Syntaxonomical analysis of the *Kobresio-Myosuroidis-seslerietea caeruleae* and *Carici Rupestris-Kobresietea Bellardii* classes in the central southern Apennines.

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Abstract

The aim of this study is a critical analysis of the syntaxonomic classification of the primary grasslands of the central-southern Apennines with a dominance of *Sesleria juncifolia* ssp. *juncifolia* and of those with a predominance of *Kobresia myosuroides*. The hypothesis considered is the coexistence in the Apennines of the classes *Kobresio-Myosuroidis-Seslerietea caeruleae* (=Elyno myosuroidis-Seslerietea caeruleae) and *Carici rupestris-Kobresietea bellardii*. 277 phytosociological relevés were analysed, which relate to seven different plant associations of the central-southern Apennines; 80 of these relevés were unpublished. A syntaxonomic revision is proposed, according to which the coenoses with a dominance of *Kobresio-Seslerietea* are distinct from those with a prevalence of *Kobresia myosuroides*, ascribed to the class *Carici-Kobresietea*, to the order *Oxytropido-Kobresietalia*, to the alliance *Kobresio-Seslerietea*, and to the suballiance *Leontopodio-Elynenion*. The proposal of Bruno & Furnari (1966) is reconsidered, with regard to the Apennine order *Seslerietalia* ssp. *juncifolia* attributed to the class *Kobresio-Seslerietea*, to the order *Seslerietalia* ssp. *juncifolia*, to the suborder *Seslerienalia* ssp. *juncifolia*, and to the alliance *Seslerion apenninae*, ascribed to the class *Carici-Kobresietea*, to the order *Oxytropido-Kobresietalia*, to the alliance *Oxytropido-Elynenion* and to the suballiance *Leontopodio-Elynenion*. Seven new subassociations are proposed: *hieracietosum cymosi* and *anthylletosum pulchellae*, referred to the association *Carici humilis-Seslerietum apenninae*; *festucetosum alfredianae*, referred to the association *Seslerio apenninae*-*Dryadetum octopetalae*; *anthylletosum weldenianae* and *helianthemetosum grandiflori*, referred to the association *Helianthemo alpestris-Festucetum italicae*; and *saxifragetosum speciosae*, referred to the association *Galio magellensis-Silenetum acaulis*.

Keywords: central-southern Apennines, *Carici-Kobresietea*, *Kobresio-Seslerietea*, primary grasslands, syntaxonomy.

Riassunto


The study area

The locations of the coenoses attributed to the classes *Kobresio-Myosuroidis-Seslerietea caeruleae* and *Carici rupestris-Kobresietea bellardii* are included in the central-southern Apennine territory, between the Umbria–Marche sector to the north, and the Lazio–Molise sector to the south (Fig. 1). This is the area with the highest peaks of the mountain chain: Sibillini, Laga, Gran Sasso, Velino-Sirente, Maiella, Terminillo and Simbruini-Ernici.

From the point of view of the altitude, as well as the cryorotemperate and orotemperate belts of these mountains, the data analysed include the upper supratemperate belt of these and of other lower mountain peaks that do not go above the altitude limits of the woods, like Mount Catria, Mount San Vicino, Mount Gemini and Mount Coscerno (Umbria–Marche Apennines).

From the floristic point of view, the central-southern
Apennines are an area that has been well characterised (Pignatti, 1982; Passalacqua & Bernardo, 1998; Passalacqua 1998; Lucchese & De Simone, 2000; Catonica & Manzi, 2002) and can be easily separated from the northern Apennines. This area also maintains strict links with the Balcan peaks, together with which they make up the Balcan–Apennine Province, within the Eurosiberian Region (Rivas-Martínez, 2001).

Materials and methods

These data, gathered in the central-southern Apennines and relative to the coenoses included in the classes *Kobresio-Seslerietea* and *Carici-Kobresietea*, have been collected together here as both unpublished and present in the literature.

Overall, 277 relevés have been considered. Of these, 197 are already published and relate to the studies of Furnari (1961; Gran Sasso), Bruno & Furnari (1966; Gran Sasso), Feoli-Chiapella & Feoli (1977; Maiella), Pedrotti (1982; Laga Mountains), Biondi et al. (1988; central Apennines), Petriccione et al. (1993; Valleys of Amplero and Vallelonga), Biondi & Ballelli (1995; Mount Coscerno and Mount of Civitella), Allegrezza et al. (1997; central Italian calcareous rocky sectors), Biondi et al. (1999; Campo Imperatore), Biondi et al. (2000; Corno Grande), Biondi et al. (2002; Gran Sasso and Laga Mountains), Allegrezza (2003; Mount San Vicino), Blasi et al. (2003, 2005, central Apennines). The other 80 relevés are unpublished and related to the Sibillini Mountains (Val di Bove and Val di Panico) and to the Maiella Massif.

The 277 relevés have undergone multivariate analysis (Package Syntax 2000, Podani 2001) using the cord distance coefficient for the construction of the dissimilarity matrix and the complete linkage as an algorithm for the construction of clusters. Moreover, principal component analysis (PCA) has also been carried out.

Statistical analysis

The dendrogram obtained from the cluster analysis (Fig. 2) shows a clear division into two main clusters (1 and 2) that can themselves be subdivided into four and three subclusters, respectively (a-d, e-g).

Cluster 1

This cluster includes the relevés that make up the perennial herbaceous communities with a dominance of *Sesleria juncifolia* ssp. *juncifolia*, *Dryas octopetala* ssp. *octopetala* and *Carex kitaibeliana* ssp. *kitaibeliana* of the following bioclimate belts: cryorotemperate, orotemperate and upper supratemperate (sub-clusters a, b, c, d). These are discontinuous formations that are often terraced, and which are located on steep slopes with rocky outcrops and a lack of soil, often under windy conditions along the top, and under particularly intense cryoturbation.

Cluster 2

Cluster 2 groups the primary coenoses of the cryorotemperate belt that have a good level of ground cover, with the exception of the *Silene acaulis* communities; the ground cover of this plant association is considered as within the hummocks that form its edaphic support. These are characterised by the presence and dominance of *Helianthemum oelandicum* ssp. *alpestre*, *Kobresia myosuroides* and *Silene acaulis* ssp. *bryoides* (sub-clusters e, f, g), which grow on evolved soils and are characterised by limited cryoturbation due to the prolonged and abundant snow cover.

From the analysis, it can therefore be seen that these 277 relevés can be attributed to the following seven different associations, in agreement with the data collected in the literature:

a: *Seslerietum apenninae* (68 rel.)
b: *Carici humilis-Seslerietum apenninae* (47 rel.)
c: *Seslerio apenninae-Dryadetum octopetalae* (16 rel.)
d: *Caricetum kitaibelianae-rupetris* (32 rel.)
e: *Helianthemo alpestris-Festucetum italicae* (32 rel.)
f: *Leontopodio nivalis-Elynetum myosuroidis* (50 rel.)
g: *Galio magellensis-Silenetum acaulis* (32 rel.)
The separation of these seven plant formations into two particularly distinct groupings is also apparent from the PCA of the seven floristic groups (Fig. 3). From this analysis (Fig. 3), it can be hypothesised that the distribution along axis 1 can be interpreted as the altitudinal gradient. Indeed, the vegetation of *Carex humilis* and *Sesleria juncifolia* ssp. *juncifolia* of the upper supratemperate belt is positioned to the extreme right, while the formations of *Silene acaulis* ssp. *bryoides* and *Kobresia myosuroides*, which can grow up to the summit sectors, are close to the second axis.

Along axis 2, the plant associations appear to be distributed from the bottom to the top according to a gradient linked to the slope of the terrain. Indeed, at the bottom, there are the coenoses of the class *Kobresio-Seslerietea*, which grow under conditions of relatively steep slope. The mean slope recorded for the four associations is 26.56°. The communities gathered in the second cluster are instead on lesser slopes, decreasing as they approach the higher part of the axis. The slope for *Leontopodio nivalis-Elynetum myosuroidis* is 17.13°, for *Helianthemo alpestris-Festucetum italicæ*, 16.82°, and for *Galio magellensis-Silenetum acaulis*, 11.88°.

Syntaxonomic problematics related to the study of the high altitude grasslands

The high-altitude vegetation of the central-southern Apennines has been studied for at least 40 years, and during the various investigations the research groups have delved into the floristic and phytosociological difficulties. The syntaxonomic classification of these grasslands is, however, still under discussion, and
there is no univocal interpretation at present. From the literature, it can be seen that various studies refer some of these coenoses to the class *Carici-Kobresietea* (Ohba 1974; Biondi *et al.* 1999, 2000, 2002), while others put them all into the class *Kobresio-Seslerietea* (Feoli-Chiapella & Feoli 1977; Oriolo 2001; Blasi *et al.* 2003, 2005).

With the aim of resolving these problems, the data collected here have been analysed not only from a numerical point of view, but also from the floristic and syntaxonomic points of view.

On the basis of these comparisons (Tables 2 and 3), it can be seen that among the species used by Ohba (1974) to characterise the class *Carici-Kobresietea*, almost all of those present in the relevés that we have analysed (9 out of 10) were already used for the characterisation at various levels of the class of the Apennine coenoses *Kobresio-Seslerietea* (Braun-Blanquet, 1948).

The coenoses of cluster 2, which represent the climatophilous vegetation of the summit sectors of the highest Apennine peaks, are anyway characterised by the constant presence of species of Arctic–Alpine and circumboreal origins, which reach mean percentage cover levels that are almost double with respect to those of cluster 1 (Fig. 4). These floristic entities, which can be considered as glacial relicts, descended to lower latitudes with the last glaciation, and then ascended again up the highest altitudes, where they found refuge from the later increases in temperature. These represent 80% of the group of species characteristic of the class *Carici-Kobresietea* that are found in the relevés collected and analysed here.

The grasslands corresponding to cluster 1, instead, mainly occupy the orotemperate belt of the Apennine chain, and are distinguished by the presence of a considerable group of orophytes and Mediterranean-montane species, which were for the large part indicated by Bruno & Furnari (1966) as characteristic of the order *Seslerietalia apenninae* and of the alliance *Seslerion apenninae*. These species, which within this cluster reach mean percentage cover values that are considerably greater than in cluster 2 (Fig. 4), found refuge at low altitudes and then differentiated during the period of the Plio-Pleistocene glaciation; only following the post glacial warming they have returned up to higher altitudes.

The hypothesis of the presence of both of the classes in the central-southern Apennines would therefore be confirmed by these considerations. This is founded not just phytophilosophical criteria, but also on the influence of edaphic factors. Indeed, the coenoses of cluster 1 appear to be differentiated from those of cluster 2 because they can survive under the more xeric conditions arising from the more superficial and less evolved soils. The coenoses corresponding to the three branches of cluster 2 grow instead under conditions of deeper soils and with less steep slopes.

In conclusion, we hypothesize a temporary solution of the syntaxonomic problematics. It modifies the previous interpretations of Feoli-Chiapella & Feoli (1977), Oriolo (2001) and Blasi *et al.* (2003, 2005), who identified the class *Kobresio-Seslerietea* as the only syntaxon that is representative of the primary grasslands of the central-southern Apennines. Our proposal is based upon a statistical analysis which confirms ecological differences at a territorial scale and shows a partial floristic autonomy of the *Carici-Kobresietea* class. This is due to the marginal position of the study area with respect to the distribution area of the same class.

**Syntaxonomic attribution of the clusters**

The coenoses corresponding to the a, b, c and d branches have been assigned to the class *Kobresio-Seslerietea*, to the order *Seslerietalia tenuifoliae*, to the suborder *Sesleriendialia apenninae* and to the alliance *Seslerion apenninae*. The suborder allows the proposal of Bruno & Furnari (1966) to be readopted, regarding the order *Seslerietalia apenninae*, and therefore the collocation of this order at the hierarchical level is revised.

The association *Caricetum kitaibeliana-rupesstris* Biondi *et al.* 2000, is referred to the alliance *Seslerion apenninae*, in agreement with its original inclusion (Biondi *et al.* 2000). This is not in agreement with the previous interpretation of Blasi *et al.* (2003), who assigned it to the suballiance *Leontopodio-Elynenion*. This is because as judged by this re-analysis, it is floristically more similar to the associations of cluster 1 than of cluster 2.

The coenoses of the class *Carici-Kobresietea*, relative to the e, f and g branches, are instead included in the order *Oxytropido-Kobresietalia*, to the alliance *Oxytropido-Elynenion* and to the suballiance *Leontopodio-Elynenion*. This syntaxon allows the coenoses of the Apennine distribution areas within the above alliance to be distinguished. For this suballiance, which was initially referred to the alliance *Seslerion apenninae* and to the class *Kobresio-Seslerietea* (Blasi *et al.*., 2003), the floristic composition has been described in detail.
Tab. 1 - Number, frequency and mean cover value for each chorotype within the considered coenosis.

<table>
<thead>
<tr>
<th>Chorotype</th>
<th>n°</th>
<th>freq.</th>
<th>cop.</th>
<th>n°</th>
<th>freq.</th>
<th>cop.</th>
<th>n°</th>
<th>freq.</th>
<th>cop.</th>
<th>n°</th>
<th>freq.</th>
<th>cop.</th>
<th>n°</th>
<th>freq.</th>
<th>cop.</th>
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<td>Pal</td>
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<td>0.04</td>
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<td>0.01</td>
<td>0.01</td>
<td>0.06</td>
<td>0.00</td>
<td>0.00</td>
<td>0.22</td>
<td>0.01</td>
<td>0.01</td>
<td>0.34</td>
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<td>Oro</td>
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<td>0.19</td>
<td>547</td>
<td>0.17</td>
<td>0.18</td>
<td>206</td>
<td>0.14</td>
<td>0.11</td>
<td>1.56</td>
<td>0.09</td>
<td>0.08</td>
<td>2.22</td>
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<td>547</td>
<td>0.37</td>
<td>0.29</td>
<td>538</td>
<td>0.23</td>
<td>0.12</td>
<td>2.96</td>
<td>0.14</td>
<td>0.09</td>
<td>4.86</td>
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<td>3.60</td>
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<td>241</td>
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<td>0.09</td>
<td>1.56</td>
<td>0.11</td>
<td>0.24</td>
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<td>0.21</td>
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<td>19.94</td>
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</tbody>
</table>

KOBRESIO MYOSUROIDIS-SESLERIETEA CAERULEAE BR.-BL. 1948 NOM. MUT. RIVAS-MARTINEZ ET AL. 2000

SUB-ORDER SESLERIENALIA APENNINAE BRUNO & FURNARI 1966 EM. HOC LOCO AND ALLIANCE SESLERION APENNINAE FURNARI IN BRUNO & FURNARI 1966 EM. HOC LOCO (TABLE 2).

The grasslands of Sesleria juncifolia are now included in the order Seslerietalia tenuifoliae, even though some of the species identified by Horvat (1930) for the Balcans are found in the Apennines.

On the other hand, it needs to be noted that the studies that have referred this coenosis to the order Seslerietalia tenuifoliae (Allegrezza et al. 1997; Allegrezza 2003; Biondi et al. 1988, 1999, 2000, 2002; Blasi et al. 2003, 2005) did this using entities not identified by Horvat (1930) and never added to the list of the characteristic species according to the norms for syntaxonomic nomenclature.

Many of these species were actually already indicated for the order Seslerietalia apenninae, proposed by Bruno & Furnari (1966) as the vicariant syntaxon of the orders Seslerietalia coeruleae (Alps) and Seslerietalia tenuifoliae (Balcans). As an alternative to maintaining the current classification, we believe that it is more correct to return to the proposal put forward by Bruno & Furnari (1966).

From this analysis, we can subdivide the characteristic species of the order Seslerietalia apenninae into three groups. As well as being found in the Apennine relevés, most of these entities are also found in the Balkans and the Alps: Minuartia verna ssp. verna, Draba aizoides ssp. aizoides, Phyteuma orbiculare, Oxytropis neglecta, Helianthemum oelandicum ssp. incanum, Pedicularis verticillata, Helianthemum nummularium ssp. grandiflorum, Polygala alpestris, Astragalus sempervirens, Biscutella laevigata ssp. laevigata, Oxytropis campestris, Thymus praecox ssp. polytrichus, Koeleria lobata, Potentilla crantzii ssp. crantzii, Cyanus triumphetti, Linum capitatum, Linum alpinum and Aster alpinus ssp. alpinus. This first group takes on a differential role of an ecological type in comparison with the associations of the class Carici-Kobresietea; only the last three of these species form part of the group identified by Horvat (1930) in his description of the order Seslerietalia tenuifoliae.

Two species are present on the Apennine and Balkan sesleria grasslands, but not in those of the Alps: Dianthus sylvestris ssp. longicaulis and Anthyllis vulneraria ssp. pulchella.

The rest of the species identified by Bruno & Furnari (1966) to define the order Seslerietalia apenninae can instead be considered as geographical differentials of the Apennine heights in comparison with the Balkan mountains: Trinia dalechampii, Anthyllis vulneraria ssp. weldeniana, Gentiana verna ssp. verna, Pulsatilla alpina ssp. millefoliata, Acinos alpinus ssp. meridionalis, Erigeron epiroticus, and Pedicularis...
Tab. 2 - The vegetation of *Kobresio myosuroidis-Seslerietea caeruleae* class in central-southern Apennines

<table>
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<th>1</th>
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<td>Mean altitude (m. a.s.l. x 10)</td>
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<td>2121</td>
<td>2182</td>
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<tr>
<td>Mean slope (°)</td>
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<td>29</td>
<td>34</td>
</tr>
<tr>
<td>Mean coverage (%)</td>
<td>86</td>
<td>65</td>
<td>67</td>
</tr>
<tr>
<td>Number of relevés</td>
<td>47</td>
<td>68</td>
<td>16</td>
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<table>
<thead>
<tr>
<th></th>
<th>Ch rept (CIRCUM.) ART.ALP.</th>
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<tbody>
<tr>
<td></td>
<td>Dryas octopetala L. ssp. octopetala</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>H caesp (CIRCUM.) ART.ALP.</td>
</tr>
<tr>
<td></td>
<td>Carex repetis All.</td>
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<td></td>
<td>.</td>
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<tr>
<td></td>
<td>Ch pulv (CIRCUM.) ART.ALP.</td>
</tr>
<tr>
<td></td>
<td>Silene acaulis (L.) Jacq. ssp. bryoides (Jord.) Nyman</td>
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<td></td>
<td>H caesp ART.ALP.</td>
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<tr>
<td></td>
<td>Kobresia myosuroides (Vill.) Fiori</td>
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<td></td>
<td>H caesp OROF. S-EUROP.</td>
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<tr>
<td></td>
<td>Carex parviflora Host</td>
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<table>
<thead>
<tr>
<th></th>
<th>•</th>
<th>Species also belonging to <em>Carici rupestris-Kobresietea bellardii</em> class and its lower hierarchical levels</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Caricetum bellardii (9)</td>
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</tbody>
</table>
Tab. 3 - The vegetation of Carici rupestris-Kobresio bellardii class in central southern Apennines

<table>
<thead>
<tr>
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<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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<tbody>
<tr>
<td>Mean altitude (m a.s.l. x 10)</td>
<td>2630</td>
<td>2420</td>
<td>2332</td>
</tr>
<tr>
<td>Mean slope ('')</td>
<td>28</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Mean coverage (%)</td>
<td>57</td>
<td>87</td>
<td>90</td>
</tr>
<tr>
<td>Number of relevés</td>
<td>32</td>
<td>50</td>
<td>32</td>
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</tbody>
</table>

- **H ros SE-EUROP.** Minuartia verna (L.) Hiern ssp. verna 72 62 47 3
- **Ch pulv (CIRCUM.)ART.ALP.** Silene acaulis (L.) Jacq. ssp. bryoides (Jord.) Nyman 75 84 100 3
- **H scap ARTICO-ALP.** Potentilla crantzii (Crantz) Beck ex Fritsch ssp. crantzii 66 80 31 3
- **H caesp ART.ALP.** Kobresia myosuroides (Vill.) Fiori 6 96 13 3
- **H scap OROF.-CIRCUMBOR.** Dryas octopetala L. ssp. octopetala . 12 . 1
- **H caesp (CIRCUM.)ART.ALP.** Carex rupestris All. . 12 . 1
- **H scap (CIRCUM.)ART.ALP.** Erigeron uniflorus L. 6 96 13 3

Moreover, we suggest the amendment of the group of characteristic species of the same suborder with the addition of Ranunculus breyninus and Festuca violacea ssp. italic. The former species is not exclusive to the Apennine relevés, but is constantly present in the associations of the first cluster and has already been identified (Biondi *et al.* 2000, 2002, Allegrezza *et al.* 2003) as characteristic of the superior level for the association of the classes Kobresio-Seslerietea. Festuca violacea ssp. italic. is endemic, and therefore it’s a geographical differential compared to the Balcan sesleria grasslands.
For the alliance Seslerion apenninaceae, we propose to integrate this group of characteristic species with Carex flexuosum, a north-eastern Mediterranean montane species that has already been indicated as characterising the syntaxon in the study of the grasslands of Campo Imperatore (Biondi et al., 1999).

CARICI HUMILIS-SESLERIETUM APENNINACEAE BIONDI ET AL. 1988
dryadetosum octopetalae Biondi et al. 1999
genistetosum michelii Allegrezza et al. 1997 em. hoc loco
hieracietosum cymosi subass. nova (type rel.: n. 38 of Table 4)
anthylletosum pulchellae subass. nova (type rel.: n. 45 of Table 4)

Synchorology
This association was described for the first time in a study of the grasslands of Sesleria juncifolia ssp. juncifolia located below the potential limits of the woods, in the central Apennines (Biondi et al., 1988). Then it was seen in the Valleys of Amplero and Vallalonga (Petriccione et al., 1993), on Mount Coscerno and Mount of Civitella (Biondi & Ballelli, 1995) and on Mount Gemmo (Allegrezza et al., 1997). The association Carici humilis-Seslerietum apenninaceae was found more recently also in Campo Imperatore (Biondi et al., 1999), on the ridges of Mount San Vicino (Allegrezza, 2003) and in Val di Bove (Sibillini Mountains, our unpublished relevés).

Syndynamics
These pastures have strong xeric characteristics and they form chain contact with the high-altitude perennial edaphoxerophilous herbaceous communities and the secondary grassland formations of Festuco-Brometea of the supratemperate belt.

The association is referred to the grasslands with a dominance of Sesleria juncifolia ssp. juncifolia that are located below the potential limits of the woods, and although included in the class Kobresio-Seslerietea it has a large contingent of species of the class Festuco-Brometea. Therefore, from the chorological point of view, this is an association in which the European species reach the greatest percentage cover (over 35%; Table 1).

Synecology
The association is found in the central-southern Apennines, from Mount Catria to Marsica. These coenoses can be considered as permanent stages, sometimes with characteristics of primary formations when they are found in summital positions, where because of cryoturbation, the growth of woody vegetation is impeded. The association Carici humilis-Seslerietum apenninaceae can be seen also on the detritus layers and the alluvial cones, where the particular drainage conditions and the absence of soil block the evolution of the substratum and therefore the development of more mature vegetation.

Physiognomy
The physiognomy is characterised by the abundant presence of dense tufts of Sesleria juncifolia ssp. juncifolia associated with chamaephytes like Anthyllis montana ssp. atropurpurea, Globularia meridionalis, Helianthemum oelandicum ssp. incanum and Teucrium montanum, and hemicyrptophytes such as Carex humilis, Koeleria lobata, Dianthus sylvestris ssp. longicaulis and Bromus erectus.

Syntaxonomy
Following the comparative analysis of the relevés under examination, it is possible to confirm the validity of the association Carici humilis-Seslerietum apenninaceae and of the subassociation dryadetosum octopetalae (Biondi et al., 1999), while it has been necessary to amend the subassociation genistetosum michelii (Allegrezza et al., 1997). Moreover, two new plant communities are proposed: hieracietosum cymosi and anthylletosum pulchellae (Table 4).

At the higher altitudes that are reached by this coenosis (1,790-1,850 m), the subassociation dryadetosum octopetalae (Biondi et al., 1999) has been described, which provides chain contact with the chamaephytic grasslands of the association Seslerio apenninaceae-Dryadetum octopetalae.

In rocky calcareous locations that are less exposed to the rigours of winter, the subassociation genistetosum michelii (Allegrezza et al., 1997, 2003) has been seen, which represents the more distinctly chamaephytic and rocky aspect of the association. In the present study, this formation is amended with the addition to the group of species already described of Potentilla cinerea, which under ecological conditions of rocky outcrops behaves as a chamaephyte.

In the basin of Mount Bove (in the Sibillini Mountains), at heights near to the potential limits of the woods (1,620-1,815 m), on slopes mainly exposed to the north and with variable slopes from 20° to 30°, the new subassociation hieracietosum cymosi is described, which is mainly made up of scapose hemicyrptophytes Campanula tanfani and Hieracium cymosum, and of the suffrutiaceous chamaephytic species Trinia dalechampii, Helianthemum nummularium ssp. grandiflorum and Erysimum cheiri; to these there can be added Saxifraga paniculata, Thymus praecox ssp. polytricus, Erophila verna ssp. verna and Solenanthus
apenninus.

The grasslands of Sesleria juncifolia ssp. juncifolia seen on Mount Coscerno and Mount of Civitella (Biondi & Ballelli, 1995) were originally attributed to the type subassociation; from the comparison proposed in Table 4, a large differential group can be distinguished: Knautia arvensis, Anthyllis vulneraria ssp. pulchella, Festuca robustifolia, Eryngium amethystinum, Onobrychis alba ssp. alba and Sedum acre allow the characterisation and description of the new subassociation anthyllietosum pulchellae.

Seslerietum apenninae Bruno & Furnari 1966

juncetosum monanthi Biondi et al., 1999

festucetosum alfredianae subass. nova (type rel.: n. 49 of Table 5)

Synodynamics

The association Seslerietum apenninae makes up the main edaphoxerophilous vegetation of the orotemperate bioclimatic belt, and locally also the same of the cryorotemperate belt. It is often in contact with the vegetation of the association Leontopodio nivalis-Elynetum myosuroidis and with that of the screes.

Synecology

This formation grows on the peaks on superficial soils with limited slope and with rocky outcrops, and also on detritus and often on terraced slopes. On the basis of the ecological evaluation carried out at Campo Imperatore (Biondi et al., 1999), the soil on which the association Seslerietum apenninae grows has a pH that is slightly basic (centroid 7.66), a high skeleton content (centroid 44%) and a relatively good ability for cationic exchange.

During the winter period, due to the actions of the wind, the soil can remain without snow cover for long periods, with the consequence that the vegetation is left exposed to the severity of the climatic agents. The harshness of the winter provides strong selection pressure against the floristic entities with greater nutritional and ecological needs, and at the same time, it supports the development of those species that are adapted to this habitat. An example is seen in the way Sesleria juncifolia ssp. juncifolia grows under certain conditions: in situations that are particularly windy and where there is no snow cover, the leaves of this grass tend to grow at the side opposite from which the dominant wind comes, while the branches at the other side tend to dry up. It is maybe a consequence of this that the hummocks formed by this vegetation are elongated in the form of strips, which on some slopes cause the typical terraced aspect.

Physiognomy

The physiognomy is due to the presence of Sesleria juncifolia ssp. juncifolia accompanied by chamaephytes such as Helianthemum oelandicum ssp. alpestre and Anthyllis montana ssp. atropurpurea and by high-altitude microthermal species like Androsace villosa ssp. villosa, Draba aizoides ssp. aizoides, Pedicularis elegans and Silene acaulis ssp. bryoides. The mean cover of the plant of the relevés analysed is 65%.

Synchorology and syntaxonomy

The association is included in the alliance Seslerion apenninae, of the suborder Seslerietalia tenuifoliae, of the order Seslerietalia tenuifoliae and of the class Kobresio-Seslerietea.

The first description of Sesleria juncifolia ssp. juncifolia grasslands in the Apennines can be attributed to Lüdi (1943), who used the term Carex laevis-Sesleria tenuifolia Trockenrasen, although, based on Article 3c of the Code for Phytosociological Nomenclature, this term cannot be considered valid. The double name of Seslerietum tenuifoliae was used to describe the formations with a dominance of Sesleria juncifolia ssp. juncifolia found on Mount Terminillo and Gran Sasso by Montelucci (1952) and Furnari (1961), respectively. Both of these descriptions cannot be considered valid because they are synonymous with the previous association Seslerietum tenuifoliae indicated by Horvat in 1930 and used to describe a vegetation seen on the Croatian mountains, which is anyway syntaxonomically different to that identified in the Apennines (Mucina, 2003).

In their report of the excursion of the International Phytosociological Society, Bruno & Furnari (1966) described two relevés (pages 5 and 17) as “Seslerietum of Sesleria apennisu Ujheyi and Carex kitaibeliana Degen”. Biondi et al. (1999) indicated that this second name here is a correction of the first one previously used. As a consequence, they considered “Seslerietum apenninae” Furnari 1961 corr. Furnari 1966” as the correct name for the coenosis in question, indicating the type relevé in Furnari (1961), the relevé that in the original study took the name of “Seslerietum tenuifoliae” instead.

Mucina (2003) did not accept the standardisation of the name Seslerietum apenninae based on the relevé in Furnari (1961). Instead, he identified relevé 4 of page 17 of Bruno & Furnari (1966) as the holotype of the association, indicating that this was the correct reference to this syntaxonomic unit, in that it is clear that the term Seslerietum is for Seslerietum apenninae, being that Sesleria apennina is the only Sesleria present in the relevé.
Migliaccio (1970) and then Bonin (1978) described a formation of Sesleria that they indicated as Seslerietum apenninae. The proposal of these last authors cannot be considered valid, in that also in this case, this was a synonym of an already used name.

For the cryorotemperate belt of the Maiella Massif, the new association Leontopodio nivalis-Seslerietum apenninae has been described, with the characteristic and differential species of the association indicated as Leontopodium nivale, Aster alpinus ssp. alpinus, Iberis saxatilis and Ranunculus breyninus (Blasi et al. 2005). According these authors, this phytocoenosis grows on brown rendzina and relatively deep soils, but with a high skeleton content, and from the point of view of the physiognomy, it has a percentage cover of soil greater than the other formations of Sesleria juncifolia ssp. juncifolia found in the central-southern Apennines. From an analysis of Table 5, it can be seen that this formation as described Blasi et al. (2005) does not show any autonomy, either floristic or structural, if it is compared with the relevés of the other primary grasslands ascribed to the association Seslerietum apenninae. In particular, the group of species proposed as characteristic and differential of this last coenosis, as Helianthemum oelandicum ssp. alpestre, Pedicularis elegans and Androsace villosa ssp. villosa, are well represented in the relevés of the new association. Also, the entities said to be diagnostic for the association Leontopodio nivalis-Seslerietum apenninae are actually constantly present and well represented also in the relevés of the previous association Seslerietum apenninae.

From the analyses of the relevés, the presence of two subassociations is revealed.

For Campo Imperatore the subassociation juncetosum monanthi has been described (Biondi et al., 1999). This syntaxon is characterised by Arctic-Alpine species and shows dynamic connections with the climatophilous vegetation of the Alpine belt of the association Leontopodio nivalis-Elynetum myosuroidis.

For the Sibillini Mountains and the Maiella, the new subassociation festucetosum alfredianae is here proposed, in which the participation of rupicolous species of the class Asplenietae trichomanis (Saxifraga paniculata) and of scree entities of the class Thlaspieta (Iberis saxatilis, Thlaspi stylosum, Silene multicaulis ssp. multicaulis, Galium magellense, Leontodon montanus ssp. melanotrichus and Saxifraga oppositifolia ssp. speciosa) indicate the change towards more xeric conditions that are typical of less evolved soils. To this can then be added Arenaria bertolonii, Cerastium thomasi and Sempervivum arachnoideum. The coenosis has a cover that is generally discontinuous and grows on a terraced morphology, with slopes greater than 20°, with mainly a southern exposure, and at altitudes between 1,880 m and 2,510 m.

### Seslerio apenninae-Dryadetum octopetalae Biondi et al. 1999
caricetosum firmae Biondi et al. 1999
polygaletosum alpestris subass. nova (type rel.: n. 14 of Table 6)

#### Synchorology

The association was first described during geobotanical analyses carried out by Biondi et al. (1999) in Campo Imperatore, and later it was found again for the summit sectors of the Maiella Massif (Di Fabrizio et al. 2006; unpublished relevés).

#### Synecology

The association Seslerio apenninae-Dryadetum octopetalae consists of primary grasslands of the cryorotemperate, orotemperate and supratemperate bioclimatic belts. It is found under particularly selective conditions that are characterised by strong winds, and soils that are subjected to intense cryoturbation.

Dryas octopetala ssp. octopetala is a creeping chamaephyte, and it is a species with a great colonisation ability both on moving detritus and on lithosols. It forms closed islands of vegetation that gathers small patches of soil, thus allowing the growth of floristic entities that would otherwise not be able to occupy these habitats.

#### Physiognomy

The physiognomy of this coenosis is characterised by Dryas octopetala ssp. octopetala and other chamaephytes, like Edraianthus graminifolius ssp. graminifolius, Androsace villosa ssp. villosa, Anthyllis montana ssp. atroporpurea, and caespitose hemicyrptophytes such as Sesleria juncifolia ssp. juncifolia, Carex kitaibeliana ssp. kitaibeliana and Carex murocrata, and it is characterised by its floristic paucity (mean of 14.5 species/relevé; Table 1).

#### Syntaxonomy

From the relevés of Campo Imperatore, the subassociation caricetosum firmae was differentiated for the cryoorotemperate belt (Biondi et al., 1999). This syntaxon is of particularly phytogeographical interest, as Campo Imperatore is the only Apennine location for Carex firma.

Some relevés were carried out in the locality of the Valle Taranta, in the Maiella Massif (Di Fabrizio et al. 2006; unpublished relevés), at altitudes between
<table>
<thead>
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<th>Aspect</th>
<th>Slope (°)</th>
<th>Coverage (%)</th>
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</table>

**Tab. 6. Seslerio apenninae-Dryadetum octopetalae Biondi et al. 1999**

*Legend:* OROF. = Orofice; EURASIAT. = Eurasiatic; NE-STENOMEDIT. = Neostenetemediterraneo; CIRCUMALP. = Circumalpino; CIRCUMMONT. = Circummontano; MEDIE-MONT. = Mediteraneo-Montano; SUBENDEM. = Subendemico; ART. = Artico; ALP. = Alpino; S.EUROP. = Sud Europa; S.EUROP. = Sud Europa; OROF. = Orofice; SE-EUROP. = Sud-est Europa; MEDIT.-MONT. = Mediterraneo-Montano; NE-MEDIT.-MONT. = Neomediterraneo-Montano; EURIMEDIT. = EuroMediterraneo; CAUC. = Caucaso; N-MEDIT.-MONT. = Nord Mediterraneo; E-MEDIT.-MONT. = Est Mediterraneo.
2,250 m and 2,320 m, on slopes with a steepness of around 30° and generally with a northern exposure. These relevés are again distinguished by their floristic paucity, the low number of species of the upper syntaxonomic units, the large cover, and the constant presence of Polygala alpestris. From these relevés, it was possible to describe the new subassociation polygaletosum alpestris. The differential species are: Trinia dalechampii, Polygala alpestris, Pedicularis verticillata and Oxytropis neglecta, all of which are of the class Kobresio-Seslerietea.

**Caricetum kitaibeliana-e rupestris Biondi et al. 2000**

**artemisietosum erianthae Biondi et al. 2000**

**Synchorology**

The association Caricetum kitaibeliana-e rupestris (Table 7) was described for the first time for Corno Grande (Biondi et al., 2000), and later found in other locations (Mount Aquila) in the Gran Sasso Group (Biondi et al., 2002; Blasi et al., 2003). This grassland with Carex kitaibeliana ssp. kitaibeliana and Carex rupestris can be considered the Apennine vicariant of the association Caricetum rupestris described for the cryorotemperate belt of the Dolomites (Pignatti & Pignatti, 1985).

**Syndynamics**

This is considered to be in chain contact with the climatophilous vegetation of the cryorotemperate belt: the elyna grassland of the association Leontopodio nivalis-Elynetum myosuroidis.

**Physiognomy**

The physiognomy of the association Caricetum kitaibeliana-e rupestris arises from a substantial group of caespitose hemicyrptophytes, such as Carex rupestris, Carex kitaibeliana ssp. kitaibeliana, Sesleria juncifolia ssp. juncifolia, and Festuca violacea ssp. italica.

**Syntaxonomy**

Of particular chorological interest, there are Carex rupestris and Silene acaulis ssp. bryooides, which are both Arctic-Alpine circumboreal species (they characterise the association and increase the mean cover value of this chorotype to more than 32%; Table 1). This is because they group in a floristic cortège that is dominated by southern European orophytes that are typically Apennine, like Sesleria juncifolia ssp. juncifolia, Carex kitaibeliana and Sedum atratum, and other species, like the endemic Edraianthus graminifolius ssp. graminifolius and Festuca violacea ssp. Italica, and the Mediterranean-montane Helianthemum oelandicum ssp. alpestrae. These last are all characteristic of the suborder Seslerienalia apenninae or of the alliance Seslerion apenninae, allowing this coenosis to be differentiated from Caricetum rupestris of the Alps and to include it within the class Kobresio-Seslerietea.

For Corno Grande and Mount Aquila, in small valley-like situations of the rocky crests with high slop (more than 35°) with a mainly northern exposure and under conditions of continual disturbance because of the wind, the subassociation artemisietosum erianthae has been described (Biondi et al., 2000). Artemisia umbelliformis ssp. eriantha is a suffruticose chamaephyte that grows on the highest calcareous heights of the Apennines (Sibillini Mountains, Gran Sasso and Maella Massifs) and of the maritime Alps. Individuals frequently grow in the cracks and breaks in the rocks, where there is accumulation of soil and where they are sheltered from the winds.

For Gran Sasso, there are also two variants that have been identified: one with Salix retusa (Blasi et al., 2003) and the other with Dryas octopetala ssp. octopetala (Biondi et al., 2000).

**Carici rupestris-Kobresietea bellardi Ohba 1974 nom. mut. prop. Rivas-Martinez et al. 2002**

**Suballiance Leontopodio nivalis-Elynetum myosuroidis Blasi et al. 2003 (Table 3)**

The associations Helianthemum alpestris-Festucetum italicae, Leontopodio nivalis-Elynetum myosuroidis and Galio magellensis-Silenetum acaulis are included in the suballiance Leontopodio nivalis-Elynetum myosuroidis according to the interpretation of Blasi et al. (2003). However, the syntaxonomic collocation of the last of these syntaxa needs to be revised, with modifications proposed for the previous interpretation (Blasi et al., 2003) that attributed it to the alliance Seslerion apenninae, to the order Seslerietalia tenuifoliae and to the class Kobresio-Seslerietea; we propose its assignment to the class Carici-Kobresietea, in agreement with Biondi et al. (1999) and as described previously. The suballiance Leontopodio nivalis-Elynetum myosuroidis would represent the Apennine-focussed syntaxon of the central-southern European alliance Oxytropido-Elyniom (Braun-Blanquet, 1948). This last, and the order Oxytropido-Kobresietalia, both
considered by Braun-Blanquet (1948) and Albrecht (1969) to be the lower hierarchical levels of the class Kobresio-Seslerietea, are now gathered in the class Carici-Kobresietea on the basis of what was stated more recently by Ohba (1974) and Biondi et al. (1999). On the basis of this syntaxonomic interpretation, only the entities representative of the three associations of interest, and not those indicated in the literature as diagnostic of the upper hierarchical levels, can be considered characteristic species of this subassociation: Bistorta vivipara, Gnaphalium hoppeanum ssp. magellense, Leontopodium nivale, Helianthemum oelandicum ssp. alpestre, Gentiana urticulosa, Oxytropis neglecta, Carex ericetorum, and Antennaria dioica.

**Helianthemum alpestris-Festucetum italicæ Blasi et al. 2005**

anthylletosum weldenianae subass. nova (type rel: 19 of Table 8)

helianhemetosum grandiflorum subass. nova (type rel: 30 of Table 8)

**Synchorology**

The association Helianthemum alpestris-Festucetum italicæ was observed in various locations of the cryorotemperate belt of the Maiella Massif (Blasi et al., 2005), and later found in other locations of the same massif (Di Fabrizio et al. 2006; unpublished relevés).

**Synodynamics**

In the systems of depressions and cattle holes, and particularly common at the head of the valleys, coenosis can provide chain contact between the vegetation at the base of the valley and that of the summit subplain sectors, covering the less steep slopes of the depressions.

**Synecology**

This is found as discontinuous grasslands both on the relatively steep slopes with rocky outcrops and in subplain situations with deeper soils

**Physiognomy**

Helianthemum oelandicum ssp. alpestre and Festuca violacea ssp. italicæ have the greatest effects on the physiognomy of this phytocoenosis. There is also an important presence of microthermal hemicyryptophytes like Carex kitaibeliana ssp. kitaibeliana, Draba aizoides ssp. aizoides and Leontopodium nivale, and chamaephytes such as Thymus praecox ssp. polytricus, Edraianthus graminifolius ssp. graminifolius and Silene acaulis ssp. aizoides.

**Syntaxonomy**

On the basis of the analyses carried out in the present study, the association Helianthemo alpestris-Festucetum italicæ can be included in the suballiance Leontopodio-Elynenion and in the alliance Oxytropido-Kobresietalia and to the class Kobresio-Seslerietea.

In the steep locations (35°-40°) that are characterised by terraced soils with greatly fractured rocky outcrops and small and medium sized rock detritus, the new subassociation heliathemetosum grandiflorii can be identified. In the relevés, there is an evident absence of species of this subassociation, while there are a number of entities that have infiltrated from the lower altitudes: Hippocrepis comosa ssp. comosa, Senecio scopoli, Hieracium naegelianum and Medicago lupulina. This infiltration from below is evidence of microclimate conditions that are relatively milder with respect to those expected for the altitude, probably because of their ESE exposure and their position protected from the wind. The differential species of the subassociation are: Helianthemum nummularium ssp. grandiflorum (Festuco-Brometea), Doronicum columnae (Mulgédo-Aconitetea), Trifolium noricum ssp. pratetuanum (Salicetea herbaceae), Rumex nebroides, Senecio scopoli, Hieracium naegelianum and Cerasitum thomasii (Thlaspietea).

In locations characterised by less steep slopes (10°-25°), on soils that are relatively more evolved and terraced, there is the new subassociation anthylletosum weldenianae. This herbaceous community can represent the chain contact between the edaphoxerophilous formations and those climatophilous that is often seen in the system of depressions and cattle holes at the bottom of the glacial valleys. The differential species of the subassociation are: Anthyllis vulneraria ssp. weldeniana (Festuco-Brometea), Armeria majellensis ssp. majellensis (Festuco-Brometea), Acinos alpinus ssp. meridionalis (Kobresio-Seslerietea) and Gentiana brachypyllylla ssp. favratii (Carici-Kobresietea).

**Leontopodo nivalis-Elynetum myosuroidis Feoli-Chiapella & Feoli 1977**

trinietosum dalechampii Biondi et al., 1999 em. hoc loco

**Synchorology**

The association Leontopodo nivalis-Elynetum myosuroidis (Table 9) was first found on the summit sectors of the Maiella Massif by Feoli-Chiapella & Feoli (1977), and later at Campo Imperatore (Biondi et al., 1999), where the subassociation trinietosum dalechampii was also described. Blasi et al. (2003) extended observations of this coenosis to other locations of Gran Sasso, Maiella and Laga Massifs.
As well as the relevés already published, unpublished relevés from the Maiella are included here (Table 9, rel. n° 16-22).

**Syncology**

From the ecological point of view, this elyna grassland is generally found for locations at altitudes greater than 2,300 m and on soils that are relatively deep.

**Physiognomy**

This vegetation is the climatóphilous formation of the cryorotemperate belt of the central-southern Apennines and it is a closed grassland with a dominance of *Kobresia myosuroides (=Elyna myosuroides)*, a caespitose hemicryptophyte with an Arctic–Alpine circumboreal distribution.

This formation is made up of numerous species with an eastern distribution, such as: *Oxytropis campestris*, *Alchemilla colorata*, *Carex ericetorum*, *Trinia dalechampii*, *Trifolium thalii*, *Androsace villosa* ssp. *villosa* and *Gentiana verna* ssp. *verna*, with a significant presence of Arctic-Alpine entities, like: *Kobresia myosuroides*, *Pedicularis verticillata*, *Ranunculus breyninus*, *Bistorta vivipara*, *Potentilla crantzii* ssp. *crantzii*, *Silene acaulis* ssp. *bryoides*, and *Gentiana nivalis*.

**Syntaxonomy**

The four species suggested by Feoli-Chiapella & Feoli (1977) to describe this coenosis have been confirmed. It is, however, necessary to propose an amendment to the group of differential species originally identified by Biondi et al. (1999) for the subassociation *trinietosum dalechampii*.

This syntaxon has been recorded for Gran Sasso, Laga, and Maiella Massifs in situations of slopes of mainly northern exposure on evolved soils from 2,020 m to 2,470 m in altitude and with a particularly dense cover, mainly due to the presence of scapose and rosette hemicryptophytes.

Of the group of differential species originally proposed, *Alchemilla colorata*, *Trinia dalechampii* and *Antennaria dioica* have been confirmed, while *Armeria majellensis* ssp. *majellensis* has little significance: it is more diffuse in the type subassociation and particularly sporadic in *trinietosum dalechampii*. Some other species instead appear to be better for the differentiation of this subassociation: *Trifolium thalii*, *Plantago alpina* and *Plantago atrata* (Nardetea), *Carex ericetorum*, *Pedicularis verticillata*, *Ranunculus breyninus*, *Luzula spicata* ssp. *italica* and *Gentiana verna* ssp. *verna* (Kobresio-Seslerietea), *Festuca rubra* (Molinio-Arrhenatheretea) and *Viola eugeniae* ssp. *eugeniae*.

**Galio magellensis-Silenetum acaulis** Blasi et al. 2003

This association was described by Blasi et al. (2003) for Maiella (Mount Focalone, Mount Amaro, Terzo Portone, Cima Pomilio and Mount Sant’Angelo), Gran Sasso (Corno Grande and Mount Aquila) and Laga (Mount Gorzano), but this formation is also found on other Apennine Massifs, such as Sibillini and Velino Mountains.

**Syncology**

The association *Galio magellensis-Silenetum acaulis* grows in particularly selective ecological situations: where there is scarce snow cover, the periglacial phenomena are intense, and the soils are primitive, mainly protorendzina, with superficial relatively large clasts derived from fragmentation through the cryoclastic actions of the rocks there. From the data relative to the location, it can be seen that in the situation investigated, the association is found at altitudes greater than 2,300 m, both on slopes (with a mainly southern exposure) and in subplain situations.

**Physiognomy**

This vegetation typology, characteristic of the Alpine belt, is tightly linked with an important pioneer species, *Silene acaulis* ssp. *bryoides*, a hummock-forming chamaephyte with a great capacity for adapting to very different environments (cliffs, scree, ridges, summit plains). Once its hummocks have developed, they provide substrate for the growth of species that cannot survive directly on the bare soils affected by intense cryoturbation.

**Syntaxonomy**

Although it is indicated as a syntaxon of the class *Kobresio-Seslerietea* (Biondi et al., 2006), in agreement with Blasi et al. (2003), it is believed best to relocate the cenoses in the class *Carici-Kobresietea*, due to a closer resemblance to the association *Leontopodio-Elynetum*, because of the strong presence of Arctic–Alpine, circumboreal, and endemic species.

From the analysis of the chorology, a strong presence of endemic species and Nordic species can be noted (Table 1).

In Blasi et al. (2003), together with the type subassociation *Galio magellensis-Silenetum acaulis* subass. *silenetosum acaulis*, two other subassociations have been described, *trifolietosum thalii* and *alyssetosum cuneifolii*, for the Laga (on arenaceous substrata) and for the Maiella (on calcareous substrata,
in subplain areas), respectively.

In the present study, the validity of the association and of the subassociations already described is confirmed, and moreover, there is a new subassociation proposed (Table 10). Here, the new subassociation saxifragetosum speciosae is proposed for the relevés carried out in the localities of Mount Focalone, Mount Amaro, Terzo Portone, Cima Pompilio and Mount Sant’Angelo (Di Fabrizio et al. 2006; Maiella Massif, unpublished relevés) in situations of relatively steep slopes (from 10° to 35°) and at altitudes between 2,525 m and 2,670 m. The differential species are: Edraianthus graminifolius ssp. graminifolius, Carex kitaibeliana ssp. kitaibeliana, Anthyllis vulneraria ssp. weldeniana, Pedicularis elegans (Kobresio-Seslerietea), Armeria majellensis ssp. majellensis (Festuco-Brometea) and Leontodon montanus ssp. melanotrichus (Thlaspietea). Saxifraga oppositifolia ssp. speciosa is instead transgressive from the suballiance Leontopodio-Elynetium.

Syntaxonomic scheme

**KOBRESIO MYOSUROIDIS-SESLERIETEA CAERULEAE BR.-BL. 1948 nom. mut. RIVAS-MARTINEZ, DIAZ, FERNANDEZ-GONZALEZ, IZCO, LOIDI, LOUSA & PENAS 2002**

Seslerietalia tenuifoliaceae Horvat 1930

◊Seslerienalia apenninae Bruno & Furnari 1966 em. hoc loco

○Seslerion apenninae Furnari in Bruno & Furnari 1966 em. hoc loco

● Carici humilis-Seslerietum apenninae Biondi, Ballelli, Guitian & Allegrezza 1988
dryadetosum octopetalae Biondi, Ballelli, Allegrezza, Taffetani, Frattaroli, Guitian & Zuccarello 1999
genistetosum michelii Allegrezza, Biondi, Formica & Ballelli 1997 em. hoc loco
hieraciocytosum cymosi subass. nova
anthylletosum pulchellae subass. nova

● Seslerietum apenninae Bruno & Furnari 1966
juncetosum monanthi Biondi, Ballelli, Allegrezza, Taffetani, Frattaroli, Guitian & Zuccarello 1999
festoctosum alfredianae subass. nova

● Seslerio apenninae-Dryadetum octopetalae Biondi, Ballelli, Allegrezza, Taffetani, Frattaroli, Guitian & Zuccarello 1999
caricetosum firmae Biondi, Ballelli, Allegrezza, Taffetani, Frattaroli, Guitian & Zuccarello 1999
polygaletosum alpestre subass. nova

● Caricetum kitaibelianae-rupestriss Biondi, Allegrezza, Ballelli & Taffetani, 2000
artemisietosum erianthae Biondi Allegrezza, Ballelli & Taffetani, 2000
Dryas octopetala ssp. octopetala variant
Salix retusa variant

**CARICI RUPESTRIS-KOBRESIETEA BELLARDII OHBA 1974 nom. mut. prop. RIVAS-MARTINEZ, DIAZ, FERNANDEZ-GONZALEZ, IZCO, LOIDI, LOUSA & PENAS 2002**

Oxytropido-Kobresietalia Oberdorfer ex Albrecht 1968

○Oxytropido-Elynetum myosuroidis Br.-Bl. 1949


● Helianthemio alpestris-Festucetum italicae Blasi, Di Pietro & Pelino, 2005
anthylletosum weldenianae subass. nova
helianthematosum grandiflorum subass. nova

● Leontopodio nivalis-Elynetum myosuroidis Feoli Chiapella & Feoli 1977
trinietosum dalechampii Biondi, Ballelli, Allegrezza, Taffetani, Frattaroli, Guitian & Zuccarello 1999 em. hoc loco

trifolietosum thalii Blasi, Di Pietro, Fortini & Catonica 2003
alyssetosum cuneifolii Blasi, Di Pietro, Fortini & Catonica 2003
saxifragetosum speciosae subass. nova
References


Appendix 1: type relevés

TAB. 4: Carici humilis-Seslerietum apenninae Biondi, Ballelli, Guittain et Allegrezza 1988 type rel.: n. 6 (n. 6 in tab. 1 in Biondi et al. 1988); dryadetosum octopetalae Biondi et al. 1999 type rel.: n. 20, (n.8 in tab. 7 in Biondi et al. 1999); genistetosum michelli Allegrezza et al. 1997 em. hoc loco type rel.: n. 26, (n. 4 in tab. 6 in Allegrezza et al. 1997); hieraciostosum cynosi subass. nova type rel.: n. 38; anthylletosum pulchellae subass. nova type rel.: n. 45.

TAB. 5: Seslerietum apenninae Bruno & Furnari 1966 type rel.: n. 2 (n. 4 at page 17 in Bruno & Furnari 1966); juncetosum monanthi Biondi et al. 1999 type rel.: n. 22 (n. 8 in tab. 6 in Biondi et al. 1999); festucetosum alfredianae subass. nova type rel.: n. 14.

TAB. 6: Seslerio apenninae-Dryadetum octopetalae Biondi et al. 1999 type rel.: n. 11 (n. 11 in tab. 5 in Biondi et al. 1999); caricetosum firmae type rel.: n.13 (n. 13 in tab. 5 in Biondi et al. 1999); polygaletosum alpestris subass. nova type rel.: n. 14.

TAB. 7: Caricetum kitaibelianae-rapestris Biondi et al. 2000 type rel.: n. 3 (n. 3 in tab. 2 in Biondi et al. 2000); artemisietosum erianthae Biondi et al. 2000 type rel.: n. 28 (n. 10 in tab. 2 in Biondi et al. 2000).

TAB. 8: Helianthemo alpestris-Festucetum italicae Blasi, Di Pietro et Pelino, 2005 type rel.: n. 4 (n. 90 in tab. 7 in Blasi et al. 2005); anthylletosum weldenianae subass. nova type rel.: n. 19; helianthetosum grandiflorum subass. nova type rel.: n. 30.

TAB. 9: Leontopodio nivalis-Elynetum myosuroidis Feoli Chiapella & Feoli 1977 type rel.: n. 14 (ril. n. 19 in tab. 2 in Feoli-Chiapella & Feoli 1977); triniinetosum daichampii Biondi et al., 1999 em. hoc loco type rel.: n. 23 (n. 3 in tab. 1 in Biondi et al. 2000).

TAB. 10: Galio magellensiss-Silenetum acaulis Blasi et al. 2003 type rel.: n. 6 (n. 6 in tab. 5 in Blasi et al. 2003); trifolietosum thalii Blasi et al. 2003 type rel.: n. 9 (n. 9 in tab. 5 in Blasi et al. 2003); alyssietosum cuneifolii Blasi et al. 2003 type rel.: n. 17, (n. 17 in tab. 5 in Blasi et al. 2003); saxifragetosum speciosae subass. nova type rel.: n. 25.

Appendix 2: accidental species


TAB. 8: Rel. 11, Luzula spicata (L.) DC. ssp. italic (Parl.) Arcang.: +, Rel. 13, Arenaria grandiflora L. ssp. grandiflora: 1, Saxifraga oppositifolia L. ssp. speciosa (Dörrl. & Hayek) Engl. & Irmsch: 1, Rel. 14, Juncus trifidus L. ssp. monanthes (Jacq.) Asch. & Graebn.: +, Rel. 18, Juncus trifidus L. ssp. monanthes (Jacq.) Asch. & Graebn.: +, Rel. 20, Festuca alfrediana Faggi & Signorini: 1. Rel. 24, Saxifraga


Appendix 3: localities and dates of relevés

Tab. 4: n. 1-2-3-4-5-6-7-8-9 Central Apennines (n. 1-2-3-4-5-6-7-8-9 from tab. 1 in Biondi et al. 1988), n. 10-11-12-13-14-15 Campo Imperatore (Gran Sasso) (n. 1-2-3-4-5-6 from tab. 7 in Biondi et al. 1999), n. 16-17-18 Valleys of Amplero and Vallelonga (Marsica) (n. 1-2-3 from tab. 1 in Petriccione et al. 1993), n. 19-20-21-22 Campo Imperatore (Gran Sasso) (n. 7-8-9-10 from tab. 7 in Biondi et al. 1999), n. 23-24-25-26 Mount Gemmo (Umbria-Marche Apennines), (n. 1-2-3-4 from tab. 6 Allegrezza et al. 1993), n. 27-28-29-30-31-32-33-34 Mount S. Vicino (Marche Apennines) (n. 1-2-3-4-5-6-7-8 from tab. 45 Allegrezza 2003), n. 35-36-37-38-39-40 Val di Bove (Sibillini Mountains) (unpublished relevés 07/2004), n. 41-42-43-44-45-46-47 Mount Coscerno and Mount of Civitella (Umbria Apennines) (n. 86-84-83-85-87-88-89 in tab. 1 Biondi & Ballelli 1995).


Tab. 6: n. 1-2-3-4-6-7-8-9-10-11-12-13 Campo Imperatore (Gran Sasso) (n. 1-2-3-4-5-6-7-8-9-10-11-12-13 from tab. 5 in Biondi et al. 1999), n. 14-15-15 Majella (unpublished relevés 07/2006).

Tab. 7: n. 1-2-3-4-5 Gran Sasso (n. 1-2-3-4-5 from tab. 2 in Biondi et al. 2000), n. 6-7-8-9-10 Mount Aquila (n. 1-2-4-5-6 from tab. 22 in Biondi et al. 2002), n. 11-12-13 Mount Aquila (n. 1-2-3-4 from tab. 4 in Blasi et al. 2003), n. 15-16-17 Gran Sasso (n. 6-7-8 from tab. 2 in Biondi et al. 2000), n. 18-19-20-21-22-23 Corno Grande (n. 6-7-8-9-10-11 from tab. 4 in Blasi et al. 2003), n. 24-25-26 Mount Aquila (n. 7-8-9 from tab. 22 in Biondi et al. 2002), n. 27-28-29-30 Gran Sasso (n. 9-10-11-12 from tab. 2 in Biondi et al. 2000), n. 31 Mount Aquila (n. 5 from tab. 4 in Blasi et al. 2003), n. 32 Mount Aquila (n. 3 from tab. 22 in Biondi et al. 2002).


Tab. 9: n. 1-2-3-4-5-6-7-8-9-10-11-12-13 Majella (n. 11-23-12-24-22-26-28-27-29-30-18-20-19 from tab. 2 in Feoli-Chiappella & Feoli 1977), n. 15 Laga Mountains (n.1 from tab. 1 in Blasi et al. 2003), n. 16-17-18-19-20-21-22 Majella (unpublished relevés 08/2001), n. 23 Gran Sasso (n. 3 from tab. 1 in Biondi et al. 2000), n. 24-25-26-27-28-29-30-31-32 Laga Mountains (n. 2-3-4-5-6-7-8-10-12 from tab. 1 in Blasi et al. 2003), n. 33-34-35 Gran Sasso (n. 13-14-15 from tab. 1 in Blasi et al. 2003), n. 36-37-38 Laga Mountains (n. 1-3-2 in tab. 5 in Pedrotti 1982), n. 39-40-41-42-43-44 Gran Sasso (n. 1-2-3-4-5-6-7-8 from tab. 1 in Biondi et al. 2000), n. 45-46 Laga Mountains (n. 11-9 from tab. 1 in Blasi et al. 2003), n. 47 Gran Sasso (n. 2 from tab. 1 in Biondi et al. 2000), n. 48-49-50 Majella and Gran Sasso (n. 16-17-18 tab. 1 in Blasi et al. 2003).