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The genus *Festuca* in Italy

Abstract

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Hackel's *Monographia Festucarum Europaeorum* (1882) can be considered the starting point of modern systematic studies on this critical genus in Europe. After his work, almost one hundred years of information was summed up by Markgraf-Dannenberg (1980) in her treatment of the genus in *Flora Europaea*. Here, the total number of species had increased from 28 (Hackel 1882) to 170. However, this was due more to the raising to the rank of species of many infraspecific *taxa*, than to the recognition of new entities as a result of taxonomic investigations. During these hundred years, the increase of knowledge on the systematic of this genus was very unequal in different European countries: in some of them like France, many in-depth investigations were carried out, while in other countries like Italy, studies started later and were much less exhaustive.

Our research team has been carrying out taxonomic investigations on the genus *Festuca* in Italy for several years, making use of modern systematic tools, among which typification and study of type material play an important role. In many instances, the results of our researches led to remarkable taxonomic rearrangements within critical groups.

Some examples are illustrated, concerning the *F. violacea* group, the endemic *F. robustifolia*, and the relations between *F. gracilior* and *F. inops*.

Introduction

The starting point of modern systematic studies on the difficult genus *Festuca* in Europe can be considered the *Monographia Festucarum Europaeorum* (Hackel 1882). Here for the first time anatomical characters of the transverse section of tiller leaf blades were taken into consideration, in addition to the traditional morphological characters. In Hackel's systematic conception, the genus includes a relatively small number of species (28), articulated in a large number of infraspecific *taxa*: subspecies, varieties and subvarieties.

After this work, almost one hundred years of information on the systematics of *Festuca* was summed up by Markgraf-Dannenberg, in her treatment of this genus in *Flora Europaea* (Markgraf-Dannenberg 1980). Here, the total number of species had increased enormously, from the 28 reported by Hackel, to 170. However, this was not only due to the recognition of new entities as a result of taxonomic investigations in critical groups, but

also to the raising to the rank of species of many infraspecific *taxa* (Fig. 1). If the total number of different taxonomic entities is considered, instead of the number of species, the increase is considerably less: from 168 to 219. It must be emphasized, however, that in this period of time the increase of knowledge on the systematics of *Festuca* had been very unequal in different European countries. In some of them (for instance in France and in French-speaking countries, in Spain, and in the British Isles), many in-depth investigations had been carried out using modern systematic methods; while in other countries, like Italy, studies started later and were much less exhaustive.

Let us turn our attention to the situation in Italy (Fig. 2). In this country, Hackel recog-

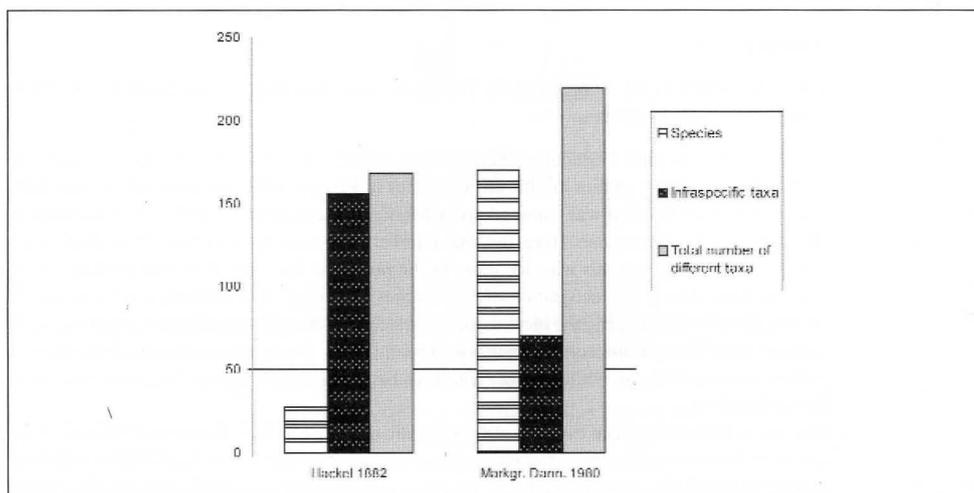


Fig. 1. Systematic knowledge on the genus *Festuca* in Europe

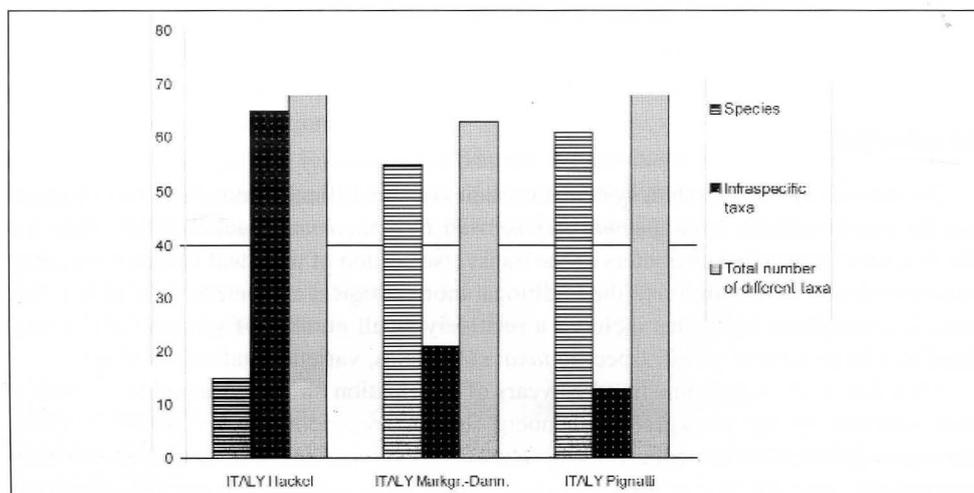


Fig. 2. Systematic knowledge on the genus *Festuca* in Italy.

nised 68 different taxonomic entities: 15 species with 65 infraspecific *taxa*. In *Flora Europaea*, only 63 different *taxa* are reported (55 species with 21 infraspecific *taxa*), that is fewer than those reported by Hackel. In the most recent Italian Flora, Pignatti's *Flora d'Italia*, the genus *Festuca* was treated by Pignatti himself in co-operation with Markgraf-Dannenberg (Pignatti & Markgraf-Dannenberg 1982). Here, 68 different taxonomic entities are listed, (61 species with 13 infraspecific *taxa*). Apart from the different conception of rank, in the space of just one hundred years, from 1882 to 1982, the number of *taxa* is unchanged. Consequently, one could imagine that all the taxonomic problems of Italian fescues had already been solved by Hackel; but this is not the case. Actually, as we already stated, during these one hundred years in Italy systematic investigations on this genus (and on the whole family Poaceae) had been very few: less than 10 contributions concerning *Festuca* had been published in this period. During that same time, about 150 papers appeared, for instance, in France, where scholars like Saint-Yves, Litardière, Auquier, Kerguélen, Plonka, and more recently Portal have been investigating the systematic of this genus since the publication of Hackel's monograph. As a consequence, the number of different *taxa* in France has been constantly increasing. In his recent treatment of the genus *Festuca* in France Portal reports for France 106 different *taxa* (Portal 1999), that is almost double the number reported by Hackel for the same territory 117 years before (Fig. 3). In Italy, even if all the contributions that have appeared since the publication of Pignatti's Flora are taken into consideration (Fig. 4), only the number of 77 different *taxa* is reached. Yet, it is well known that, generally speaking, the Italian flora is much richer than the French, thanks to a greater biogeographical diversity. Therefore, it sounds very strange that diversity within the genus *Festuca* is so much lower in Italy than in France. Even if this is possibly partly due also to the scarceness of floristic exploration of some parts of Italian territory, above all it is related to the insufficient systematic investigation of this genus. After Hackel's monograph, few new *taxa* have been described for Italy, and most of them

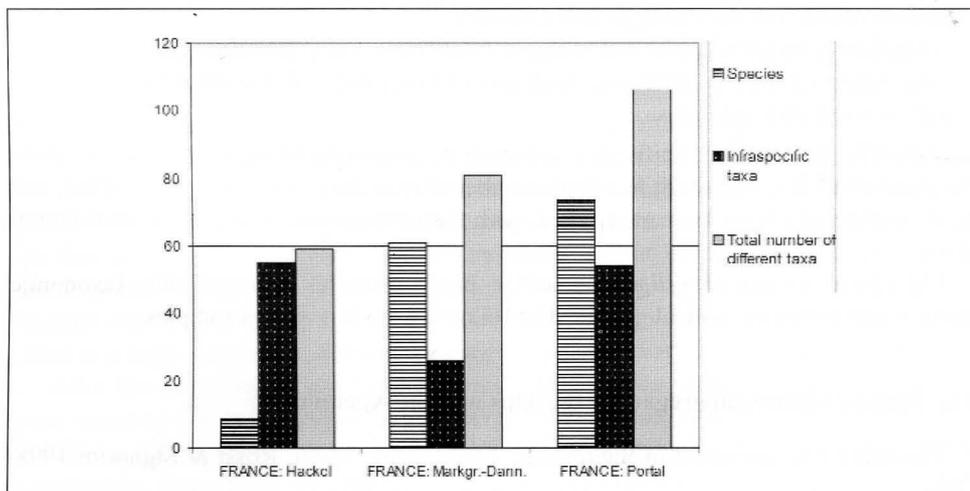


Fig. 3. Systematic knowledge on the genus *Festuca* in France.

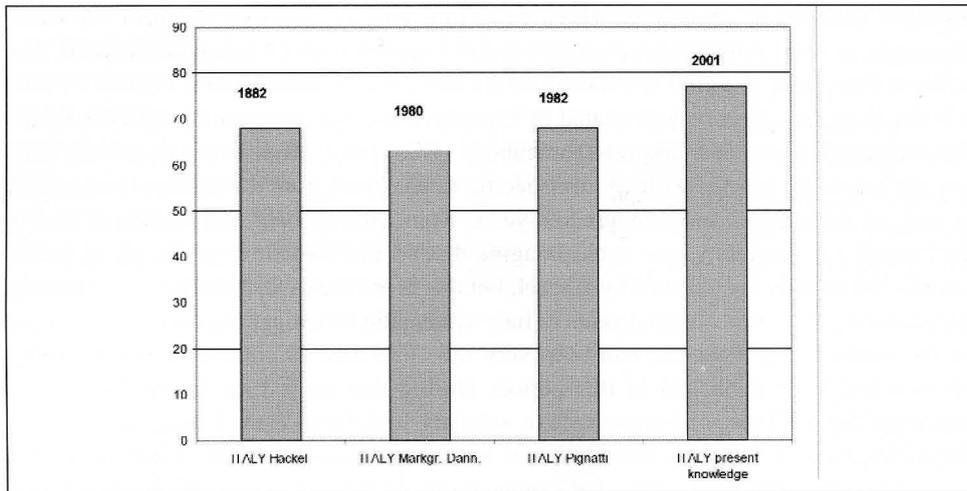


Fig. 4. Total number of different taxa of *Festuca* in Italy.

at the rank of species; this means that systematic relationships among *taxa* have not been sufficiently investigated. Consequently, there is still much work to be done.

Since 1996, our research team has been carrying out taxonomic investigations on the genus *Festuca* in Italy, with special attention to the so-called “thin-leaved fescues” belonging to subgen. *Festuca*. Our approach has involved the use of the following essential investigation tools:

- typification and study of type-material;
- nomenclatural restatement;
- morphometric analysis of macro- and micro-morphological features observed on specimens collected in the whole distribution area;
- collection of morphological and ecological data from living populations;
- observation of features on living plants grown under controlled conditions;
- karyological investigations.

It must be stressed that typification and study of type-material must always be the starting point of all investigations, as a high number of *taxa* have been validly described, and many names have been later misapplied, with the consequence of a great nomenclatural mess.

The results of our investigations led in many instances to remarkable taxonomic rearrangements within critical groups. The following are just a few examples.

The *Festuca violacea* aggregate in the Alps and the Apennines

This topic was discussed in Signorini & Foggi 1997; Foggi, Rossi & Signorini 1998, 1999.

Among the *taxa* of this group reported by different authors for the considered area, three

species are confined only to the Eastern Alps: *F. norica*, *F. picturata*, *F. nitida*. For these, our data essentially confirmed the taxonomic treatment proposed in a recent systematical review (Pils 1980) and later kept by other authors.

On the other hand, for those *taxa* growing also or exclusively in the Western Alps and the Apennines, the results of our investigations led to a complete taxonomic revision. For this area, in Hackel's monograph two *taxa* are reported (Fig. 5a): *F. rubra* var. *nigricans* growing in the whole Alpine chain; and *F. rubra* subsp. *violacea* subvar. *typica* for the Western Alps and the Apennines. In this latter *taxon*, he included also *F. puccinellii*, a

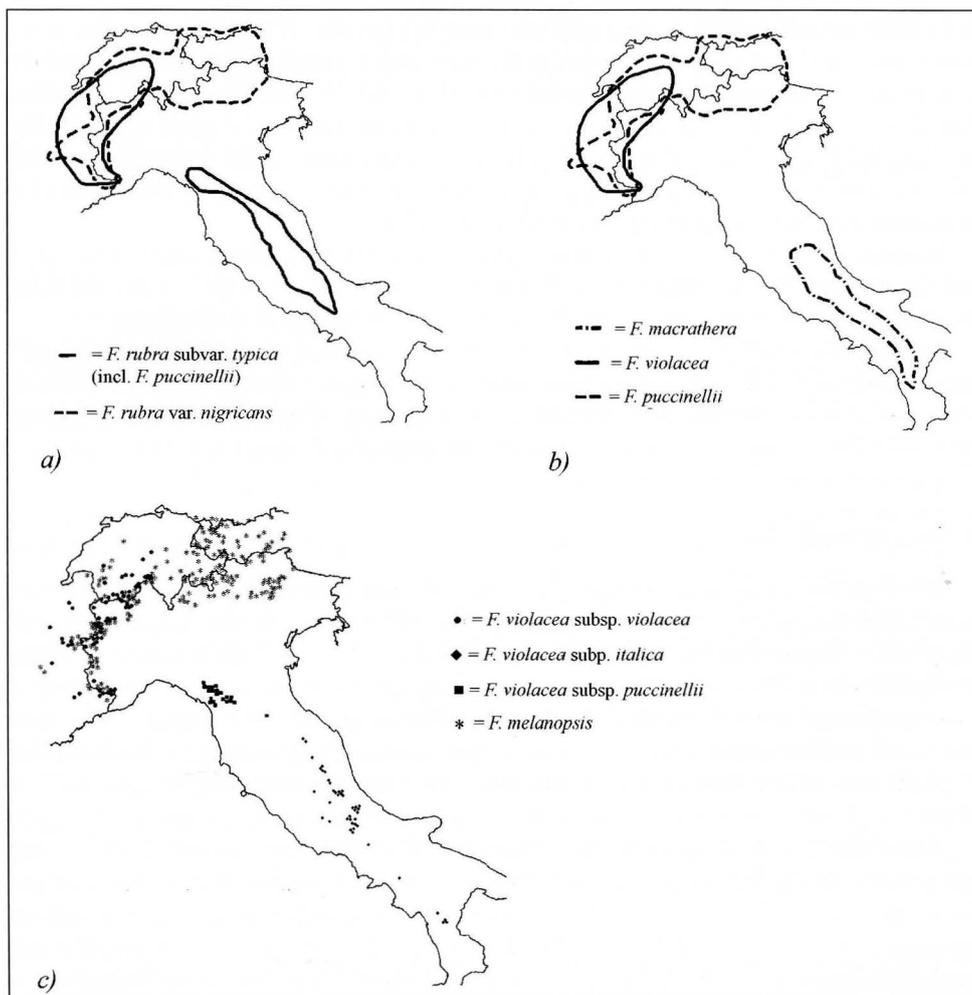


Fig. 5. Distribution area in the Alps and the Apennines of the *taxa* belonging to the *Festuca violacea* aggregate; a) data from Hackel (1882); b) data from Markgraf-Dannenberg (1980) and Pignatti & Markgraf-Dannenberg (1982); c) data from Foggi, Rossi & Signorini (1999).

species originally described for some localities in the Northern Apennines (Parlatore 1850). In *Flora d'Italia* (Pignatti & Markgraf-Dannenberg 1982) and fundamentally also in *Flora Europaea* (Markgraf-Dannenberg 1980), the situation is radically changed (Fig. 5b). *F. violacea* is raised to the rank of species and is restricted to the W-Alps, while populations from the Central and Southern Apennines are referred to *F. macrathera*, a *taxon* that had been described by Hackel for Bosnia-Herzegovina (Hackel in Beck 1887). No species is reported for the Northern Apennines. In the Alps, *F. rubra* var. *nigricans* is raised to the rank of species, under the name *F. puccinellii*, but the *locus classicus* of this species (in the Northern Apennines) is surprisingly excluded from its distribution area.

The results of our investigations, which included multivariate analyses on morphometric data, led to a completely different taxonomic outline. Two species were found to occur, well differentiated both karyologically and morphologically: *F. melanopsis* - that is the new name for *F. rubra* var. *nigricans* - in the Alps, and *F. violacea* in the W-Alps and the Apennines, subdivided into three subspecies (Fig. 5c). *F. melanopsis* is a hexaploid ($2n=42$), while all the three subspecies of *F. violacea* proved to be diploid ($2n=14$). The two species can be easily distinguished mainly on the basis of the appearance of leaf sheaths, which are smooth and straight in *F. melanopsis* and corrugated, with somewhat entangled old fibers in the three subspecies of *F. violacea*.

Populations of *F. violacea* from the Northern Apennines have been referred to subsp. *puccinellii*. They are well differentiated from *F. rubra* var. *nigricans* growing in the Alps, to which the name *F. puccinellii* had been misapplied by Markgraf-Dannenberg.

Populations from the Central and Southern Apennines, included by Markgraf-Dannenberg in *F. macrathera*, we have referred to the new endemic subspecies *italica*. Our studies on the type material of *F. macrathera* showed, in fact, that this is a completely different *taxon*, which is possibly more closely related to *F. nitida* than to *F. violacea*.

Festuca robustifolia

This endemic *taxon* was originally described (Hackel 1882) as *F. ovina* subv. *robusta*, with a distribution area confined to Monteferrato near Prato (Tuscany, Italy). Markgraf-Dannenberg raised it to the rank of species under the new name *F. robustifolia*. In *Flora Europaea* and in *Flora d'Italia*, the systematic conception of this *taxon* is much broader than the original one held by Hackel and its distribution area includes a large part of Italy and a lot of different habitats (Fig. 6a). As a consequence, many records of *F. robustifolia* from all parts of Italy and from very different ecological situations have been reported in floristic and vegetational works from then on. In a recent review on this species (Foggi & Signorini 2001), after studying the type material of Hackel's subvar. *robusta* and selecting a lectotype, we carried out a study on herbarium specimens, natural populations from the *locus classicus*, and living plants grown under controlled conditions. On the basis of our investigations, we were able to give a full description of morphological, karyological and ecological characters of *F. robustifolia*. The species can be identified on the basis of:

- stems scabrid in the upper part, under the panicle;
- sheaths glabrous;
- leaf blades scabrid;

- transverse section of leaf blades regularly ovate, with sclerenchyma in a regularly thickened continuous ring.

We could detect that many of the records of *F. robustifolia* from different Italian regions were to be referred to other *taxa*, morphologically similar, but distinct from *F. robustifolia* both systematically and ecologically. Among these:

- *F. laevigata* Gaudin, with glabrous stem and broken sclerenchyma, widespread in open grasslands on limestone, over 1000 m, $2n=56$;
- *F. billyi* Kerguelen & Plonka, vicarious to *F. laevigata*, on siliceous substrata, growing in *Vaccinium* heaths and Apennines grasslands at high altitudes, $2n=42$;
- *F. stricta* Host subsp. *trachyphylla* (Hack.) Patzke ex Pils, with pubescent sheaths and sclerenchyma in 3 more or less confluent strands, widespread in open arid grasslands and synanthropic, to 1000 m, $2n=42$;
- *F. riccerii* Foggi & Graz. Rossi, described for populations growing in the Northern Apennines (Appennino Tosco-Emiliano) in mountain grasslands over 1600 m, on sandstone, $2n=28$;
- *F. apuanica* Markgr.-Dann., endemic to open grasslands and rocky sites in the Apuan Alps, $2n=70$;
- *F. gamisansii* Kerguelen subsp. *aethaliae* Signorini & Foggi, endemic to Mount Capanne on the Island of Elba, $2n=70$.

In this narrow conception, *F. robustifolia* is currently known with certainty only for ophiolitic and ultramafic outcrops of southern Tuscany (Fig. 6b).

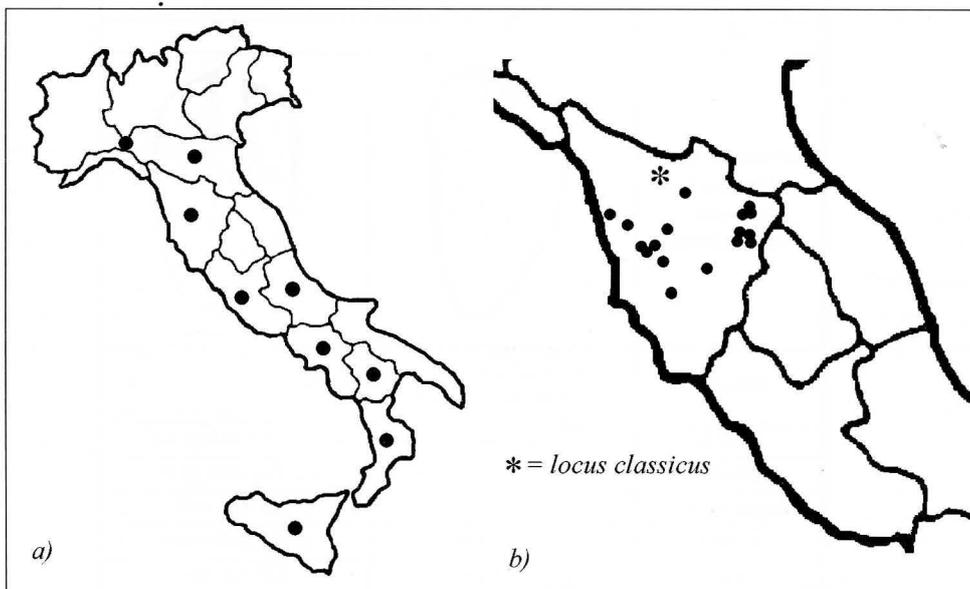


Fig. 6. Distribution area of *Festuca robustifolia*; a) data from Markgraf-Dannenberg (1980) and Pignatti & Markgraf-Dannenberg (1982); b) data from Foggi & Signorini (2001).

Festuca inops - *Festuca gracilior*

This study is currently in progress.

Festuca inops was described for Liguria, in North-Western Italy (De Notaris 1844). Hackel considered it as a subvariety of *F. ovina* var. *glauca*, with a distribution area in the N-Apennines (Liguria, Tuscany).

Festuca gracilior was described by Hackel (1882) as a subvariety of *F. ovina* var. *duriuscula*, with a distribution area from Spain (Pyrenees) to SE-France, and Italy (Tuscany). It was later raised to the rank of species by Markgraf-Dannenberg (1978). In Hackel's conception, the two *taxa* were fundamentally distinguished on the ground of glaucous color of leaves, a characteristic that actually can vary even within single populations and is consequently of no systematic value. In *Flora Europaea* and in *Flora d'Italia*, the two species appear to be almost indistinguishable on the basis of macro- and micro-morphological characters (Fig. 7). According to *Flora Europaea*, *F. gracilior* grows in

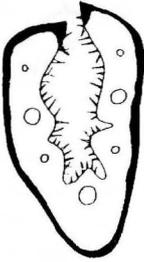
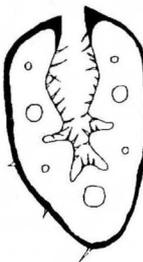
	<i>F. inops</i>	<i>F. gracilior</i>
habit	densely caespitose	densely caespitose
stem	19-25(50), smooth or scabridulous	20-35 cm, glabrous
leaves	0.4-0.8 cm wide, ± smooth, pruinose	(0.45)0.5-0.8 cm wide, ± smooth, somewhat pruinose
veins	7	7
sclerenchyma	complete ring	continuous or slightly interrupted ring
ribs	5	3
leaf section (from Pignatti & Markgraf-Dannenberg)		
sheaths	minutely ciliate, closed in the lower 1/4-1/2	glabrous or puberulent, closed in the lower 1/4-1/2
panicle	3.5-6.5 cm, rather dense	4-7.5 cm, rather dense
spikelets	6-7.7 mm, glaucous	6.5-7.5 mm, green
upper glume	2.7-4.6 mm	3.5-4.5 mm
lemma	3.9-5 mm	4-4.4 (5.5) mm
awn	0-1 mm	0.2-1.5 mm

Fig. 7. Morphological characters of *Festuca inops* and *Festuca gracilior* (data from Markgraf-Dannenberg 1980; Pignatti & Markgraf-Dannenberg 1982).

France and Italy and is excluded from Spain; *F. inops* is endemic to Italy (N-Apennines). In Italy and France, both species were found to be diploid, with $2n=14$ (Kerguélen 1975; Bechi & Miceli 1995; our own data).

In the most recent papers on the gen. *Festuca* in Spain (e.g. de la Fuente & Ortuñez 1998), a *F. gracilior* is reported for the eastern part of the country, but with $2n=28$. According to the most recent French contributions (Kerguélen & Plonka 1989; Portal 1999), in France this species surprisingly disappears just beyond the border with Spain, and is substituted by *F. occitanica* (Litard.) Auquier & Kerguélen, a species morphologically close to *F. gracilior* with $2n=28$.

We are currently investigating Italian and French diploid populations referred both to *F. inops* and to *F. gracilior*. Inter- and intra-populational variation of micro- and macro-morphological characters in specimens coming from the whole area (including type material) are being analyzed. Intrapopulational variation is going to be investigated also by molecular analyses (RAPD).

Further investigations will also be necessary to clarify systematic relationships of these diploid *taxa* with the tetraploid *taxa* growing in SW France (reported under the name *F. occitanica*) and in E Spain (reported under the name *F. gracilior*, sensu De La Fuente & Ortuñez, and including also *F. tarraconensis* (Litard.) Romo and *F. valentina* (St.-Yves) Markgr.-Dann.).

Acknowledgements

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