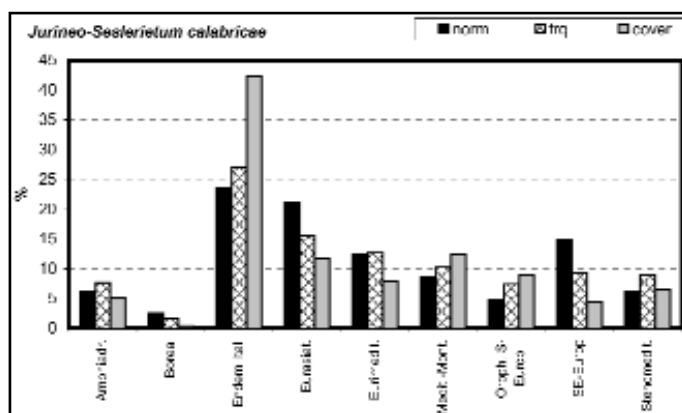


Fig. 9.- *Jurineo mollis-Seslerietum calabricae* chorological spectra calculated on presence (norm.), frequency (frq.) and specific cover index values (cover) of the species in the relevés.

Fig. 9.- Spectres chorologiques du *Jurineo mollis-Seslerietum calabricae*.

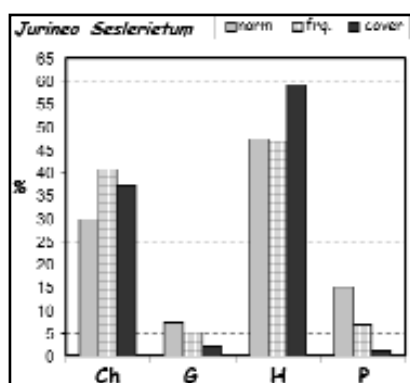


Fig. 10.- *Jurineo mollis-Seslerietum calabricae* life forms spectra calculated on presence (norm.), frequency (frq.) and specific cover index values (cover) of the species in the relevés.

Fig. 10.- Spectres biologiques du *Jurineo mollis-Seslerietum calabricae*.

V. SYNTAXONOMICAL DISCUSSION

As it was mentioned before, most of the phytosociological studies regarding the *Sesleria juncifolia* collective group are restricted to the central Apennines, where *Sesleria juncifolia* s.l. grasslands exhibit their widest distribution. The first phytosociological reference concerning the *Sesleria juncifolia* communities of the Pollino massif was provided by Avena & Bruno (1975). These authors included the Pollino communities in the alliance *Seslerion apenninae* and in the order *Seslerietalia apenninae*, but they did not provide any syntaxonomical indications regarding the association rank. Later Bonin (1978) proposed that all dry grassland communities characterizing the subalpine belt of the entire Pollino mountains range should be included in the association *Carici (macrolepidis)-Seslerietum nitidae*. The original phytosociological table of *Carici-Seslerietum nitidae*, however, is completely lacking in *Sesleria juncifolia*, since most of the relevés were performed below 2000 m a.s.l.

Petriccione (1991) includes all the *Sesleria juncifolia* communities of the subalpine belt of both the central and southern Apennines in the association *Helianthemo canis-Seslerietum tenuifoliae*, which is to be considered as invalid (art. 1) on the basis of ICPN (Weber *et al.*, 2000). Subsequently Petriccione & Persia (1995) included these communi-

ties within the new association *Pediculari elegantis-Seslerietum tenuifoliae*, which, however, is an invalid and illegitimate name (art. 5, 6, 23, 25) (Blasi *et al.*, 2005).

The fact that the guide species of Pollino *Sesleria* grasslands is neither *S. juncifolia* Suffr. (*S. tenuifolia* Schrad.) nor *S. apennina* Ujhelyi does not allow either of these two syntaxa to be used as a syntaxonomical reference for them. The floristic and coenological features of *S. calabrica* grasslands are so particular that they deserve to be described using autonomous syntaxa, at least at the rank of association. Indeed, in addition to *Sesleria calabrica*, *Anthyllido-Seslerietum* includes several species such as *Onobrychis alba* subsp. *pentelica*, *Campanula scheuchzeri* subsp. *pollinensis*, *Allium flavum*, *Festuca bosniaca* and *Asperula calabra*, the distribution area of which is restricted to the southern Apennines. The inclusion of *Anthyllido-Seslerietum* communities in *Carici-Seslerietum nitidae* (as proposed in Bonin, 1978) appears to be inappropriate since the former is a pioneer community typical of windy crests and ridges, whereas the latter is representative of grassland community types which are normally developed at lower altitudes and on deeper soils (a similar example of edaphic vicariance occurs in the central Apennines, between the relatively dense-continuous *Caricetum kitaibeliana* and the open-xerophitic *Seslerietum apenninae*).

As regards the *Sesleria calabrica* grasslands here included in *Jurineo-Seslerietum*, it must be observed that no references concerning such communities were found in the phytosociological literature. So the proposal of a new association appears to be both necessary and justified. Only in Bonin (1978) was the Calabrian type of *S. apennina* quoted as a companion species in *Genisto sericeae-Pinetum nigrae*. The original phytosociological table of *Genisto-Pinetum*, however, is extremely heterogeneous with typical woodland relevés being placed alongside relevés in which woody species had cover/abundance values less than 10%.

It is likely that these latter relevés should more properly be included in syntaxa which belong physiognomically and coenologically to grassland environments. It is worth noting that, in the western Balkans too, an association named *Polygalo chamaebuxi-Pinetum nigrae* (Horvat *et al.*, 1974) has been described as a coniferous woodland community very rich in *Sesleria juncifolia* in the undergrowth. At the same time it is known (Horvat *et al.*, 1974) that the association *Seslerietum juncifoliae* behaves as the grassland regressive successional stages of the *Genisto januensis-Pinetum nigrae* both in northern and southern Croatia. However it is interesting that Bonin (1978), observing the peculiar occurrence of *Sesleria juncifolia/apennina* in the undergrowth of pine forests along both sides of the Adriatic sea, hypothesized that this entity was probably also differentiable taxonomically.

The two new associations proposed in this paper are referable to different higher rank syntaxa (alliance, order, classes). On the basis of current information, the only convincing reference for *Anthyllido-Seslerietum* is *Seslerion apenninae*, an alliance whose centre of distribution is in the Central Apennines but which is also widespread towards the south. In fact some of the characteristic species of this syntaxon (*Festuca violacea* subsp. *italica*, *Cerastium tomentosum*, *Helictotrichon praetutianum*) occur in *Anthyllido-Seslerietum*. Yet the presence of a group of species which are endemic to southern Apennines (*Sesleria calabrica*, *Campanula scheuchzerii* subsp. *pollinensis*, *Asperula calabra*, *Onobrychis alba* subsp. *pentelica*) or which are only marginally found in the central Apennine (e.g. *Festuca bosniaca*, *Anthyllis montana* subsp. *atropurpurea*) could, in the future, lead to the proposal of a new southern Italy sub-alliance (centered on Pollino-Orsomarso massif) separated both biogeographically and coenologically from the *Seslerion apenninae* (subalpine

belt) and *Leontopodio nivalis-Elynenion myosuroidis* (alpine belt) of central Apennines. As regards the order, the obligatory choice is *Seslerietalia tenuifoliae*, an Amphiadriatic syntaxon which includes some highly frequency mountain species (e.g. *Carex kitaibeliana* and *Edraianthus graminifolius*). The class is *Elyno-Seslerietea*.

Jurineo-Seslerietum, on the other hand, is to be included in *Festuco-Brometea*. In fact the relatively low altitudes where this community is normally developed result in there being an almost complete absence of all subalpine belt species. Moreover, a strong component of species typical of the secondary grasslands and garrigues of the hilly and montane belt (e.g. *Scabiosa crenata* subsp. *crenata*, *S. columbaria*, *Echinops ritro*, *Achnatherum calamagrostis*, *Asperula aristata*, *Euphorbia barrelieri*) is found. In fact the occurrence of saplings or young bushes of woodland woody species such as *Quercus pubescens*, *Q. ilex*, *Sorbus aria* and *Pinus nigra* subsp. *nigra* is highly indicative of the bioclimatical belt to which *Jurineo-Seslerietum* belongs. The order is *Brometalia erecti*, although the occurrence of several micro-chamaephytes reveals the presence of an intermediate environmental conditions towards the sub-montane garrigues of *Cysto-Micromerietalia (Cytiso-Satureion)*. As far the alliance is concerned, a first choice could be that of *Cytiso-Bromion caprini*, which in its the original diagnosis was considered representative of the dry grasslands rich in chamaephytes of southern Italy (Bonin, 1978; Biondi *et al.*, 1995, Biondi *et al.*, 2005). According to the most recent revision of Biondi *et al.* (2005), however, *Jurineo-Seslerietum* must be placed in the central-southern Apennine alliance of *Phleo ambigu-Bromion erecti* and in the southern Italy suballiance of *Sideritidenion italicae*.

As expected, a comparison with similar communities occurring in the Balkan peninsula (Horvat *et al.*, 1974; Redžić, 2003; Surina & Dakskobler, 2005) shows several floristic and ecological similarities versus both *Anthyllido-Seslerietum* and *Jurineo-Seslerietum*. These similarities, however, are certainly of a minor extent if compared with those exhibited by the Balkan *Sesleria* grasslands versus the central Apennines *Sesleria* grasslands (e.g. the presence of *S. juncifolia* as guide species in both districts).

Anthyllido-Seslerietum would find geographic vicariant in *Helianthemo alpestris-Caricetum kitaibeliana* (*Seslerion juncifoliae*, *Seslerietalia juncifoliae*) and *Helianthemo scardici-Seslerietum juncifoliae* (*Edraiantho-Seslerion*, *Onobrychido scardicae-Seslerietalia*). In addition of having some diagnostic species in common (*Edraianthus graminifolius*, *Carex kitaibeliana*, *Festuca bosniaca*, *Teucrium montanum*, *Anthyllis montana* s.l.), these associations share the same ecological place in the high mountain summit spatial pattern. However, in addition of a substantial group of balkan endemic species *Edraianthus serpyllifolius*, *Onobrychis montana* subsp. *scardica*, *Helianthemum scardicum*, *Achillea ageratifolia*, *Thymus boissieri*, *T. balkanus*, *Oxytropis urumovii*, etc., both these associations include several circumboreal taxa *Carex rupestris*, *C. ericetorum*, *Dryas octopetala*, *Bistorta vivipara* which have nothing to do with the biogeographical context of Pollino-Orsomarso area having their southernmost range limit in the central Apennines.

Of minor entents are the similarities of *Jurineo-Seslerietum* with the lower altitude Balkan *Sesleria* gr. *juncifolia* communities. Pollino-Orsomarso's *Jurineo-Seslerietum* seems to occupy an intermediate ecological position between those showed by *Seslerietum juncifoliae* (*Seslerion juncifoliae*) and *Carici humilis-Centaureetum rupestris seslerietosum juncifoliae* (*Chrysopogono-Satureion subspicatae*). The former exhibit more mesophilous attitudes testified by the occurrence of species such *Salvia pratensis*, *Bromus erectus*, *Leucanthemum vulgare*, *Ranunculus bulbosus*, *Lotus corniculatus*, *Briza media* while the second exhibits a peculiar floristic note in the dealpinization of species current-

ly occurring in the subalpine belt (*Arctostaphylos uva-ursi*, *Calamagrostis varia*, *Phyteuma orbiculare*, *Edraianthus graminifolius*, *Anthyllis montana*) which are absent in *Jurineo-Seslerietum*.

VI. CONCLUSIONS

The Pollino-Orsomarso *Sesleria* dry-grasslands communities which were formerly considered as dominated by *S. tenuifolia* (*S. juncifolia*) or *S. apennina* (Ujhelyi, 1959) are to be ascribed to *Sesleria calabrica* a neopolyploid apodemism whose distribution area is restricted to this massif and which behaves as geovicariant of the former species. In coenological terms, the description of two new phytosociological associations represents an important addition to the knowledge of the montane vegetation of southern Italy and a significant step in the completion of the coenological and syntaxonomical pattern of *Sesleria juncifolia* group communities in south-eastern Europe. Both *Anthyllido-Seslerietum* and *Jurineo-Seslerietum* exhibit synchorological features which attest to the strong amphiadriatic links existing between the Apennines and the Balkans and reflect the influence of the Balkan-Appennine biogeographical province (sensu Rivas-Martínez et al., 2002) on the Boreo-Alpine region migrated southwards to the Italian peninsula during the Ice Age.

Acknowledgments - The author expresses his gratitude to all the components of Italian Corpo Forestale dello Stato for their fundamental logistic support during my excursions, in particular Dr. Graziano, Dr. Alberti and Inspectors Madormo, Santilli, Pecoriello (C.T.A. Pollino National Park). This research was supported by Italian Ministero per l'Università e la ricerca scientifica, and the University of Rome.

REFERENCES

- Avena G. & F. Bruno, 1975.- Lineamenti della vegetazione del massiccio del Pollino, Appennino calabro-lucano. *Not. Fitosoc.*, **10**, 131-153.
- Barbero M. & G. Bono, 1973. - La végétation orophile des Alpes Apuanes. *Vegetatio*, **27** (1-3), 1-48.
- Bazzichelli G. & F. Furnari, 1979.- *Ricerche sulla flora e sulla vegetazione d'altitudine nel Parco Nazionale d'Abruzzo (la vegetazione)*. Tipografia Coniglione, Catania, 87 p.
- Biondi E., M. Allegrezza & V. Zuccarello, 2005.- Syntaxonomic revision of the Apennine grasslands belonging to *Brometalia erecti*, and an analysis of their relationships with the xerophilous vegetation of *Rosmarinetea officinalis* (Italy). *Phytocoenologia*, **35** (1), 129-164.
- Biondi E., S. Ballelli, M. Allegrezza, F. Taffetani, A. R. Frattaroli, J. Guitan & V. Zuccarello, 1999.- La vegetazione di Campo Imperatore (Gran Sasso d'Italia). *Braun-Blanquetia* **16**, 33-53.
- Biondi E., S. Ballelli, M. Allegrezza, & V. Zuccarello, 1995.- La vegetazione dell'ordine *Brometalia erecti* Br.-Bl. 1936 nell'Appennino (Italia). *Fitosociologia*, **30**, 3-45.
- Biondi E., J. Guitan, M. Allegrezza & S. Ballelli, 1988.- Su alcuni pascoli a *Sesleria apennina* Ujhelyi nell'Appennino centrale. *Doc. Phytosoc.* n.s., **11**, 417-422.
- Blasi C., 2006.- Il fitoclima d'Italia. In: *Completamento delle Conoscenze Naturalistiche di base, GIS Natura*. C. Blasi (ed.), Direzione per la protezione della Natura, Ministero dell'ambiente e della tutela del territorio,.
- Blasi C., R. Di Pietro, P. Fortini & C. Catonica, 2003.- The main plant community types of the alpine belt of the Apennine chain. *Plant Biosyst.*, **137** (1), 83-110.
- Blasi C., R. Di Pietro & G. Pelino, 2005.- The vegetation and landscape of alpine belt karst-tectonic basin in the Majella mountain (central Apennines). *Plant Biosyst.*, **139** (3), 357-385.
- Bonin G., 1972.- Première contribution à l'étude des pelouses mésophiles et des groupements hygrophiles du Monte Pollino (Calabre). *Phyton*, **14** (3-4), 271-280.
- Bonin G., 1978.- *Contribution à la connaissance de la végétation des montagnes de l'Apennin centro-meridional*. Thèse Univ. Marseille, 318 p.
- Braun-Blanquet J., 1964.- *Pflanzensoziologie*, ed. 3. Springer, Wien, 865 p.
- Brummitt R.K. & C. E. Powell, 1992.- *Authors of plant names*. Royal Botanic Gardens, Kew, 732 p.
- Bruno F. & F. Furnari, 1966.- Excursion de la Société internationale de phytosociologie dans les Abruzzes (Apennins centraux). *Not. Fitosoc.*, **3**, 1-50.

- Catorci A., R. Gatti & S. Ballelli, 2007.- Studio fitosociologico della vegetazione delle praterie montane dell'Appennino maceratese (Italia centrale). *Braun-Blanquetia*, **42**, 101-143.
- Conti F., 1998.- Contributions to the knowledge of *Jurinea mollis* s.l. (Compositae). 1 - *Jurinea mollis* subsp. *moschata*, a synonym of *J. mollis* subsp. *mollis*. *Willdenowia*, **28**, 47-52.
- Conti F., G. Abbate, A. Alessandrini & C. Blasi, 2005.- *An Annotated Checklist of the Italian Vascular Flora*. Palombi Ed., Roma, 430 p.
- Deyl M., 1946.- Study of the genus *Sesleria*. *Opera Bot. Čech.*, **3**, 1-246.
- Deyl M., 1980.- 36 *Sesleria* Scop. In: *Flora Europaea*. T.G. Tutin *et al.* (eds.), **5**, 173-177, Cambridge University Press.
- Di Pietro R., 2007.- Taxonomical features of *Sesleria calabrica* stat. nov. (Poaceae), a neglected species from southern Italy. *Folia Geobot.*, **42**, 289-313.
- Di Pietro R., G. D'Amato & B. Trombetta, 2004a.- Karyology and distribution of *Sesleria tenuifolia* complex (Poaceae) in the Italian Peninsula. *Nord. J. Bot.*, **23** (5), 615-624.
- Di Pietro R. & S. Fascetti, 2005.- A contribution to knowledge of *Abies alba* Mill. woodlands in the Campania and Basilicata. *Fitosociologia*, **42** (1), 71-96.
- Di Pietro R. S. Fascetti & G. Filibeck, 2006.- Serie di vegetazione della Regione Basilicata. In: *Completamento delle Conoscenze Naturalistiche di base, Carta delle Serie di vegetazione d'Italia, scala 1:250.000, GIS Natura*. C. Blasi (ed.), Direzione per la protezione della Natura, Ministero dell'ambiente e della tutela del territorio,.
- Di Pietro R., J. Izco & C. Blasi C., 2004b.- Contribute to the nomenclatural knowledge of the beech-woodland communities of southern Italy. *Plant Biosyst.*, **138** (1), 27-52.
- Furnari F., 1961.- Osservazioni sui pascoli cacuminali del Gran Sasso d'Italia. *Nuovo Giorn. Bot. Ital.* n.s., **68**, 364-371.
- Furrer E. & F. Furnari, 1960.- Ricerche introduttive sulla vegetazione d'altitudine del Gran sasso d'Italia. *Boll. Ist. Bot. Univ. Catania*, **2**, 143-201.
- Horvat I., 1956.- Ein interessanter Föhrenwald im Obruč-Massiv. *Biol. Glas.*, **9**, 43-50 (kroat.)
- Horvat I., V. Glavac & H. ElleMBERG, 1974.- *Vegetation Sudosteuroapas*. Fischer Verlag, Stuttgart, 768 p.
- Maiorca F. & G. Spampinato, 1999.- La vegetazione della riserva naturale orientata "Valle del Fiume Argentino". *Fitosociologia*, **36** (2), 15-60.
- Petriccione B., 1991.- *Ecologia e fitogeografia delle praterie d'altitudine a Sesleria tenuifolia degli Appennini*. Ph.D. thesis, Biblioteche Nazionali di Roma e Firenze, 99 p.
- Petriccione B., 1993.- *Flora e vegetazione del Massiccio del Monte Velino*. Ministero delle Risorse Agricole e Forestali, Collana verde, **92**, 261 p.
- Petriccione B. & G. Persia, 1995.- Prodromo delle praterie di altitudine degli Appennini su calcare (classe *Festuco-Seslerietea*). *Atti dei convegni lincei, Acc. Naz. Lincei (Roma)*, **115**, 361-389.
- Pignatti S., 1982.- *Flora d'Italia*, 3. Edagricole, Bologna.
- Podani J. 1993.- SYN-TAX 5.0: Computer programs for multivariate data analysis in ecology and systematics. *Abstr. Bot.*, **17**, 289-302.
- Podani J., 2007.- *Analisi ed esplorazione multivariata dei dati in ecologia e biologia*. Liguori Editore, 515 p.
- Poldini L., 1980.- Outlines of the vegetation of the karst of Trieste and Gorizia. *Studia Geobot.*, **1** (1), 79-130.
- Redžić S., 2003.- The syntaxonomy and syngensis of the *Elyno-Seslerietea* Br.-Bl. 1948 in the Balkan peninsula. *Ann. Bot. (Roma)*, n.s., **3**, 53-74.
- Rivas-Martínez S., A. Penas, T. Diaz, 2002.- *Biogeographic map of Europe*. Universidad de Leon.
- Stanisci A., 1997.- Gli arbusteti altomontani dell'Appennino centrale e meridionale. *Fitosociologia*, **34**, 3-46.
- Surina B., & I. Dakskobler, 2005.- Delimitation of the alliances *Caricion firmae* (*Seslerietalia albicantis*) and *Seslerion juncifoliae* (*Seslerietalia juncifoliae*) in the southern Alps and Dinaric mountains. *Plant Biosyst.*, **139** (3), 399-410.
- Tomaselli M., L. Bernerdo & N. Passalacqua, 2003.- The vegetation of *Ranunculo-Nardion* in the Southern Apennines. *Phyton*, **43** (1), 39-57.
- Tutin T.G. *et al.* (eds.), 1968-1993.- *Flora Europaea*. Cambridge University Press.
- Ubaldi D., 2006.- Contributo alla tassonomia di *Sesleria apennina* Ujhelyi. *Quaderno di studi e notizie di storia naturale della Romagna*, **22**, 65-74.
- Ujhelyi J., 1959.- Revision des espèces du genre *Sesleria* en Italie. *Webbia*, **14**, 597-614.
- Van der Maarel E., 1979.- Transformation of cover-abundance values in phytosociology and its effects on community similarity. *Vegetatio*, **39**, 97-144.
- Weber H.E., J. Moravec & J. P. Theurillat 2000.- International Code of Phytosociological Nomenclature, 3rd. edition. *J. Veg. Sci.*, **11**, 739-768.

APPENDIX 1 - SYNTAXONOMICAL SCHEME

- ELYNO MYOSUROIDIS-SESLERIETEA* Br.-Bl. 1948
Seslerietalia tenuifoliae Horvat 1930
Seslerion apenninae Furnari in Bruno & Furnari 1966
Anthyllido atropurpureae-Seslerietum calabrica Di Pietro *ass. nov.*
Anthyllido atropurpureae-Seslerietum calabrica *typicum*
Anthyllido atropurpureae-Seslerietum calabrica caricetosum macrolepidis subass. nova
- FESTUCO-BROMETEA* Br.-Bl. & Tüxen ex Br.-Bl. 1949
Brometalia erecti Br.-Bl. 1936
Phlebo ambigui-Bromion erecti Blasi ex Biondi, Ballelli, Allegrezza & Zuccarello 1995
Sideritidenion italicae Biondi, Allegrezza, Zuccarello 2005
Jurineo mollis-Seslerietum calabrica Di Pietro *ass. nov.*

APPENDIX 2 - COMPLETE NAMES OF THE SYNTAXA QUOTED IN THE TEXT

Anemone apenninae-Fagetum sylvaticae (Gentile 1970) Brullo 1984; *Anthyllido atropurpureae-Seslerietum calabrica* Di Pietro *ass. nov.*; *Bellidi pusillae-Alopecuretum gerardii* Tomaselli, Bernardo & Passalacqua 2003; *Brometalia erecti* Br.-Bl. 1936; *Caricetum kitaibeliana* Migliaccio 1970; *Carici humilis-Centaureetum rupestris seslerietosum juncifoliae* Horvat 1931; *Carici humilis-Seslerietum apenninae* Biondi, Guitian, Allegrezza & Ballelli 1988; *Carici macrolepidis-Seslerietum nitidae* Bonin 1978; *Chrysopogono grylli-Satureion subspicatae* Horvat & Horvatić 1934; *Helianthemo alpestris-Caricetum kitaibeliana* Horvat 1930; *Cisto-Micromerietea juliana* Oberd. 1954; *Cytiso spinoscenti-Satureion montanae* Pirone & Tammaro 1997; *Cytiso-Bromion caprini* Bonin in Barbero & Bonin 1969; *Edraiantho graminifolii-Seslerion* Horvat 1949; *Elyno myosuroidis-Seslerietea* Br.-Bl. 1948; *Festuco-Brometea* Br.-Bl. & Tüxen ex Br.-Bl. 1949; *Genisto januensis-Pinetum nigrae* Tomažič 1940; *Genisto sericeae-Pinetum nigrae* Bonin 1978; *Helianthemo cani-Seslerietum tenuifoliae* Petriccione 1991; *Helianthemo scardici-Seslerietum juncifoliae* Horvat 1960; *Jurineo mollis-Seslerietum calabrica* Di Pietro *ass. nov.*; *Leontopodio nivalis-Seslerietum apenninae* Blasi, Di Pietro & Pelino 2004; *Meo athamantici-Asphodeletum albi* Bonin 1972; *Nardo strictae-Luzuletum pindicae* Bonin, 1972; *Onobrychido scardicae-Seslerietalia* Horvat 1949; *Pediculari elegantis-Seslerietum tenuifoliae* Petriccione & Persia 1995; *Pino leucodermis-Juniperetum alpinae* Stanisci 1997; *Polygalo chamaebuxi-Pinetum nigrae* Horvat 1956; *Ranunculo brutii-Fagetum sylvaticae* Bonin 1967; *Seslerenion apenninae* Blasi & Di Pietro in Blasi Di Pietro, Fortini & Catonica 2003; *Seslerietalia apenninae* Furnari in Bruno & Furnari 1966; *Seslerietalia juncifoliae* Horvat 1930; *Seslerietum apenninae* Furnari in Bruno & Furnari 1966; *Seslerietum juncifoliae* Horvat 1942; *Seslerio apenninae-Dryadetum octopetalae* Biondi, Ballelli, Allegrezza, Taffetani, Frattaroli, Guitian, Zuccarello 1999; *Seslerion apenninae* Furnari in Bruno & Furnari 1966; *Seslerion juncifoliae* Horvat 1930; *Sorbo graecae-Pinetum leucodermis* Maiorca & Spampinato 1999.

APPENDIX 3 - SPORADIC SPECIES

Table I: *Anthyllido-Seslerietum*

rel. 1, *Cuscuta epithimum* +; rel. 2, *Gentianella crispata* 1, *Silene multicaulis* +, *Linum austriacum* subsp. *tomasinii* +, *Plantago atrata* subsp. *fuscens* +; rel. 6, *Sedum hispanicum* +; rel. 12, *Berberis vulgaris* subsp. *aetnensis* 1, *Daphne oleoides* +; rel. 15, *Thlaspi montanum* +, *Tragopogon crocifolius* +; rel. 18, *Plantago lanceolata* subsp. *sphaerocephala* +.

Table II: *Jurineo-Seslerietum*

rel. 5, *Centaureum erythraea* +, *Pteridium aquilinum* +; rel. 6, *Quercus ilex* +; rel. 7, *Carlina corymbosa* +, *Cuscuta epithimum* +; rel. 8, *Carlina acaulis* subsp. *caulescens* +, *Festuca arundinacea* +; rel. 9, *Gymnadenia conopsea* +; rel. 13, *Senecio scopolii* +; rel. 14, *Genista tinctoria* subsp. *ovata* +.

APPENDIX 4 - PLACE AND DATE OF RELEVÈS

Table I: *Anthyllido-Seslerietum*

rel. 1-4, Serra Dolcedorme northern slopes (Basilicata, 25/07/2003); rel. 5, Serra Dolcedorme southern slopes (Calabria, 26/07/2003); rel. 6-10, Serra Dolcedorme summit area (Calabria/Basilicata, 26/07/2003); rel. 11, Serra Dolcedorme southern slopes (Calabria, 26/07/2003); rel. 12-14, Mount Pollinello (Calabria, 22/06/2002); rel. 15-21, Mount Caramolo, Orsomarso massif (Calabria 27/07/2003).

Table II: *Jurineo-Seslerietum*

rel. 1-7, Fosso Serrapaolo (Calabria, 28/07/2003); rel. 8-9, Prezzamano southern slopes of La Mula (Calabria, 10/07/2007); rel. 10-16, La Montea southern slopes (Calabria 23/08/2002); rel. 17, Cozzo dell'Orso northern slopes of Cozzo del Pellegrino (Calabria, 12/07/2007).