

TAXONOMIC FEATURES OF *SESLERIA CALABRICA* (*POACEAE*), A NEGLECTED SPECIES FROM SOUTHERN ITALY

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Abstract: A taxonomic study of the *Sesleria juncifolia* complex in the Italian Peninsula is presented, with a focus on southern Italian populations here named as *Sesleria calabrica* (DEYL) DI PIETRO comb. nov. et stat. nov. Karyological, morphological and anatomical characters were used for comparative analyses with populations of closely related species, such as *S. juncifolia* SUFFREN and *Sesleria apennina* UJHELYI occurring in the Italian Peninsula. Multivariate and univariate morphometric analyses, and qualitative morphological characters showed a distinct position of *S. calabrica*. Populations of *S. calabrica* differ in respect to various morphological characters of leaf and spikelet, such as the glume, lemma and palea length, stem length, the leaf sheath, leaf width, leaf thickness, and the total number of vascular bundles. Furthermore, previous karyological studies demonstrated that all the populations of both *S. juncifolia* and *S. apennina* examined are octoploid ($2n=8x=56$), whereas *S. calabrica* was found to be dodecaploid ($2n=12x=84$). *S. calabrica* is strictly confined to the Pollino massif and the Orsomarso mountains in southern Italy, which represent the southernmost limit of the *Sesleria juncifolia* complex distribution area both in Italy and in Europe. In addition to *S. juncifolia* and *S. calabrica*, the recognition of *S. apennina* as a taxon distinct from *S. juncifolia* is supported, at least for the area of the Apuan Alps.

Keywords: Calabria, Chorology, Distribution area, Karyology, *Poaceae*, Polyploid, *Sesleria*, Taxonomy

INTRODUCTION

Among the southern European grasses, the genus *Sesleria* SCOP. is one of the taxonomically most critical groups, as it includes numerous poorly defined taxa. The unstable taxonomy of the genus is explained by the intricate phenotypic variation patterns and problematic delimitation of distribution areas for most species. Because the *Sesleria* sections are comprised of species which are very similar and closely related, it is almost impossible to define the species on the basis of their morphological characters alone; other data also have to be taken into account, such as karyology, anatomical structures, ecological and sociological features (DEYL 1946, STEBBINS 1956).

The *Sesleria juncifolia* complex belongs to *Sesleria* sect. *Calcariae* DEYL ser. *Tenuifoliae* STRGAR. It is widespread in southern and central Europe where it exhibits a typically amph-Adriatic distribution area ranging over the western Balkans and the Apennines (Fig. 1). As far as Italy is concerned, the *S. juncifolia* complex is widespread in most regions of the Peninsula, from northern Tuscany to northern Calabria, while to the north of the Padana Plain it occurs only in Friuli Venezia-Giulia (PIGNATTI 1982, CONTI et al. 2005, DI PIETRO et al. 2005). According to the infrageneric groups proposed by STRGAR (1981) the following taxa



Fig. 1. Distribution area of the *Sesleria juncifolia* complex. The dashed lines are the boundaries between the northern (in this case restricted to the Apuan Alps), central and southern Apennines.

occur in the Balkan part of the range: *S. juncifolia* SUFFREN (SW Slovenia, SW Croatia), *S. interrupta* VIS. (W Bosnia, SW Serbia), *S. kalnikensis* JÁV. (SW Slovenia, NW Croatia), *S. albanica* UJHELYI (Albania) and *S. ujhelyii* STRGAR (E Bosnia, W Serbia, N Montenegro).

For Italy, DEYL (1946, 1980) reported only *S. tenuifolia* SCHRADER, which was divided into two subspecies: *S. tenuifolia* subsp. *tenuifolia* (Friulian Carso and Apennines) and *S. tenuifolia* subsp. *kalnikensis* (JÁV.) DEYL (eastern Alps at the boundary between Italy and Slovenia). Regarding the former of these subspecies, the author proposed two new varieties (except for the typical plants), *S. tenuifolia* subsp. *tenuifolia* var. *istriaca* DEYL and var. *calabrica* DEYL. The latter variety was based on the collection Nr. 431 by Rigo from Mount Pollino in 1898 (Fig. 2), and was hypothesized by DEYL to represent a polyploid.

In his monograph on *Sesleria* species in Italy, UJHELYI (1959b) considered the true *Sesleria tenuifolia* to be restricted to the Balkan Peninsula and the area of Friulian Carso, while populations in the Italian Apennines were assigned to *S. apennina* UJHELYI.

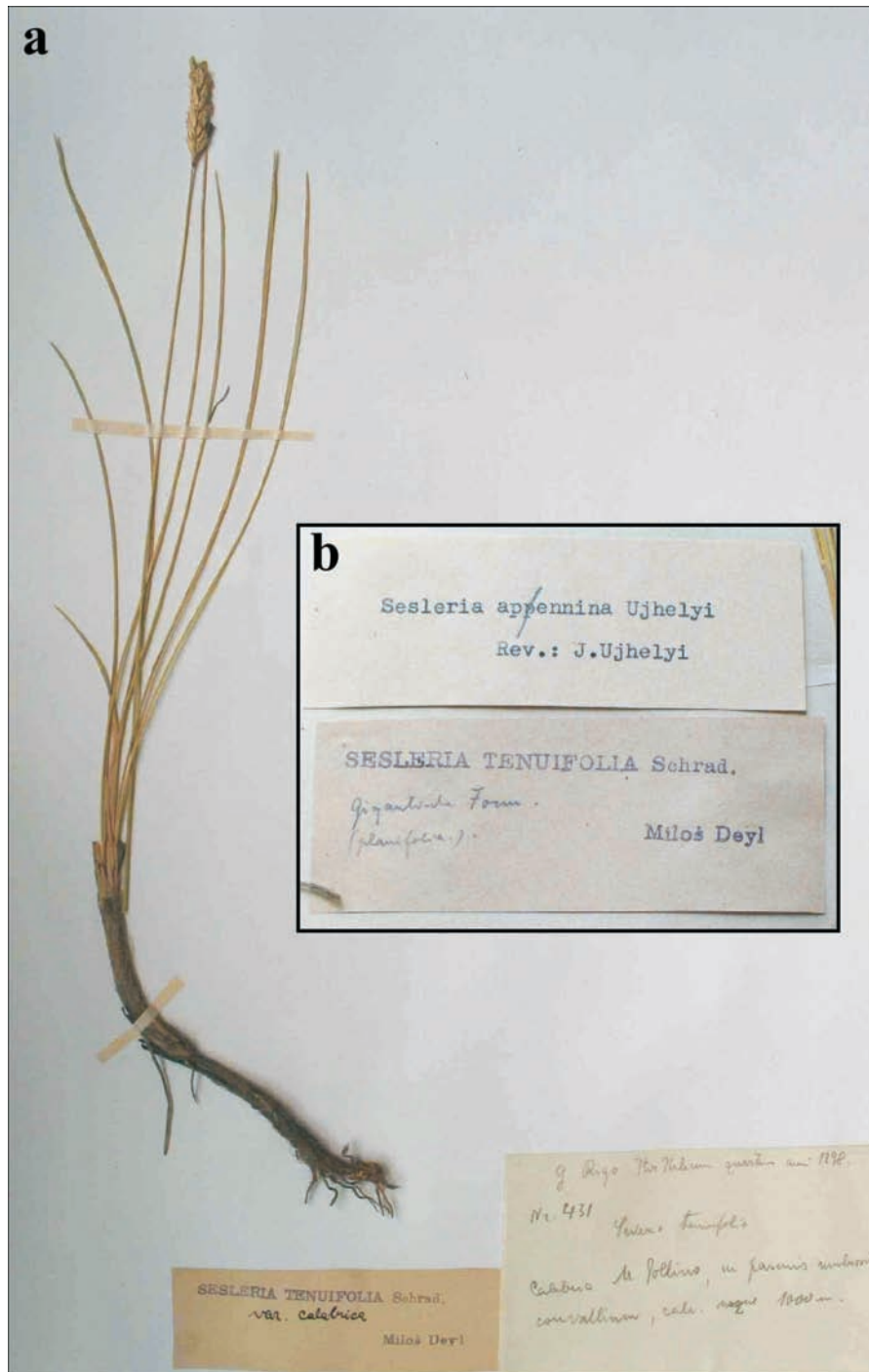


Fig. 2. a – Lectotype of the name *Sesleria tenuifolia* var. *calabrica* DEYL deposited in PR. b – The label of the isolectotype deposited in WU.

Both DEYL (1980) and PIGNATTI (1982) questioned the separate taxonomic status of *S. apennina* and *S. juncifolia*, and proposed to keep *S. tenuifolia* as the only taxon occurring in the Italian Peninsula. This treatment was followed by other checklists (e.g. ANZALONE 1998, CONTI 1998, PASSALACQUA 1998) of the Italian territory (or its restricted parts such as administrative regions, provinces, mountain ranges...), and reported *S. tenuifolia* only. STRGAR (1981), however, pointed to the fact that *S. juncifolia* is an older name and has nomenclatural priority over *S. tenuifolia*. Therefore, it is clear that if these two names are considered synonyms, the name *S. juncifolia* must be used, contrary to the treatments by DEYL (1946, 1980) and PIGNATTI (1982). Other authors, both for the Balkans (CONERT 1992) and for Italy (POLDINI 1991, BANFI 2000) have recently followed this taxonomic treatment. In the recent Checklist of the Italian Vascular Flora (CONTI et al. 2005) both *S. apennina* and *S. tenuifolia* are considered as synonyms of *S. juncifolia*.

Sesleria karnikensis is currently also included within the Italian flora, although only in northeastern Italy, on the boundary with Slovenia (PIGNATTI 1982, STRGAR 1984, JOGAN 2001, POLDINI et al. 2002). In fact, there is substantial agreement among the various authors that this taxon is sufficiently distinct, so it will not be considered further in this paper. In contrast, the taxonomic debate about the possible occurrence of more than one taxon of the *Sesleria juncifolia* complex in the Apennines has still not been resolved. The name *Sesleria apennina* is still widely used, especially in the phytosociological tables and syntaxonomy where it gives rise to various association, alliance, and order names (BRUNO & FURNARI 1966, BIONDI et al. 1999, BLASI et al. 2003, 2005, MUCINA 2003).

All the taxa belonging to the series *Tenuifoliae* occurring in the Balkans were found to be octoploids, with chromosome number $2n=8x=56$ (UJHELYI 1959a, STRGAR 1966, 1979, 1981), with the exception of *S. ujhelyii*, which was identified as tetraploid by STRGAR (1981). A recent karyological analysis of the *S. juncifolia* complex in Italy (DI PIETRO et al. 2005) demonstrated that some populations of the *S. juncifolia* complex are dodecaploid ($2n=12x=84$). These populations are restricted to the Pollino massif and the Orsomarso mountains at the southernmost limit of the distribution range of the *S. juncifolia* complex.

In the present study, populations of the *S. juncifolia* complex from southern Italy were examined from the taxonomic viewpoint. Investigations based on field-collected plants, field observations, karyological analysis and herbarium specimens led to the conclusion that the populations from the Pollino-Orsomarso massif, originally described as a variety of *S. tenuifolia*, are to be recognized as a separate species, *S. calabrica*.

MATERIAL AND METHODS

The presented taxonomic study is based on field collections and observations made by the author in the Italian Peninsula, combined with a study of herbarium specimens from the herbaria of FI, RO, APP, TS, IS, HLUC, W, WU, BP, PR, PRC, BEOU, and from personal collections of G. Bazzichelli, E. Lattanzi, G. Tondi (Rome), S. Fascetti (Potenza). The specimens studied are listed in Appendices 1 and 2. Populations sampled by the author originated from sites throughout the entire Apennines and from the Friulian Carso area (Appendix 1). Voucher specimens are deposited in the herbarium RO. Morphological and phenological characters were also observed on living plants collected in the field and grown in

Table 1. List of the morphological and anatomical characters used as variables in multivariate analyses. The characters labelled with asterisks were also subjected to detailed univariate analyses (see Figs. 6, 7). The length of spikelet was measured from the base of the lower glume to the tip of the higher upper lemma (awn excluded); lemma and palea length was measured as the distance from the base to the apex (awn excluded) in a flower from the distal 1/3 of inflorescence. The characters of tiller leaves were observed in the uppermost well-developed leaf. Transverse sections of leaf blades were made in the 2nd quarter (from the base) of the lamina; leaf width was measured on transverse sections as the distance from blade margin to abaxial surface adjacent to central bundle; leaf thickness was measured on a transverse section as the distance between the adaxial and abaxial surface above and below the central vascular bundle.

Type of leaf sheaths
1. disintegrate reticulately mainly in the basal half
2. completely disintegrate reticulately
Uppermost leaf length (cm)
Number of vascular bundles*
Leaf width (mm)*
Leaf thickness (mm)*
Spike length (cm)
Spikelet length (mm)
Spikelet width (mm)
Glumes length (mm)*
Glumes awn length (mm)*
Lemma length (mm)*
Lemma main awn length (mm)*
Lemma secondary awn length (mm)
Pubescence of lemmas
1. smooth
2. slightly puberulous only in the upper part
3. puberulous
Lemma marginal hairs length (mm)*
Palea length (mm) *
Palea awn length (mm)
Palea marginal hairs length (mm)

pots in the Botanical Garden of the Department of Plant Biology of the University of Rome "La Sapienza".

Altogether 250 specimens were used to gather morphometric data for multivariate analysis. Eighteen morphological characters (Table 1), most of them considered as diagnostic in various monographs and floras (DEYL 1938, 1946, 1980, UJHELYI 1959b, PIGNATTI 1982, CONERT 1992, JOGAN 1999), were measured or scored. The standard measurements and the terminology adopted are explained in Table 1. Most of the characters were quantitative; the leaf sheaths were coded as a binary character, and the pubescence of lemmas as a semi-quantitative one. In addition to the characters included in multivariate analyses, some other (stem length, juvenile leaf length, anther length, see Table 2) were also examined. These characters, which strongly depend on the growth phase of a plant were not present in all herbarium specimens, and/or were not always usable for direct morphological comparisons.

Agglomerative UPGMA cluster analysis was performed on the data matrix, following data standardization by standard deviation and computation of the dissimilarity matrix using Gower coefficient. The data matrix was also submitted to ordination (principal component

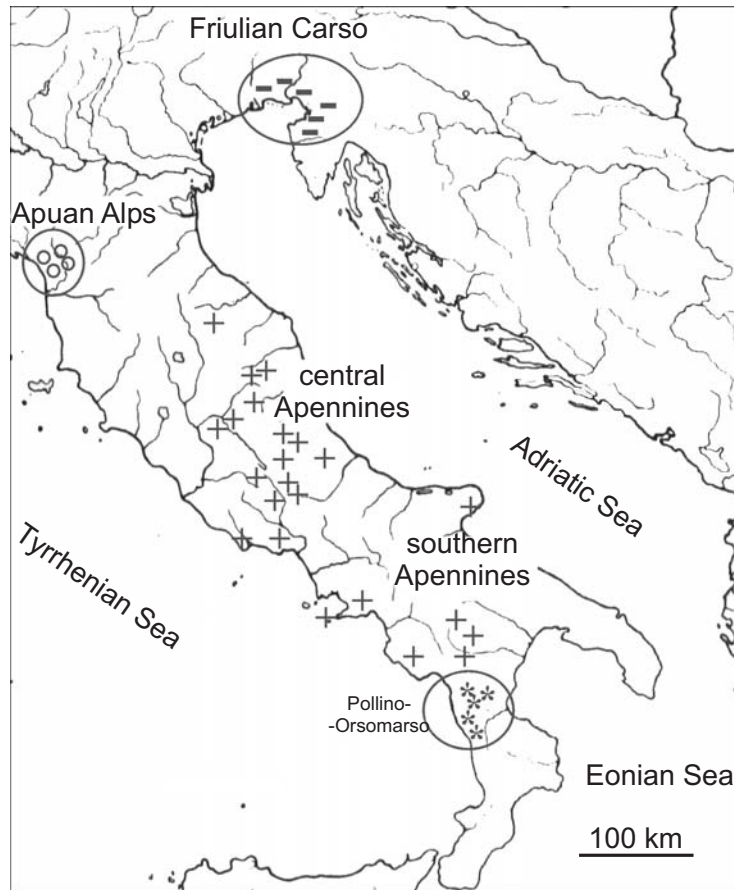


Fig. 3. Map depicting locations of morphometrically analyzed populations of the *Sesleria juncifolia* complex. -- *S. juncifolia* from Friulian Carso; +- *S. juncifolia* from central-southern Apennines; ° - *S. juncifolia* from the Apuan Alps (*S. apennina*); * - *S. calabrica* from the Pollino-Orsomarso range.

analysis, PCA), with geographical partition superimposed. Both cluster analysis and ordination were performed using the SYN-TAX 5.02 and SYN-TAX 2000 package (PODANI 1993, 1994, 2001). Univariate analysis (median, percentiles, outliers) of eight selected characters derived from floral and leaf parts (Table 1) was computed and presented in box plot charts (STATSOFT 1997).

The 250 specimens employed in these analyses originated from a wide range of sites across the Italian Peninsula, to cover, as much as possible, the entire distribution area of the *S. juncifolia* complex in Italy (Fig. 3). The specimens were grouped according to their geographic origin as follows: Friulian Carso (60 specimens), central-southern Apennines (61 specimens), Apuan Alps (54 specimens) and Pollino-Orsomarso range (75 specimens). Ecological and coenological characterization of populations from the Pollino-Orsomarso range (*S. calabrica*) was based on field observations and phytosociological relevés; the results will be presented elsewhere (DI PIETRO, in prep.).

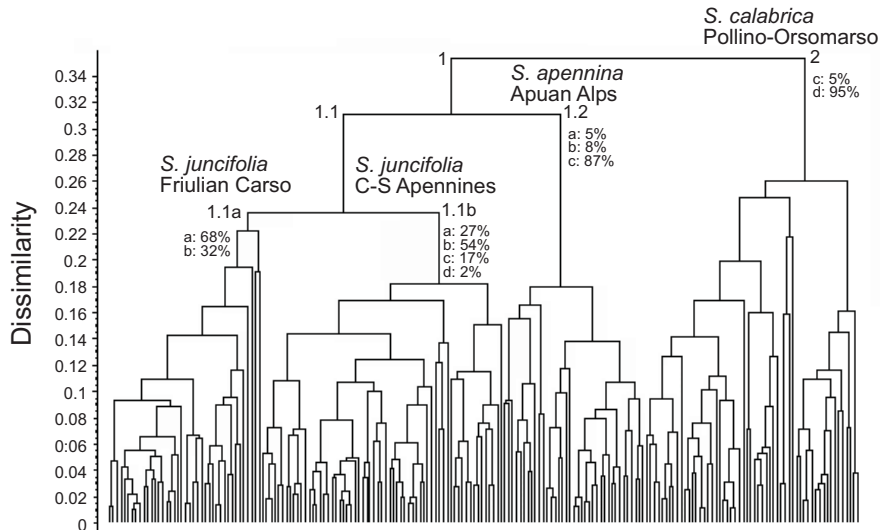


Fig. 4. Dendrogram resulting from the UPGMA cluster analysis of the entire set of specimens of the *S. juncifolia* complex based on 18 morphological characters of leaves and spikelets (Table 1). Proportion of specimens in each of the main clusters is indicated: a – specimens of *S. juncifolia* from Friulian Carso; b – specimens of *S. juncifolia* from the central and southern Apennines; c – specimens of *S. apennina* from the Apuan Alps; d – specimens of *S. calabrica* from the Pollino-Orsomarso range.

RESULTS

Multivariate analysis

Both cluster analysis and ordination supported the morphological separation of populations from the Pollino-Orsomarso range from other populations of the Apuan Alps, C-S Apennines and Friulian Carso. The dendrogram (Fig. 4) shows two main clusters (1 and 2); the first one (1) is divided into two sub-clusters. Sub-cluster 1.1 is composed mainly of specimens from Friulian Carso (cluster 1.1a) and the C-S Apennines (cluster 1.1b), while sub-cluster 1.2 is composed mainly of specimens from the Apuan Alps. Cluster 2 is composed almost entirely of specimens from Pollino-Orsomarso (*S. calabrica*). The dendrogram thus reveals a fairly distinct separation of *S. calabrica* from the other populations; the separation of specimens from the Apuan Alps is also recognizable, whereas *S. juncifolia* populations from the C-S Apennines and Friulian Carso do not seem to be clearly differentiated from each other.

The results of the cluster analysis are confirmed by the PCA ordination diagram (Fig. 5). The partition superimposed on the PCA diagram is primarily based on groups assumed from a geographical standpoint (collection site) and taking into account the location of type localities of particular taxa. Friulian Carso represents the northwestern limit of the Balkan range of the *Sesleria juncifolia* complex, and at the same time it is the area very close to the locus classicus of *S. juncifolia* (SUFFREN 1802). The Apuan Alps are the locus classicus of *S. apennina*. The central-southern Apennines (from the Sibillini Mts. to M. Alpi) are an area where *Sesleria juncifolia* populations exhibit intermediate morphological characters, and this led some authors to assign them either to *S. tenuifolia* and *S. juncifolia*, or to *S. apennina*. The

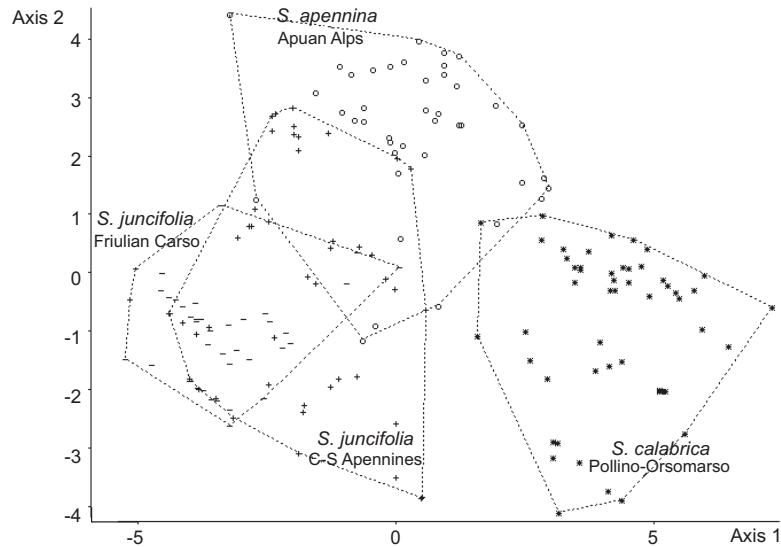


Fig. 5. Ordination (PCA) based on 18 morphological characters (Table 1) and the entire set of specimens of the *S. juncifolia* complex, with the following geographical partition superimposed: - - *S. juncifolia* specimens from Friulian Carso; + - *S. juncifolia* specimens from the central-southern Apennines; ° - *S. juncifolia* specimens from the Apuan Alps (*S. apennina*); * - *S. calabrica* specimens from the Pollino-Orsomarso range. The cumulative percentage of eigenvalues for the first two axes is 75.98% (axis 1 = 55.53%; axis 2 = 20.45%).

Pollino-Orsomarso range is the area where the dodecaploid populations occur, and it is the locus classicus of the taxon here proposed as *S. calabrica*.

The PCA shows a broad grouping where three groups of specimens can be recognized (Friulian Carso, Apuan Alps and Pollino-Orsomarso). With the exception of *S. calabrica*, whose polygon in the ordination diagram is clearly separated from the others, the polygons regarding the other three groups exhibit a significant degree of overlapping. In fact, as far as the Friulian Carso (*S. juncifolia*) and Apuan Alps (*S. apennina*) specimens are concerned, this overlapping is almost entirely due to the occurrence of very few specimens having intermediate morphological features, meaning that the polygon becomes enlarged with respect to the theoretical centroid of the group. It is only in the case of the populations from the C-S Apennines that the significant overlapping of the polygon is actually due to a more random distribution (in the ordination space) of the specimens from this group. The highest contribution to the first principal component was by the characters of the leaves (width and thickness), and secondarily by the size of the floral parts (in the increasing gradient from left to right). The highest contribution to the second axis was by the degree of pubescence of lemma, and by the length of palea and lemma marginal hairs (both characters having higher values in specimens from the Apuan Alps).

Univariate analysis

Figures 6 and 7 show the results of univariate analysis performed on selected morphological characters measured in the four geographical groups: Friulian Carso, C-S Apennines, Apuan Alps, and Pollino-Orsomarso. Morphological differentiation between

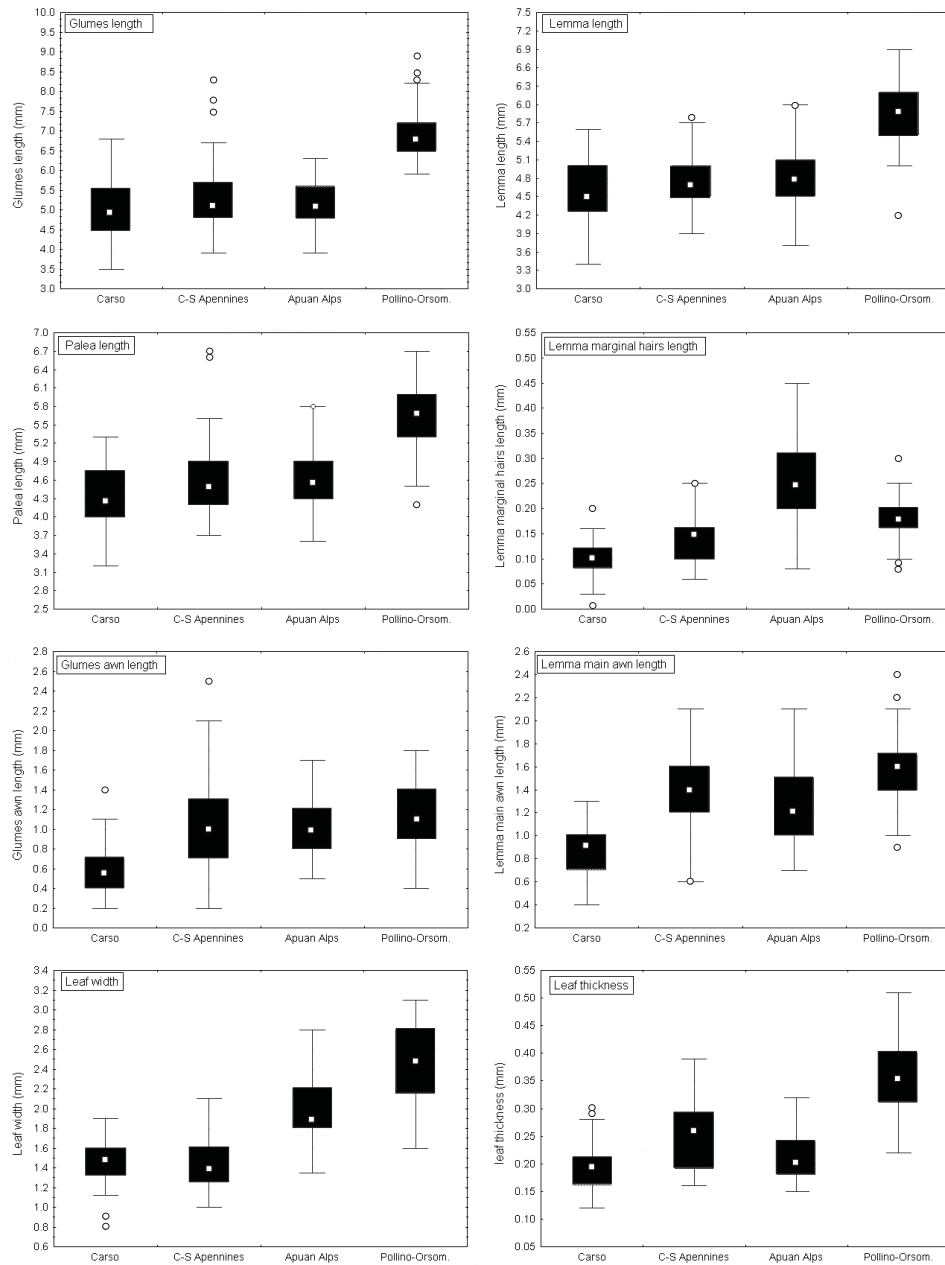


Fig. 6. Box plot charts expressing variability in selected characters in populations of *S. juncifolia* (central-southern Apennines, Friulian Carso), *S. apennina* (the Apuan Alps), *S. calabrica* (the Pollino-Orsomarso range). The top, bottom and square in the middle of the boxes correspond to the 75th percentile, 25th percentile, and 50th percentile (median), respectively. The whiskers extend from the 10th percentile to the 90th percentile. Small circles represent remaining extreme values.

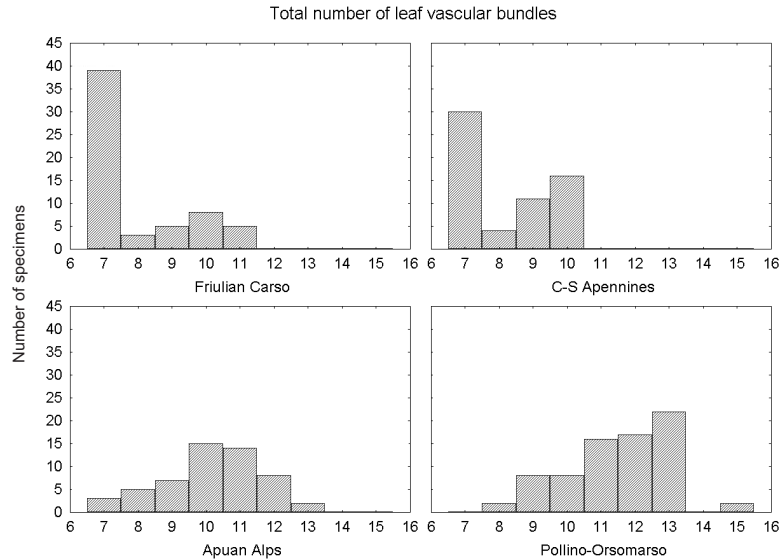


Fig. 7. Histograms showing the number of tiller leaf vascular bundles in populations from different geographic areas, altogether representing the entire set of 250 examined specimens.

S. calabrica from Pollino-Orsomarso and other populations of the *S. juncifolia* groups is apparent in several characters (both in respect to medians and the 25th and 75th percentiles): length of glume, length of lemma, length of palea, as well as leaf width and leaf thickness. The length of marginal hairs of lemma is the character that can be used to distinguish between *S. calabrica* and the populations from the Apuan Alps (*S. apennina*). The low values in the length of the awn of lemma and glume separate the populations from Friulian Carso from the other populations (Fig. 6). The number of vascular bundles (Fig. 7) also shows marked differences among the four groups analyzed.

Morphological differentiation of *Sesleria calabrica*

The *Sesleria* specimens from the Pollino-Orsomarso range were compared to many herbarium specimens of supposedly related species from various Italian and European herbaria, and with the original descriptions drawn from taxonomic literature (UJHELYI 1959a, 1959b, DEYL 1946, CONERT 1992, STRGAR 1981, PIGNATTI 1982). Morphological differentiation of *S. calabrica* from other populations of the *S. juncifolia* complex from Friulian Carso, C-S Apennines and Apuan Alps (*S. apennina*) is summarized in Table 2. These characters are both qualitative and quantitative, and they were proved to be maintained under standard cultivation conditions for a period of 3–4 years.

Compared to *S. juncifolia* from the Friulian Carso and the C-S Apennines, the leaves of *S. calabrica* are conduplicated rather than convolute, and are typically pruinose on both sides. The withered sheaths of *S. calabrica* are reticulate only in the basal half, while those of *S. juncifolia* are completely reticulate. In general, however, plants of *S. calabrica* exhibit

Table 2. Comparative table showing variation of morphological and anatomical characters in populations from Pollino-Orsomarso in Calabria (*S. calabrica*), from Friulian Carso (*S. juncifolia*) and the Apuan Alps (*S. apennina*). Concerning quantitative characters, 25th and 75th percentiles are given, with 5th and 95th percentiles in parentheses.

	<i>Sesleria calabrica</i> (2n=84)	<i>Sesleria juncifolia</i> (2n=56)	<i>Sesleria apennina</i> (2n=56)
Leaf sheaths	disintegrate reticulately mainly in the basal half	disintegrate reticulately	disintegrate reticulately
Stem length (maximum)	up to 60 cm	up to 40 cm	up to 40 cm
Tiller leaf length (maximum)	up to 50 cm	up to 40 cm	up to 35 cm
Uppermost leaf length (cm)	(0.9)1.5–2.5(4.0)	(0.6)1.0–1.6(2.2)	(0.5)1.2–1.9(2.8)
Leaf type	conduplicate very pruinose	convolute often green	conduplicate pruinose
Spike length (cm)	(1.7)2.4–3.0(3.8)	(1.5)2.2–2.9(3.5)	(1.2)1.7–2.1(2.7)
Bracts at the base of the spike occurring in	90% of individuals	50% of individuals	100% of individuals
Spikelet length (mm)	(6.0)6.5–7.2(8.2)	(4.5)5.0–5.7(6.7)	(4.8)5.4–6.0(6.8)
Glume length (mm)	(5.9)6.5–7.2(8.1)	(3.5)4.5–5.6(6.7)	(3.9)4.8–5.5(6.3)
Glume awn length (mm)	(0.4)0.9–1.4(1.8)	(0.2)0.4–0.7(1.1)	(0.5)0.8–1.2(1.7)
Lemma length (mm)	(5.0)5.5–6.2(6.9)	(3.4)4.3–4.9(5.7)	(3.7)4.5–5.1(6.0)
Lemma main awn length (mm)	(1)1.4–1.7(2.2)	(0.4)0.7–1.0(1.3)	(0.7)1.0–1.5(2.2)
Pubescence of lemmas	scabrid at the apex	smooth	slightly pubescent
Lemma marginal hair length (mm)	(0.10)0.16–0.20(0.25)	(0.04)0.07–0.10(0.13)	(0.09)0.30–0.31(0.45)
Palea length (mm)	(4.5)5.3–6.0(6.7)	(3.2)4.0–4.7(5.3)	(3.7)4.3–4.9(5.8)
Palea marginal hair length (mm)	(0.09)0.16–0.22(0.30)	(0.03)0.09–0.12(0.16)	(0.13)0.25–0.33(0.43)
Anther length (mm)	3.5–4.3	2.5–3.7	3.1–4.0
Leaf width (mm)	(1.6)2.2–2.8(3.3)	(1.0)1.3–1.6(1.9)	(1.4)1.8–2.2(2.8)
Leaf thickness (mm)	(0.22)0.31–0.40(0.51)	(0.12)0.16–0.21(0.27)	(0.15)0.18–0.24(0.32)
Number of vascular bundles	(8)11–13(15)	7–9(11)	(8)9–11(12)
Number of flowers per spikelet	2 rarely 3	2 very rarely 3	2 often 3

higher values, compared to *S. juncifolia*, in respect to stem length, leaf width and leaf thickness, glume, lemma and palea length, and glume and lemma awn length. Morphological differences between *S. calabrica* and populations from the Apuan Alp (*S. apennina*) are present, even if less evident. In fact, the specimens from the Apuan Alps exhibit pruinose and conduplicated leaves (often flattish and up to 2.5 mm wide), and 9 to 11 vascular bundles (Fig. 7). However, the spikelets and flowers are considerably smaller than in *S. calabrica* specimens, as is the size of tuft and stem height. Characters peculiar to populations from the Apuan Alps (*S. apennina*) are lemmas more hairy, the constant presence of sterile bracts (up to 4–5 mm long) at the base of the spike, and a high frequency of spikelets bearing three flowers.

Ecology

Populations of *Sesleria calabrica* occur at altitudes ranging from 1100 m to the summits of the Pollino National Park mountains (Serra Dolcedorme 2286 m a.s.l.). In its geographical and ecological range *S. calabrica* forms two distinct communities, the distributions of which are strictly related to the altitudinal gradient. It grows in high altitudes primarily in dry grasslands, which are restricted to the windy ridges and gravelly slopes of the main peaks of

the Pollino massif. Here *S. calabrica* is constantly accompanied by a number of other species, such as *Carex kitaibeliana* DEGEN ex BECH., *Anthyllis montana* L. subsp. *atropurpurea* (VUK.) PIGNATTI, *Anthyllis vulneraria* L. subsp. *pulchella* (VIS.) BORNHM., *Festuca bosniaca* KUMM. & SENDTN., *Edrajanthus graminifolius* (L.) A. DC. subsp. *siculus* GREUTER & BURDET, all being confined to dry grasslands of the subalpine belt. *S. calabrica*, however, may also form secondary dry grasslands, which are dynamically related to the woodlands of *Fagus sylvatica* L., *Pinus leucodermis* ANTOINE and *Pinus nigra* J.F. ARNOLD subsp. *nigra*, and which include several southeastern European species that do not usually occur beyond the timberline, such as *Jurinea mollis* (L.) RCHB. subsp. *mollis*, *Echinops ritro* L., *Lomelosia crenata* CIRILLO subsp. *crenata* GREUTER & BURDET, *Euphorbia barrelieri* SAVI, *Carex macrolepis* DC. and *Cytisus spinescens* C. PRESL.

DISCUSSION

Taxonomic discussion

Based on the presented morphometric analyses and previous karyological data (DI PIETRO et al. 2005), the separate taxonomic position and the species-level treatment for the populations from the Pollino-Orsomarso range (*S. tenuifolia* var. *calabrica* DEYL) are strongly favoured. Consequently, a new combination, *S. calabrica*, is proposed below.

The evolutionary importance of polyploidization in angiosperms is widely acknowledged (SOLTIS & SOLTIS 1999, OTTO & WHITTON 2000, SOLTIS et al. 2003), together with frequent cases of polyploid speciation in *Poaceae* (e.g., AINOUCHE & BAYER 1997, AINOUCHE et al. 2004, PECINKA et al. 2006). The dodecaploid chromosome number ($2n=12x=84$) identified in *S. calabrica* is without any doubt taxonomically highly significant, because as far the *Sesleria* genus is concerned, all the species are either tetraploid ($2n=24$) or octoploid ($2n=56$) (UJHELYI & FELFÖLDY 1948, LÖVE & LÖVE 1961, STRGAR 1966, 1979, 1981, LYSÁK et al. 1997, DI PIETRO et al. 2005). All the populations of both *S. apennina* (Apuan Alps) and *S. juncifolia* analyzed throughout the entire Italian Peninsula are octoploid. Within *S. calabrica* only dodecaploid individuals were found in all the populations investigated. Furthermore, no geographical overlapping between octoploid and dodecaploid populations was found; dodecaploid populations appear to be restricted to the Pollino massif and the Orsomarso range (representing the southern part of the total distribution area of the *Sesleria juncifolia* complex), whereas octoploid populations occur everywhere else in the Italian Peninsula and in the Balkans.

As shown in this study, multivariate and univariate analysis based on both anatomical and morphological characters proved morphological separation of *S. calabrica* from the other Italian populations of the *S. juncifolia* complex. LYSÁK et al. (1997) considered certain morphological characters, such as plant height, leaf width, and the number of vascular bundles, as unreliable for establishing new taxa, because they depend mainly on the ecological conditions of the habitat and on the ontogenetic stage. Still, I assume that these morphological characters may have a discriminant taxonomic value, if the differences between taxa remain constant under cultivation and in each of the analyzed population. Obviously, any results emerging from morphological analyses are strengthened when combined with other data, in this case, chorological (geographical isolation at the margin of

the distribution range) and karyological data. On the basis of the results obtained in the present study, Deyl's hypothesis (DEYL 1946) concerning the probable occurrence of polyploid populations of the *Sesleria juncifolia* complex in southern Italy is confirmed, although not in the form of "simple temporal deviation". Indeed, it is now clear that this particular combination of karyological and morphological characters is intrinsic and unique to these populations.

Actually, *S. calabrica* is by far the most easily recognizable taxon among the Italian populations belonging to the *S. juncifolia* complex. The higher ploidy level is apparently correlated with the increased size of both vegetative and floral organs, when compared to the other populations of the complex. UJHELYI (1959b) had clearly become aware of these phenotypes when he reported that he had observed specimens from the Pollino (assigned by him to *S. apennina*) having stems and leaves of above the average length. That *S. calabrica* had never previously been identified as a distinct species can largely be attributed to the extreme paucity of herbarium specimens of the southern Apennine provenance available in European herbaria, including Italian major ones, such as the "Herbarium centrale Italicum" (FI) in Florence, where not a single specimen of the Pollino-Orsomarso area was found.

Nevertheless, these few specimens from the RIGO collection proved sufficient for DEYL (1946) to realize that he was faced with something substantially different, which deserved to be treated at a different taxonomic rank (variety). Preliminary comparisons with herbarium specimens of the other Balkan taxa belonging to the *S. juncifolia* complex, *S. interrupta*, *S. kalnikensis*, *S. ujhelyi*, *S. albanica* (not dealt with in this study) indicate that *S. calabrica* is clearly distinguishable from these species, which are all octoploids or tetraploids (*S. ujhelyi*).

The anatomical and morphological features of *S. calabrica* show that this taxon would be related primarily to populations of the *S. juncifolia* complex from the Apuan Alps (*S. apennina*), with which it shares some features, in particular, conduplicate and relatively wide pruinose leaves. Contrary to *S. calabrica*, however, *S. apennina* includes only octoploid populations. Given the stability of the chromosome number among the various *Sesleria* species, the difference in chromosome number between *S. calabrica* and *S. apennina*, together with the spatial discontinuity of their populations, are sufficient to distinguish these taxa at species level. It is worth noting that the aforementioned convergence of characters has occurred in the Apuan Alps and Pollino-Orsomarso, i.e., on opposite sides of the Italian distribution area of the *S. juncifolia* complex. Most of the *S. juncifolia* populations from the central Apennines exhibit morphological characters more similar to those of *S. juncifolia* s.str. populations in the Balkans. Exceptions refer to some peculiar populations in the northernmost part of the central Apennines.

There is no doubt, however, that both *S. calabrica* and *S. apennina* from the Apuan Alps are strictly related to the *S. juncifolia* complex, with which they share all the morphological and anatomical features (sheaths typically reticulate, leaves never completely flat, number of vascular bundles only exceptionally exceeding 13, etc.) that allow this complex to be distinguished from other *Sesleria* species. The closer relationship that UJHELYI (1959b) hypothesized between *S. apennina* (in his concept including also the populations from the Pollino-Orsomarso range) and *S. insularis* SOMMIER, compared to that between *S. apennina* and *S. juncifolia*, seems to be unfounded. However, this does not exclude the possibility that

some interaction between *S. apennina* and *S. insularis* may have occurred, because in the areas surrounding the Apuan Alps various sites exist in which *Sesleria* populations belonging to the *S. insularis* complex have been found (ZAPPA 1992, ROSSI & UBALDI 1995, TROMBETTA et al. 2005).

Hypothesis on the origin of *Sesleria calabrica* and other examples of species endemic to the Calabrian mountains

The origin of the *Sesleria juncifolia* complex can be assumed in the middle Tertiary in the Balkan Peninsula. The occurrence of the lower ploidy species, tetraploid *S. ujhelyii* only in the Balkans seems to support this hypothesis. Migration to the Italian Peninsula, as expected also for several other grasses typical of steppe-like environments, probably occurred between the end of the Tertiary and the Pleistocene, via different migration routes (BLASI et al. 2006). The populations of the *S. juncifolia* complex in southern Italy may have been derived from ancient migration through the Miocene bridges connecting the Gargano promontory and the Apulian limestone chalk with central and southern Dalmatia (DE GIULI et al. 1987). Regarding the origin of the dodecaploid populations of *S. calabrica* in the Pollino-Orsomarso mountains, three hypotheses have been proposed (DI PIETRO et al. 2005): chromosome doubling, hybridization and meiotic non-reduction. Out of these, the second and third hypotheses have been considered to be more likely. As far as the hybridization is concerned, it is possible that octoploid populations of *S. juncifolia* hybridized with populations belonging to the tetraploid *S. nitida* TEN. (a species endemic to the Apennines, which does not belong to the series *Tenuifoliae*), giving rise to a sterile hexaploid and subsequently to a dodecaploid (autopolyploid). In the case that the hybrid origin of *S. calabrica* is confirmed, DEYL's terms "constant hybrid" or "hybridospical" could be applied to this taxon (DEYL 1946). These terms refer to a stable species that may be described taxonomically. It is probable that *S. calabrica* is the most recent taxon in the evolution of the *S. juncifolia* complex; according to FAVERGER (1961) and FAVERGER & COUNTRANDRIOPOULOS (1961) this species should be defined as a southern Italian apocendemic neopolyploid. Owing to their isolation (the marginal location at the border of the distribution range of the complex) the newly arisen dodecaploid populations of *S. calabrica* may have begun to differentiate. The cold and dry periods of the Pleistocene probably offered favourable conditions for the establishment and spreading of the dodecaploid *S. calabrica*, which completely replaced the octoploid populations during the Quaternary.

There are also other endemic taxa, whose current distribution is probably related to the cold periods of the Quaternary, and which are restricted to the high altitude pastures of the Pollino-Orsomarso range: *Plantago brutia* TEN., *Hieracium portanum* BELLI, *Campanula pollinensis* PODLECH, *Achillea rupestris* HUTER, PORTA et RIGO. Also several species with southeastern European distribution areas are known, whose occurrence in the Italian Peninsula is restricted to the Pollino-Orsomarso range. These include *Pinus leucodermis* ANTOINE, *Gentianella crispata* (VIS.) HOLUB, *Luzula pindica* (HAUSSKN.) CHRTEK et KŘÍSA, *Pedicularis petiolaris* TEN. (CONTI et al. 2005, PERUZZI & GARGANO 2006).

There are yet other species endemic to the Calabria region, but which are restricted to siliceous substrates of the Calabrian Apennines (Catena Costiera, Serre, Sila, Aspromonte),

and whose origin is probably also linked to Quaternary glaciations. Among these endemics the polyploids *Cardamine battagliae* CESCA et PERUZZI and *Cardamine silana* MARHOLD et PERNÝ may be cited. *Cardamine battagliae*, in particular, is an apopolyploid derivative of *C. heptaphylla*, which, like *Sesleria calabrica*, exhibits a surprisingly high chromosome number (*C. battagliae* $2n=160$ vs. *C. heptaphylla* $2n=48$) (CESCA & PERUZZI 2002). As regards *Cardamine silana*, it has been proposed that it is of allopolyploid origin, and was derived from *C. apennina* LIHOVÁ et MARHOLD (endemic of the Apennines) and *C. acris* GRISEB. (endemic of the Balkans) (PERNÝ et al. 2005). Other endemic species of the high altitude belt of the siliceous massifs of the Calabrian Apennines are *Hypericum calabricum* SPRENG., *Soldanella calabrella* KRESS, and *Anthemis cretica* L. subsp. *calabrica* (ARCANG.) R. FERN., *Armeria aspromontana* BRULLO, SCELSEI et SPAMPINATO, *Limodorum brulloi* BARTOLO et PULV., *Agrostis canina* L. subsp. *aspromontana* BRULLO, SCELSEI et SPAMPINATO, *Alchemilla austroitalica* BRULLO, SCELSEI et SPAMPINATO (BRULLO et al. 2001, CONTI et al. 2005).

Phytosociological and syntaxonomic features

Regarding the syntaxonomy of *S. calabrica*, the most convincing assignments of the high altitude *S. calabrica* and *Carex kitaibeliana* communities are, respectively, *Seslerion apenninae*, *Seslerietalia juncifoliae*, and *Elyno-Seslerietea*. In contrast, the almost complete absence of all subalpine species in the low altitude *Sesleria* and *Jurinea mollis* communities suggests these are to be included in *Festuco-Brometea*, while, as regards alliance and order, a provisional assignment to *Cytiso-Bromion caprini* and *Brometalia erecti* can be proposed.

A broader sociological comparison shows that all the species belonging to the *S. juncifolia* complex are related to the same habitat type, which coincides with the montane and subalpine dry grasslands on limestone. Syntaxonomic differences are mainly due to biogeography. In the central and southern Apennines, as well as in the Apuan Alps, this species grows in the *Seslerion apenninae* communities in the subalpine and alpine belts (*Seslerietum apenninae*, *Seslerio apenninae-Dryadetum octopetalae*, *Leontopodio nivalis-Seslerietum apenninae*), and the *Phleo-Bromion erecti* communities in the montane belt (*Carici humilis-Seslerietum*, *Carici macrolepis-Seslerietum*). In the Balkans, coenological affinity is only known for *S. juncifolia* s.str. This species dominates grasslands in the upper montane and subalpine belts (*Seslerion juncifoliae*, *Edrajantho-Seslerion*, *Seslerio-Edrajanthion*), but it may also occur as a companion species in the colline belt (*Satureion subspicatae*, *Scorzoneretalia villosae*) or the alpine belt (*Caricion firmae*, *Seslerietalia coeruleae*) (HORVAT et al. 1974, POLDINI 1989, FEOLI-CHIAPELLA & POLDINI 1993, REDZIC 2003, SURINA & DAKSKOBLER 2005). For the complete names of syntaxa, see Appendix 3.

CONCLUSIONS

The present study showed that the populations of the genus *Sesleria* growing in the montane and subalpine belts of the Pollino massif and Orsomarso mountains correspond to the taxon previously described by DEYL (1946) as *Sesleria tenuifolia* var. *calabrica*, and that this taxon should be treated at the species level. Its distinct morphology, dodecaploid

chromosome number, and its restricted distribution area are all factors strongly supporting the new taxonomic status presented below (Figs. 8, 9).

The species acts as a guide species in the dry grasslands of the upper part of the Pollino and Orsomarso mountains. It behaves as a geo-vicariant of *S. apennina* of the Apuan Alps and *S. juncifolia* s.str. of northwestern Balkans and Friulian Carso, and to the other taxa belonging to the *S. juncifolia* from the Balkan Peninsula (Fig. 8).

***Sesleria calabrica* (DEYL) DI PIETRO comb. nov. et stat. nov.**

≡ *Sesleria tenuifolia* var. *calabrica* DEYL, Op. Bot. Čech. 3: 202 (1946).

Lectotypus (hoc loco designatus): Calabria, M. Pollino, in pascuis umbrosis convallium, calc., usque 1000 m (RIGO, Iter Italicum quartum anni 1898, Nr. 431, PR!; *S. tenuifolia* var. *calabrica*, det. M. DEYL); Isolectotypus WU!

- *Sesleria tenuifolia* auct. (p. p.) non SCHRAD.: FIORI, Nuov. Fl. Italia 1: 116 (1923–1929); PIGNATTI, Fl. Italia 3: 508 (1982).

- *Sesleria apennina* auct. (p. p.) non UJHELYI: UJHELYI, Webbia 14: 609 (1959); ZANGHERI, Fl. Ital. 1: 945 (1976).

In the protologue of *Sesleria tenuifolia* var. *calabrica* (DEYL 1946), the author clearly refers to the material collected in 1898 by Rigo on Mount Pollino (collection Nr. 431). I have traced two herbarium specimens of this gathering, one in Prague (PR) and another in Vienna (WU). Because no holotype was indicated in the original publication, both specimens should be considered as part of original material. The PR specimen is chosen as lectotype, because it was annotated by DEYL as “*S. tenuifolia* var. *calabrica*”, while the WU specimen was annotated by him as “*S. tenuifolia* Gigantische Form (*planifolia*)” (Fig. 2).

Morphological description

Plant densely tufted. Culms (25)30–50(60) cm, glabrous. Leaves smooth or slightly scabrid in the distal part, very pruinose (maintained under cultivation). Leaf sheaths yellowish-green, glabrous or slightly puberulous on veins. Withered leaf-sheaths typically covering the base of the plant up to 5–6 cm; auricles minutely ciliate at base. Ligule short (0.3–0.5 mm), minutely ciliate. Leaf blades straight only in the juvenile phase, but more often fairly lank or slightly curved, (10)15–35(60) cm, acute and pungent, glabrous or slightly scabrid in the distal part. Leaf blade anatomy: outline V-obovate to somewhat flat; leaf width (1.6)2.2–2.8(3.2) mm; leaf thickness 0.3–0.5 mm; number of veins normally (8)10–13(17). Transverse section of leaf blade (Fig. 9e) with at least 7 sclerenchymatous traverses at vascular bundles, 2–4 abaxial sclerenchyma girders (i.e., sclerenchyma reaching vascular bundles), and 2–4 vascular bundles completely free from sclerenchyma. Continuous subepidermal sclerenchyma absent. Leaf blade abaxial epidermis (Fig. 9f): long cells rectangular, sinuous or slightly sinuous (160–175 × 25–30 μm); stomata absent. Leaf blade adaxial epidermis (Fig. 9g): stomata density 55 × 0.294 mm². Spikes (1.2)3–3.5(4.2) cm long, rather dense in a juvenile phase and typically lax at maturity with glabrous or slightly scabrid branches, bearing 6–12 spikelets. Spikelets (6)6.5–7(9.2) mm long with 2(3) florets. Glumes subequal, (5.5)6–6.5(7) mm long, 1-veined, glabrous, almost entirely scarious or with



Fig. 8. Preliminary scheme of the distribution ranges of the species belonging to the *S. juncifolia* complex in the Apennine and Balkan Peninsulas.

a scarious margin up to 1/3 of half width, typically acuminate and always awned; awns (1)1.5–2.5(3) mm long. Lemmas rounded and usually bluish-violet tinged in the upper part abaxially, glabrous or with few short hairs in the upper part and typically ciliate (0.1–0.25 mm) along its entire margin (in some cases for less than 1/6 from the base), 5-veined, 5-toothed at apex (ciliate), each tooth with awn: lateral awn 0.5–1.2 mm long, median awn 0.2–0.5 mm long, and central awn 1–2.7 mm long. Palea 2-toothed, sometimes tinged bluish-violet and covered with relatively long hairs (0.2–0.3 mm) along the margin. Stamens 3. Anthers (2)2.8–3.5(4.2) mm long. Ovary oboval showing its maximum width in the distal side, pubescent only in the upper part. Style 3–4 mm long; stigma 1.8–2.2 mm long.

Both the results of multivariate and univariate analyses on morphological and anatomical characters and the karyological evidence suggest that three distinct entities of the *Sesleria juncifolia* complex occur in the Italian Peninsula. Each of them is well-correlated with a geographic area (Friulian Carso, Apuan Alps, and Pollino-Orsomarso). A fourth form, corresponding to the C-S Apennines populations, exhibits intermediate features between the

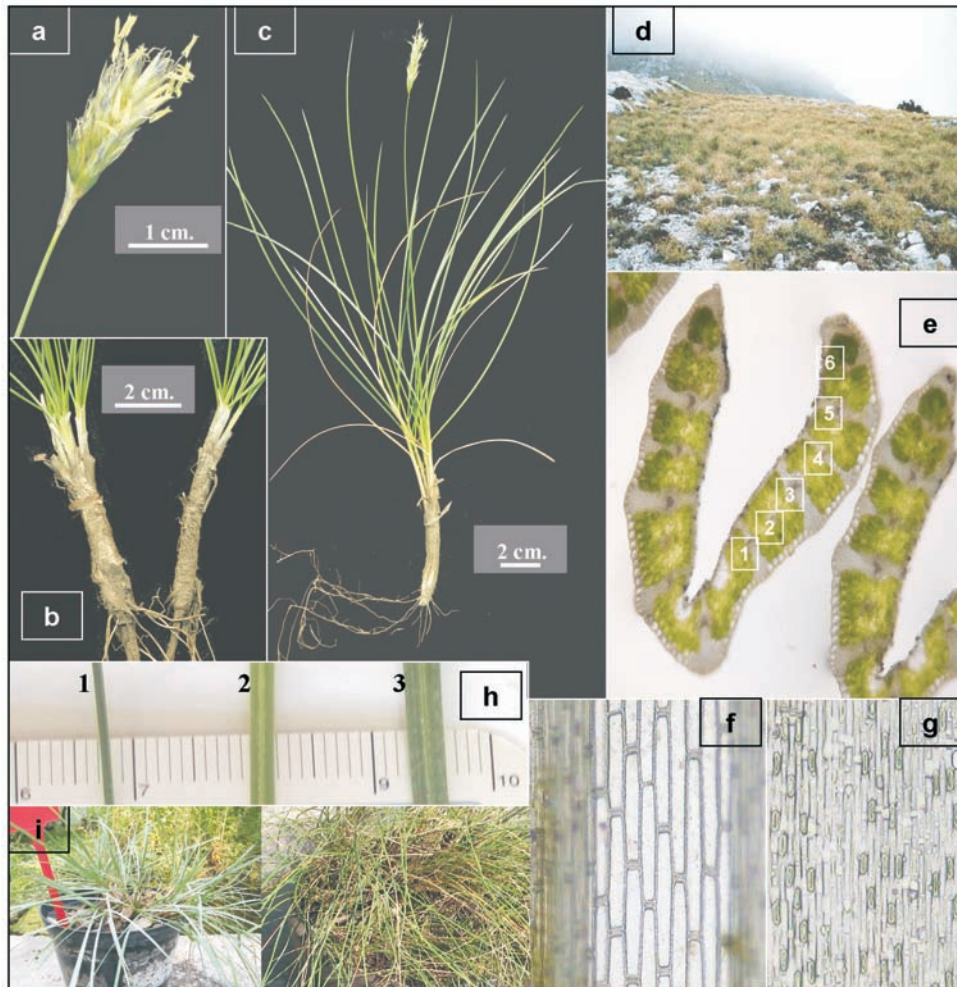


Fig. 9. Morphological and ecological features of *S. calabrica*. a – spike; b – leaf sheaths and roots; c – the whole plant; d – typical *Anthyllido-Seslerietum calabricae* primary subalpine dry grasslands occurring near the top of Serra Dolcedorme (2260 m); e – transverse section of leaf blade (loc. Fosso Serrapaolo, 1250 m a.s.l., northern Calabria), with vascular bundles shown; f – longitudinal section of the abaxial leaf blade; g – longitudinal section of the adaxial leaf blade; h – leaf blade width in *S. calabrica* (3) compared with *S. juncifolia* (1) and *S. apennina* (2); i – tufts of *Sesleria calabrica* (left) collected on Mount Montea 1500 m a.s.l. (Pollino National Park) and of *Sesleria juncifolia* (right) collected in Friulian Carso region (400 m a.s.l.).

population of Friulian Carso and those of the Apuan Alps. Among all these populations, however, *S. calabrica* can be morphologically most easily recognized.

It is obvious that the taxonomic revision of the entire *S. juncifolia* complex lies outside the aims of the present study. Although further studies are needed, the existence of *S. apennina* as a separate taxon within the *S. juncifolia* complex is strongly favoured. In contrast to UJHELYI (1959b), however, the distribution area of *S. apennina* is apparently restricted only to the Apuan Alps and possibly to adjacent regions (see Fig. 8). In conclusion, the following key to

the species of the *Sesleria juncifolia* complex occurring in the Italian Peninsula (*S. kalnikensis* excluded) is proposed.

- 1a Transverse section of tiller leaf blade with (10)11–13(15) vascular bundles. Leaf 2.2–2.8 mm wide and 0.3–0.4 mm thick. Adaxial surface abundantly pruinose. Lemma > 5 mm; glumes > 5.8 mm. Dodecaploid plants (2n=84) *S. calabrica* (DEYL) DI PIETRO
- 1b Transverse section of tiller leaf blade with 7–9(13) vascular bundles. Leaf 1.2–2.2 mm wide and 0.15–0.3 mm thick. Adaxial surface green or pruinose. Lemma normally < 5 mm; glumes < 5.5 mm. Octoploid plants (2n=56) 2
- 2a Transverse section of tiller leaf blade with 7(9) vascular bundles. Leaf 1.2–1.6 mm wide. Adaxial surface normally green and only rarely pruinose. Back of lemmas smooth or slightly puberulous near the apex. Hairs on margin of lemmas short (< 0.15 mm) *S. juncifolia* SUFFREN
- 2b Transverse section of tiller leaf blade with (9)10–11(13) vascular bundles. Leaf 1.8–2.2 mm wide. Adaxial surface normally pruinose. Back of lemma often pubescent or puberulous for more than distal half. Hairs on margin of lemmas normally exceeding 0.2 mm and up to 0.45 mm *S. apennina* UJHELYI

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Encl. Appendix 1, 2, 3 – pp. 310–313

APPENDIX 1

Specimens seen and used for morphometric analyses.

Sesleria juncifolia SUFFREN

Slovenia: M.te Nanos, pascoli intorno Cappella S. HIERONYMUS, 09.V.1971, D. LAUSI (TSM); Valle del Vipacco, falde meridionali del Monte Kucej, 850 m, 08.IV.1961, L. POLDINI (TSM). **Croatia:** Cicceria, falde meridionali della Rasusica, 940 m, 22.IV.1971, L. POLDINI (TSM). **Italy: Friuli Venezia-Giulia:** Val Rosandra (Friuli), sub. *S. tenuifolia*, 29.V.1966, G. SAULI (TSM); M.te Nevoso (Sneznik), Friuli, sub *S. tenuifolia* SCHRAD., 16.VI.1963, L. POLDINI (TSM); M.te Černikal, Friuli, sub *S. tenuifolia* SCHRAD., 18.III.1962, L. POLDINI (TSM); Val Rosandra, Friuli, sub *S. tenuifolia* SCHRAD., 19.IV.1965, E. & S. PIGNATTI (TSM); Sopra Concovello, sub *S. tenuifolia*, 4.IV.1965, S. PIGNATTI (TSM); Veglia, M.te Crgan, 24.IV.1966, G. SAULI (TSM); Veglia Rt. Glovina, 24.IV.1966, L. POLDINI (TSM); M.te Organ (Veglia), 24.IV.1966, G. CRISTOFOLINI (TSM); Rupi M.te Itlan (isola di Veglia), 24.IV.1966, D. LAUSI (TSM); Val del vajocco, strada per M.te Nanos, 19.III.1968, L. POLDINI (TSM); M.te Gurca, Carso, Prov. Trieste, ca. 380 m, 5.IV.1968, L. POLDINI (TSM); Divaccia (Dolina Risnik), 4.IX.1965, L. POLDINI (TSM); Opicina presso vedetta Alice (Friuli), 09.V.1970, S. PIGNATTI (TSM); M. Calvo (Friuli), 11.IV.1966, S. PIGNATTI (TSM); Prosecco (Friuli), sub *S. tenuifolia*, 07.IV.1969, S. PIGNATTI (TSM); Prati Monte Spaccato (Trieste), 10.IV.1963, D. LAUSI (TSM); Val Rosandra, 8.IX.2002, R. DI PIETRO (herb. DI PIETRO RO); – **Marche:** Gole del Furlo (Marche), sub *S. tenuifolia*, 10.V.1968, S. PIGNATTI (TSM); Forca di Presta (M.ti Sibillini), 1600 m, 18.VIII.2002, R. DI PIETRO (herb. DI PIETRO RO); Vetta di M. Vettore, 7.VI.2001, R. DI PIETRO (herb. DI PIETRO RO); – **Lazio:** Monte Altino-Redentore (Monti Aurunci), rupi antistanti il mare, 27.V.2000, R. DI PIETRO (herb. DI PIETRO RO); Parco Nazionale del Circeo, rupi antistanti il mare, nelle fessure della roccia o sulle pareti ombrose, 13.VI.2000, R. DI PIETRO (herb. DI PIETRO RO); Stazzo di Gorzano, Monti della Laga, prateria arida a dominanza di *Sesleria tenuifolia*, 18.VIII.2002, R. DI PIETRO (herb. DI PIETRO RO); Monte Pelone, Monti della Laga, 13.VI.2003, R. DI PIETRO (herb. DI PIETRO RO); Monte Terminillo verso Cresta Sassetelli, praterie xeriche subalpine, 6.VI.2001, R. DI PIETRO (herb. DI PIETRO RO); Sella di Leonessa, 12.VI.2003, R. DI PIETRO (herb. DI PIETRO RO); Santa Maria della Portella (Monti Simbruini), rupe accanto alla chiesa, 14.V.2000, R. DI PIETRO (herb. DI PIETRO RO); – **Campania:** Valico di Chiunzi (Monti Lattari), rupi fronteggianti il mare, 19.X.2000, R. DI PIETRO (herb. DI PIETRO RO); Monte Solaro (Capri), rupi fronteggianti il mare, 20.X.2000, R. DI PIETRO (herb. DI PIETRO RO); vetta Monte Cervati, 18.X.2000, R. DI PIETRO (herb. DI PIETRO RO); – **Abruzzo:** Gran Sasso, Corno Grande, 2600 m, sub *S. tenuifolia*, 26.VII.1966, S. PIGNATTI (TSM); Monte Aquila, 17.VI.2003, R. DI PIETRO (RM); Campo Imperatore, 17.VI.2003, R. DI PIETRO (RM); Majella, Fondo di Femmina Morta, 8.VIII.2002, R. DI PIETRO (RM); Parco Nazionale d’Abruzzo, Serra Rocca Chiarano, 5.VII.2002, R. DI PIETRO et M. Rutigliano (RM); Monte Argatone, 6.VII.2000, R. DI PIETRO et G. FILIBECK (RM); Monte Prena, vado di Ferruccio, 5.VII.2003, R. DI PIETRO (RM); M. Prena (Gran Sasso), nei pressi di vado di Ferruccio, 2200 m, 05.VII.2003, R. DI PIETRO (herb. DI PIETRO RO); – **Puglia:** Pulsano, Manfredonia (Gargano), 6.VI.1966, D. LAUSI (TSM); Pulsano, Manfredonia, rupi, 06.VI.1966, D. LAUSI (TSM); Vallone di Pulsano (Gargano), prateria arida, 22.III.2002, R. DI PIETRO (herb. DI PIETRO RO); – **Basilicata:** M.te Alpi., Monte Alpi, rupi, 6.VI.2003, R. DI PIETRO et G. MISANO (herb. DI PIETRO RO); Maratea, sotto il Redentore, 6.VI.2003, R. DI PIETRO et G. MISANO (herb. DI PIETRO RO); Monte La Rotonda di Balvano, VI.2001, R. DI PIETRO et F. CONTI (herb. DI PIETRO RO; APP); M. Vulturino, IX.2003, R. DI PIETRO (herb. DI PIETRO RO).

Sesleria apennina UJHELYI

Italy: P.sso del vestito, Alpi Apuane, V. 2003, R. DI PIETRO (herb. DI PIETRO RO); Passo del vestito (Alpi Apuane), prateria arida, 18.IX.2001, R. DI PIETRO (herb. DI PIETRO RO); Alpi Apuane, tappeto di Dryas, VII.1960, G. BAZZICHELLI (herb. BAZZICHELLI RO); Pania, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), VII.1960, G. BAZZICHELLI (herb. BAZZICHELLI RO); Vetta della Pania della Croce, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), VI.1960, G. BAZZICHELLI (herb. BAZZICHELLI RO); Pania, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), Rupi a *Brachypodium* e *Robertia*, 21.VII.1960, G. BAZZICHELLI (herb. BAZZICHELLI RO); Lungo la strada dal rifugio Pietrapana alla Pania della Croce, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), VI.1960, G. BAZZICHELLI (herb. BAZZICHELLI RO); Pendio merid. della Focetta del Puntone, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), *Brachypodieto rupestre* 6.VI.1961, G. BAZZICHELLI (herb. BAZZICHELLI RO); Campi di massi a

Nord del Rifugio Pania nei pressi della Vetricia, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), VI.1961, G. BAZZICHELLI (herb. BAZZICHELLI RO); Dintorni del Rifugio Pania, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), I.VI.1961, G. BAZZICHELLI (herb. BAZZICHELLI RO); Dintorni del Rifugio Gr. Dorneganni, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), VIII.1961, G. BAZZICHELLI (herb. BAZZICHELLI RO); Pania della Croce, Alpi Apuane (sub *S. tenuifolia* SCHRAD.), VII.1960, G. BAZZICHELLI (herb. BAZZICHELLI RO); Pizzo d'Uccello (Alpi Apuane), (sub *S. tenuifolia* SCHRAD.), 18.VIII.1961, G. BAZZICHELLI (herb. BAZZICHELLI RO); Lungo la strada dal Rifugio Pania verso Nord-Ovest, alla Borra di Canala Alpi Apuane, (sub *S. tenuifolia* SCHRAD.), 04.VI.1961, G. BAZZICHELLI (herb. BAZZICHELLI RO); Nei pressi del Rifugio Pania (sub *S. tenuifolia* SCHRAD.), VI.1961, G. BAZZICHELLI (herb. BAZZICHELLI RO); Rifugio Donegani, Orto di Donna (Alpi Apuane), (sub *S. tenuifolia* SCHRAD.), 16.VIII.1961, G. BAZZICHELLI (herb. BAZZICHELLI RO); M.te Procinto, 1050 m (Alpi Apuane), (sub *S. cf. tenuifolia*), 27.V.1973, S. PIGNATTI (TSM).

***Sesleria calabrica* (DEYL) DI PIETRO**

Italy: Calabria: Pendici Serra Dolcedorme, VII.1998, escursione SBI, R. DI PIETRO (herb. DI PIETRO RO); Serra Dolcedorme, 17.IX.2001, R. DI PIETRO (herb. DI PIETRO RO); vetta di Serra Dolcedorme, 26.VII.2003, R. DI PIETRO (herb. DI PIETRO RO); pendici di Serra Dolcedorme versante nord, 26.VII.2003, R. DI PIETRO (herb. DI PIETRO RO); vetta Monte Caramolo, 17.XI.2000, R. DI PIETRO (herb. DI PIETRO RO); pendici Monte Caramolo, 17.XI.2000, R. DI PIETRO (herb. DI PIETRO RO); Monte Pollinello, 7.VIII.2001, R. DI PIETRO (herb. DI PIETRO RO); Fosso Serrapaolo adiacente a bosco a *Pinus nigra* subsp. *calabrica*, 5.IX.1999, R. DI PIETRO (herb. DI PIETRO RO); Monte Montea, prateria arida a dominanza di *Sesleria*, 08.VIII.2002, R. DI PIETRO (herb. DI PIETRO RO). Montea, S. Agata d'Esaro, prateria arida a dominanza di *S. calabrica*, 23.VIII.2002, R. DI PIETRO (herb. DI PIETRO RO); Serra Dolcedorme, praterie, II iter amphiadriaticum, 27.9.1999, CONTI, LAKUŠIĆ et KÜPFER (APP); Serra Dolcedorme, 30.VI.2004, vetta, R. DI PIETRO (herb. DI PIETRO RO); M.te Pollinello, 07.VIII.2001, R. DI PIETRO (herb. DI PIETRO RO); M.te Caramolo, 1680 m, 27.VII.2003, R. DI PIETRO (herb. DI PIETRO RO); F.so Serrapaolo, 1150 m, 27.VII.2003, R. DI PIETRO (herb. DI PIETRO RO).

APPENDIX 2

Specimens seen in various herbaria but not used in morphometric analyses.

Sesleria juncifolia

Italy: Friuli Venezia Giulia: Presso trieste, 8.IV.1864, V. TOMMASINI (WU); M.Vipera, 11.IV.1914, F. MORTON (WU); Trieste (Prosecco), IV.1883, MARCHESETTI (WU); In litorali Austriaco. In rupestribus apricis prope Tergestum, MARCHESETTI 667 (WU); M. Cahl, IV.1902, C. TECHET (WU); Contovello (Trieste), IV.1873, GLOSVACK (WU); S. Servolo, IV.1881, MARCHESETTI (BEOU); Pres de Trieste (Illyrie), Lieux rocaillieux des cotes calcaires, 8.IV.1864, M. DE TOMMASINI (BEOU); Trieste, 1870, PANČIĆ (BEOU, sub *Sesleria interrupta*); – **Toscana:** Oasi WWF Bosco Rocconi, roccia, 13.IV.2000, G. BONCOMPAGNI (SI); – **Marche:** M.Catria, VII.1966, S. SOMMIER (FI); Caldarola, R. Ricci (FI, sub *S. nitida*, det. V. STRGAR sub *S. tenuifolia*, det. J.UJHELYI sub *S. apennina*); In vertici Monti Priori, D. MARZIALETTI (FI); In M.te S. Vicini apennini cingulani, 22.V.1977, leg. NARDUCCI, det. V. STRGAR (FI); – **Umbria:** In cima a Monte Vettore luoghi sassosi, 11.VII.1877, G. LEVIER (FI); Monte Vettore, 14.III.1994, leg. S. SOMMIER, det. P.V. ARRIGONI (FI); Pendici di Monte Vettore, 7.VI.2001, R. DI PIETRO (RM); – **Abruzzi:** Aprutis in rupestribus m.te Majellae loc. Scrimacavallo, n°70, 3.VIII.1875, PORTA et RIGO (BP, sub *S. nitida*, det. M. DEYL sub *S. tenuifolia* SCHRAD, det. J.UJHELYI sub *S. apennina*); Prati di Tivo, 21.V.1970, B. ANZALONE (FI); Montis Morrone, Schiena d'Asino, VIII.1884, H. GROVES (BP); Rochers, Monte Corno, 16.VII.1876, ALFIT (BP); Montagna dei Fiori, loc. Il Vallone, pascoli aridi 1600 m, 28.V.1999, CONTI, CAPECCI et TINTI (APP); Macella, Vallone di Izzo, pascoli aridi 1415 m, 2.VI.2004, CONTI et DI RENZO (APP); – **Puglia:** M.Calvo, Iter Garganicum, 27.V.1893, MARTELLI (FI, sub *S. nitida* TEN. det. V. STRGAR, sub *S. tenuifolia*); – **Lazio:** Monte Leano (Monti Ausoni), Rupi fronteggianti il mare, 24.V.2000, R. DI PIETRO (herb. DI PIETRO RO); – **Campania:** Rupi, pascoli sassosi aridi di vetta, loc. M.Accellara, 1.VII.1973, B. MORALDO (FI, sub *Sesleria apennina*); Ex Insula Capraearum pr. Neapolim in rupibus Anacapri, IV.1874, J. BALL (BP); Vesuvio sopra Portici, 1874, PANČIĆ (BEOU, doubtful location).

Slovenia: Carniolia: An Felsen bei Fiume Fl. Germ. n. 221, RCHB. (WU); Istria (M. Maggiore), 28.IX.1906, A. GINZBERGER (WU); Istria (M. Maggiore), 28.VII.1902, A. GINZBERGER (WU). – **Croatia:** M. Velebit, Nacionalni park, Packlenica, 24.V.1996, M. MAREK (WU); Pelješac, Svedi Ilija bei Orebić, 12.IV.1979, E. VITEK (WU); Jankovo brdo u. Treglav (Bosnien-Dinarischen Alpen), 4.VII.1907, E. JANCHEN & B. WATZL (WU); Natrjanski Kras, in sylvis Fagetis montis Nanos, 900 m, 28.IX.1958, T. POCS (BP); Divaca-Scocjause, in regio collina, JAKUCS-FEKETE (BP); In montibus pr. Cattars, V.1872, PICHLER (BP); Insel Brazzaz, X.1906, A. GINZBERGER (BP); Insel Lizza, 25.V.1901, A. GINZBERGER (BP); Istria, 19.IX.1910, A. GINZBERGER (BP); M. Iersatti, in rupium fissuris, 30.III.1870, M. SMITH (BP); Orjen (Sud-Dalmatien), 14.VII.1907, F. VIERHAPPER (BP); Fiume, 4.VI.1902, A. DE DEGEN (BP); M. Orien, VII.1906, ADAMOVIĆ (BP); Trsak bei Fiume, ROSSI (BEOU). – **Bosnia and Herzegovina:** Vran Mali, 27.VII.1907, J. STADLMANN, F. FALTIS, E. VIBIRAL (WU); M. Romanija, 1500 m, 17.V.1960, L. KUTLESA (BP); Flora illyrica, Prevy-planina, in rupibus calcareis supra vic. Glagronica, 14.VII.1933, P. SILLINGER et M. DEYL (PR); Flora illyrica, Prevy-planina, in pratis subalpinis montis Maly Prevy, 10.VII.1933, P. SILLINGER et M. DEYL (PR); Plasia planina, 8.VII.1909, J. PRODAN (PR). – **Serbia-Montenegro:** Ovčarska klisura, W Čačak, 13.VII.1967, PACHERNEGG (WU); Plav, 17.VII.1967, PACHERNEGG (WU); Ipek, 2300 m, 22.VII.1917, J. ANDRASOVSKY (BP); in alp. montis Durmitor, VIII.2004, J. ROHLENA (BP); Durmitor, in graminosis et saxosis montis Savin Kuk, VII.1933, P. SILLINGER et M. DEYL (PR); prope Lever Tara, in rupibus et silvis, in valle fluminis Tara, VII.1933, P. SILLINGER et M. DEYL (PR); Savina Isposnica (Studenica), Orno-Ostryetum, 29.IX.1988, S. MIŠIĆ (BEOU); Mt. Bioč, 1600 m, 10.X.1997, D. LAKUŠIĆ (BEOU); Starae Srbije, 9.VI.1923, SOŠK (BEOU); Zupaba Kethusia lepx, 31.VII.1912, N. KOŠANIN (BEOU); Flora Montenegrina, 29.VII.1912, N. KOŠANIN (BEOU, sub *Sesleria*); Flora Jalica, 14.VIII.1919, N. KOŠANIN (BEOU); Lovćen, PANČIĆ (BEOU, sub *Sesleria interrupta*); Durmitor, in rupestribus cfr. Forma mediterranea, PANČIĆ (BEOU); Gora (Tara mountains) w-Serbia, PANČIĆ (BEOU, sub *Sesleria interrupta*). – **Macedonia:** Flora Macedonica, in alpinis montis, Luboten prope Skopilye, VII.1937, M. DEYL (PR). – **Albania:** Gupfeldes des Maranaj nördl. von Scutari, 2.VI.1918, I. DÖRFLER (WU); Albania borealis, in saxo arenaceo et calcareo, Krajsnic (Bajram Curri), 25.VI.1955, JÁVORKA et UJHELYI (WU); Hasi, Paštrik, 15.V.1818, I. DÖRFLER (WU); Siševo pr. Uskub, 28.IV.1893, I. DÖRFLER (WU); M. Radohines, 1800 m, 25.VII.1960, P. JAKUCS (BP); Albania borealis, sub rupe Maja Drosks, versus cacumen (2600 m), 1.VII.1955, J. UJHELYI (BP); in declivibus alpis Hecuravet (1600–2600), 2.VII.1955, J. UJHELYI (BP); in valle superiore alpestri rivi Volbona, 900–1100 m, 3.VII.1955, JÁVORKA & UJHELYI (BP); in jugo Qafa Valbons, 2000 m, 4.VII.1955, JÁVORKA & UJHELYI (BP); In rupibus dolomitibus montis Radohines, prope pag Theti, 23.VII.1960, P. JAKUCS (BP).

Sesleria apennina

Italy: Alpi Apuane, in alpinis Apuanis Hetruria (sub *S. tenuifolia* SCHRAD.), 16.IV.1881, J. BALL (FI); Alpi Apuane, cima del procinto (sub *S. tenuifolia* SCHRAD.), 29.III.1894, R. PAMPANINI (FI); Alpi Apuane, Pania della Croce (sub *S. tenuifolia* SCHRAD.), VI.1878, A. BOTTINI (FI); Garfagnana, Valle della Turrite Secca, cave presso Campagrina (sub *S. tenuifolia* SCHRAD.), 16.VII.1955, P. V. ARRIGONI (FI); Balze del Vallone, 1865, PICCININI (FI); Alpi Apuane (sub *S. tenuifolia* SCHRAD.), IV.1897, C. ROSSETTI (FI); Alpi Apuane, sui prati della Pania, costituente principale il pascolo (sub *S. tenuifolia* SCHRAD.), 29.VII.1893, S. SOMMIER (FI); Alpi Apuane, cima del procinto (sub *S. tenuifolia* SCHRAD.), 29.VI.1891, S. SOMMIER (FI); Alpi Apuane, alpe della Grotta, sotto il Procinto (sub *S. tenuifolia* SCHRAD.), 30.III.1894, S. SOMMIER (FI); Alpi Apuane, cima del procinto (sub *S. tenuifolia* SCHRAD.), 29.III.1894, S. SOMMIER (FI); Alpi Apuane, cima della Pania (sub *S. tenuifolia* SCHRAD.), VI.1878, A. BOTTINI (FI); Alpi Apuane, nei pressi del Rifugio Gobbie, praterie rupestri, 17.VII.1991, B. FOGGI (FI); Alpi Apuane, fra Antona ed il Canale dell'Agnale, rupi calcaree lungo la strada, 17.VII.1991, B. FOGGI (FI); Alpi Apuane, foce di Pianza, 13.V.1965, E. FERRARINI (FI); Alpi Apuane, 17.VI.1862, O. BECCARI (FI); Alpi Apuane, 12.VI.1820, ZOCCHI (sub *Sesleria*) (FI); Alpi Apuane, Pania della Croce, tra Lavigliani e la vetta (sub *S. coerulea*), 18.VI.1962, M. JACOBS (FI); Alpi Apuane, Cintura del Procinto, 29.VI.1893, S. SOMMIER (sub *S. tenuifolia*); Alpi Apuane, M. Forato (sub *S. tenuifolia*), 10.VIII.1892, S. SOMMIER (FI); Alpi Apuane, verso il M. Matanna (sub *S. tenuifolia*), 6.VII.1884, S. SOMMIER (FI); Alpi Apuane, Pania della Croce, 8.VI.1892, P. FANTOZZI (FI); Alpi Apuane, ultimi prati verso la cima del Pisanino (sub *S. tenuifolia* SCHRAD.), insieme al *Brachypodium*, 30.VII.1888, S. SOMMIER (FI); Alpi Apuane, Passo del Vestito (sub *S. tenuifolia* SCHRAD. var. *juncifolia* MARCHEZ.), 22.IV.1935, R. PICHI-SERMOLLI (FI); Alpi Apuane, Foce di Moscata, 1.VI.1958, B. LANZA (FI).

Sesleria calabrica

Italy: Calabria: Mt. Pollino, in umbrosis pascuis convallium, usque 1000 m.s.m., calc., G. RIGO, No. 431, 1898, sub. *S. tenuifolia* SCHRADER (PR, det. M. DEYL sub *S. tenuifolia* var. *calabrica*); Mt. Pollino, in umbrosis pascuis convallium, usque 1000 m.s.m., calcareous, G. RIGO, No. 431, 1898, sub. *S. tenuifolia* SCHRADER (WU, det. M. DEYL sub *S. tenuifolia* var. *planifolia*, gigantische Form); Reggio in Calabrien, DIERGES (BP, sub *S. juncifolia*, det. J. UJHELYI sub *S. apennina*, doubtful location).

APPENDIX 3

Complete names of the syntaxa quoted in the text.

Seslerietum apenninae FURNARI in BRUNO et FURNARI 1966; *Carici humilis-Seslerietum apenninae* BIONDI, GUITIAN, ALLEGREZZA et BALLELLI 1988; *Carici macrolepis-Seslerietum apenninae* BIONDI, PINZI et GUBELLINI 2004; *Caricion firmae* GAMS 1926; *Edrajantho-Seslerion* HORVAT 1949; *Leontopodio nivalis-Seslerietum apenninae* BLASI, DI PIETRO & PELINO 2005; *Phleo ambigu-Bromion erecti* BIONDI & BLASI ex BIONDI, BALLELLI, ALLEGREZZA et ZUCCARELLO 1995; *Satureion subspicatae* HORVAT 1962; *Scorzoneretalia villosae* HORVATÍĆ 1965; *Seslerio apenninae-Dryadetum octopetalae* BIONDI, BALLELLI, ALLEGREZZA, TAFFETANI, FRATTAROLI, GUITIAN et ZUCCARELLO 1999; *Seslerio-Edrajanthion* REDZIC 2003 nom. prov.; *Seslerion apenninae* FURNARI in BRUNO et FURNARI 1966; *Seslerietalia apenninae* FURNARI in BRUNO et FURNARI 1966; *Seslerietalia coeruleae* BR.-BL. in BR.-BL. et JENNY 1926; *Seslerietalia juncifoliae* HORVAT 1930; *Seslerion juncifoliae* HORVAT 1930; *Elyno-Seslerietea* BR.-BL. 1948; *Festuco-Brometea* BR.-BL. et TÜXEN ex BR.-BL. 1949; *Brometalia erecti* BR.-BL. 1936; *Cytiso-Bromion caprini* BONIN in BARBERO et BONIN 1969.

