

## The distinction between the *Festuca ovina* L. and *Festuca rubra* L. aggregates in the British Isles

C. A. STACE, A.-K. K. A. AL-BERMANI and M. J. WILKINSON\*

Department of Botany, University of Leicester, Leicester, LE1 7RH

### ABSTRACT

The *Festuca rubra* L. and *F. ovina* L. aggregates (Poaceae) are defined and reliable means of distinguishing them in the British Isles are given. The best character concerns the young tiller leaf-sheaths, which are tubular in the former and split and overlapping in the latter aggregate. Characters that are often used to separate the two aggregates but are unreliable and therefore frequently cause misidentification are also listed.

### INTRODUCTION

*Festuca ovina* L. and *F. rubra* L. fall into section *Ovinæ* Fries (= sect. *Festuca*) according to Hackel's (1882) classification of the genus in Europe. Apart from these two species, which were each subdivided into a complex hierarchy of subspecies, varieties and subvarieties, Hackel included only nine other species, none of them British. He divided the section into two groups: *Intravaginales*, including *F. ovina* and eight other species; and *Extravaginales vel Mixtae*, with *F. rubra* and *F. porcii* Hackel.

Markgraf-Dannenberg (1980) abandoned Hackel's infrageneric classification, placing the 170 European species that she recognised into a number of informal, unnamed groups. However, it is clear that 129 of these species would have been included in section *Ovinæ* by Hackel. The increase from eleven to 129 over a period of 100 years is partly due to the description of newly discovered taxa, and partly due to a much narrower species concept that gradually developed.

All the British taxa now recognised were placed by Hackel (1882) into either *F. ovina* or *F. rubra*, which are for convenience here referred to as the *F. ovina* and *F. rubra* aggregates. These taxa are listed under the names used by Hackel, Markgraf-Dannenberg and us (Wilkinson & Stace 1991, Al-Bermani 1991) in Table 1.

Both the aggregates are very variable and also very important from both ecological and economic points of view. It is vital that plants of such importance are identified correctly, so it is particularly unfortunate that not only have the segregates of both aggregates been very widely misunderstood, but the two aggregates have been and are still frequently confused, particularly by British botanists. Virtually all the current British Floras, identification manuals and flower-guides that we have examined contain errors that would prevent accurate determination of at least some plants. Although most taxa of *F. ovina* agg. are easily separated from most taxa of *F. rubra* agg., certain taxa are not so easily placed. For example, within *F. ovina* agg., *F. lemanii* Bast. and *F. brevipila* Tracey are usually much more robust than, for example, *F. ovina* and are often misidentified as *F. rubra*. Conversely, *F. rubra* subsp. *commutata* Gaudin usually lacks rhizomes and is sometimes identified as a robust variant of *F. ovina* agg. In addition, pseudoviviparous variants of *F. rubra* are quite frequent and usually misdetermined as *F. vivipara* (L.) Sm., which belongs to the *F. ovina* agg. Although characters such as spikelet, lemma or awn lengths, leaf thickness and flatness and degree of adaxial ridging, culm height, degree of tuftedness and presence of rhizomes are important diagnostically in the section as a whole, they are of very little value on their own in distinguishing between the two aggregates, being in fact the most usual causes of confusion. Moreover, habitat preferences are of very limited value in separating these aggregates. For accurate determination it is

\* Present address: Scottish Crop Research Institute, Invergowrie, Dundee, DD2 5DA.

TABLE 1. CLASSIFICATION OF *FESTUCA RUBRA* AND *F. OVINA* AGGREGATES IN THE BRITISH ISLES

Hackel (1882)				Markgraf-Dannenberg (1980)	Present paper
<i>F. ovina</i>	subsp. <i>eu-ovina</i>	var. <i>vulgaris</i>	subvar. <i>genuina</i>	<i>F. ovina</i>	<i>F. ovina</i> subsp. <i>ovina</i>
—			subvar. <i>guestphalica</i>	{ ? <i>F. guestfalica</i>	subsp. <i>hirtula</i>
			subvar. <i>firmula</i>	{ <i>F. ophioliticola</i>	subsp. <i>ophioliticola</i>
		var. <i>capillata</i>		<i>F. lemanii</i> †	<i>F. lemanii</i> †
—				<i>F. tenuifolia</i>	<i>F. filiformis</i>
—				<i>F. armoricana</i>	<i>F. armoricana</i>
		var. <i>supina</i>	subvar. <i>vivipara</i>	<i>F. huonii</i>	<i>F. huonii</i>
		var. <i>glauca</i>	subvar. <i>caesia</i>	<i>F. vivipara</i>	<i>F. vivipara</i>
		var. <i>duriuscula</i>	subvar. <i>trachyphylla</i>	{ <i>F. longifolia</i>	<i>F. longifolia</i> *
				{ <i>F. trachyphylla</i>	
				{ <i>F. brevipila</i>	<i>F. brevipila</i> †
<i>F. rubra</i>	subsp. <i>heterophylla</i>			<i>F. heterophylla</i>	<i>F. heterophylla</i>
	subsp. <i>dumetorum</i>			{ <i>F. juncifolia</i>	<i>F. arenaria</i>
	subsp. <i>eu-rubra</i>	var. <i>genuina</i>	subvar. <i>arenaria</i>	{ <i>F. rubra</i> subsp. <i>arenaria</i>	<i>F. rubra</i> subsp. <i>rubra</i>
—			subvar. <i>vulgaris</i>	subsp. <i>rubra</i>	subsp. <i>litoralis</i>
			{ subvar. <i>junceae</i>	{ subsp. <i>litoralis</i>	subsp. <i>junceae</i>
			{ subvar. <i>pruinosa</i> (1885)	{ subsp. <i>junceae</i>	
			subvar. <i>grandiflora</i>	{ subsp. <i>pruinosa</i>	
		{ var. <i>planifolia</i>		<i>F. diffusa</i>	subsp. <i>megastachys</i>
		var. <i>fallax</i>		<i>F. nigrescens</i>	subsp. <i>commutata</i>
—				<i>F. richardsonii</i>	subsp. <i>arctica</i>
—				—	subsp. <i>scotica</i>

\* The name *F. glauca* has often been wrongly applied to this species.

† The name *F. longifolia* has often been wrongly applied to these species.

important that all these misleading characters be abandoned and that attention be focused on the characters described in the next section.

The purpose of this paper is to provide infallible means of distinguishing between the *F. ovina* and *F. rubra* aggregates in the British Isles. Distinctions between the various segregates as listed in Table 1 have been detailed by Wilkinson & Stace (1991) for the *F. ovina* aggregate and will be detailed by Al-Bermani & Stace (in prep.) for the *F. rubra* aggregate. The data presented in the present paper have been gathered from many thousands of specimens, both living and preserved, over the past 20 years. Several hundred clones are grown and frequently studied in the University of Leicester Botanic Garden.

The characters discussed here would require some modification if they were to be used successfully in some other parts of Europe.

#### DIAGNOSTIC CHARACTERS

The first two characters below provide an infallible distinction between the two aggregates; the others may be useful guides but should not be relied upon.

##### TILLER LEAF-SHEATHS – FUSED OR OVERLAPPING

In almost all grass leaves there is a clear distinction between the sheath, which encircles the stem and/or developing leaves above, and the blade, which arises from the top of the sheath. In some cases this overlapping structure persists to the base of the sheath, i.e. to the stem-node below, but often it progresses only part of the way down to the node, becoming a fused tube further down. In other cases the sheath has no free overlapping edges, but is a fused tube from the node below right up to the mouth of the sheath. This is particularly characteristic of the genera *Glyceria* and *Melica*.

In the *Festuca rubra* aggregate the leaf-sheaths are tubular right up to or almost to the mouth, whereas in the *Festuca ovina* aggregate they have free overlapping edges for at least the upper 40% (and usually the upper 75%) of their length (Fig. 1). Only in very rare cases in the latter aggregate are the leaf-sheaths as much as 50% tubular.

This difference is very clear-cut, but careful examination (preferably with a lens) must be made in order to avoid mistakes. Fresh material is much more easily observed than dried or pressed material. Moreover the tubular sheaths of *F. rubra* agg. are easily split on handling. It is essential that this observation is made on *sterile innovation shoots* (*tillers*), not on flowering shoots (*culms*), and that only the younger sheaths are examined. Older sheaths, including all those on the culms, become naturally split to the base. The older leaves should be successively stripped back from a tiller, leaving the uppermost sheath that was partly exposed as the one to examine.

This is the single best character to distinguish the two aggregates.

##### TILLERS – EXTRAVAGINAL OR INTRAVAGINAL

Tillers arise from lower nodes of culms or of other tillers (actually from the axil between the stem and the base of the leaf-sheath) in one of two ways.

In intravaginal branching (Fig. 1) the new shoot grows up more or less parallel with its parent stem and remains enclosed for some distance within the leaf-sheath in whose axil it arose. Higher up, the new shoot diverges from its parent, and later on the parental leaf-sheath often decays away, but the parallel growth of the old and new stems at the very base usually persists as evidence of intravaginal branching. In the *Festuca ovina* aggregate all branching is of this sort.

In extravaginal branching (Fig. 1) the new shoot does not grow up parallel with the parent stem but grows out more or less at right angles, breaking through the base of the parent leaf-sheath (cf. lateral branches of *Equisetum* stems). Members of the *Festuca rubra* aggregate always exhibit extravaginal branching, but this varies in relative frequency from being the only type of branching to being much less common than intravaginal branching (hence Hackel's group *Extravaginales vel Mixtae*). With copious fresh material the presence of extravaginal branches is therefore diagnostic of *F. rubra* agg. (and their absence diagnostic of *F. ovina* agg.), but with herbarium material, which is often very poorly collected, it is not safe to use this character except in a positive way.

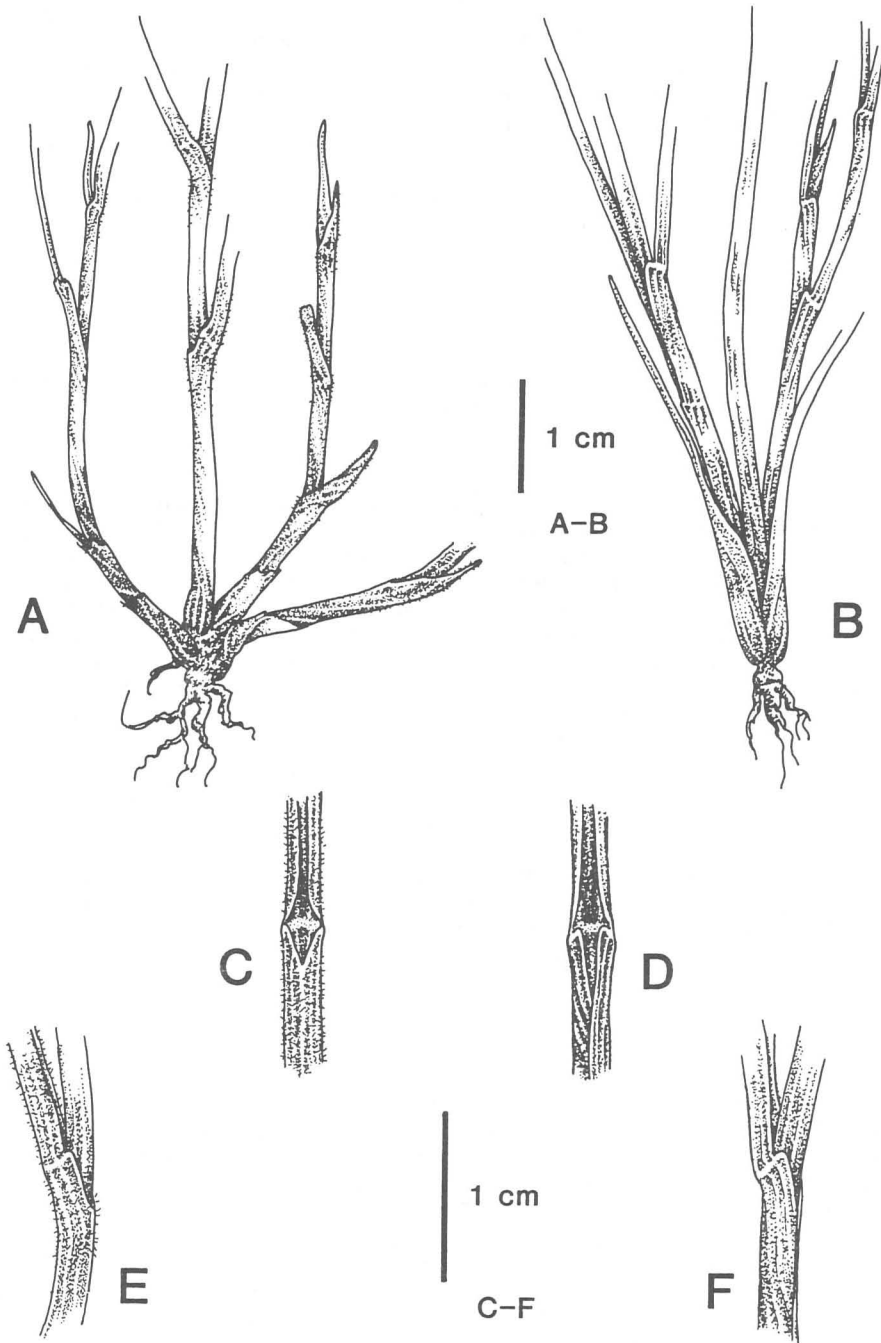


FIGURE 1. Morphological characters of *Festuca rubra* agg. and *F. ovina* agg. A, extravaginal tillers. B, intravaginal tillers. C, fused tiller leaf-sheath as in *F. rubra* agg. D, overlapping tiller leaf-sheath as in *F. ovina* agg. E, vestigial auricles as in *F. rubra* agg. F, distinct auricles as in *F. ovina* agg.

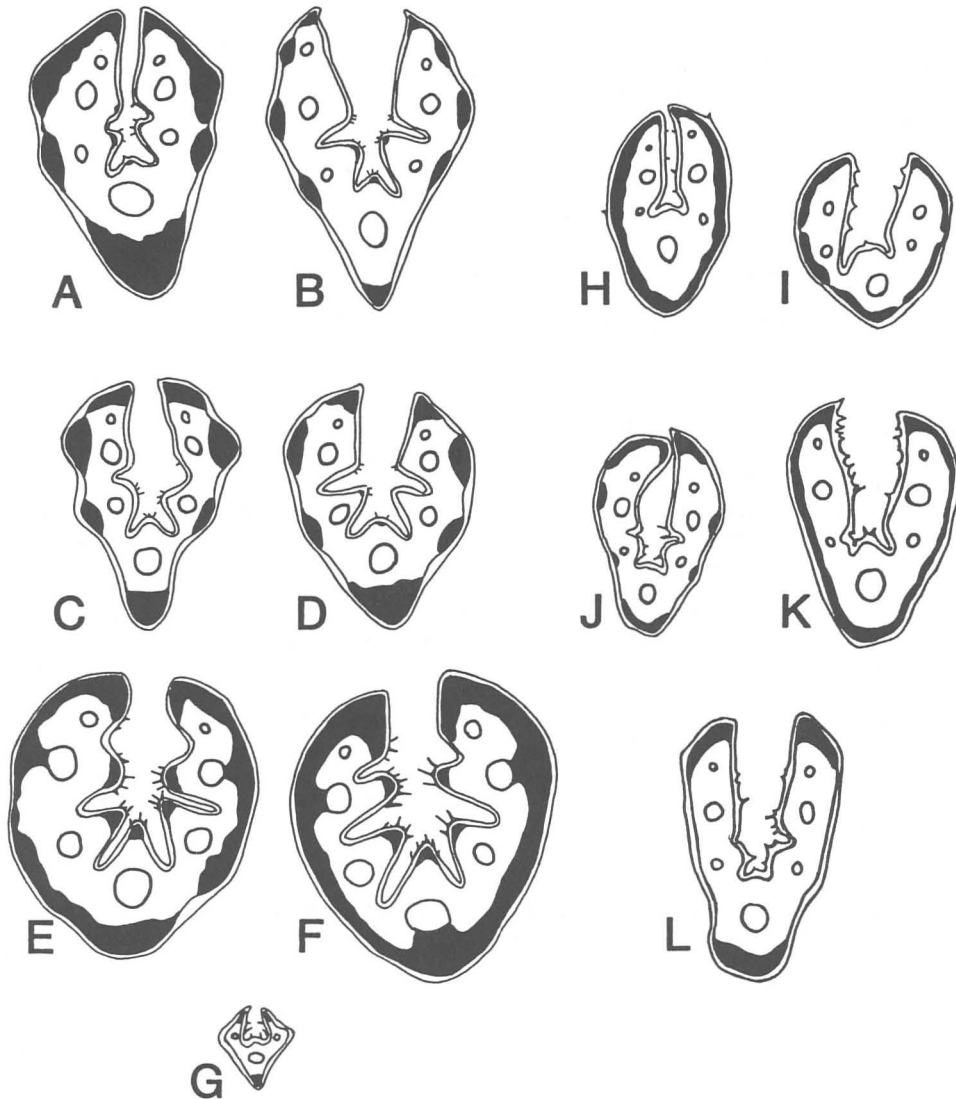


FIGURE 2. Patterns of sclerenchyma distribution (in black) in tiller leaf sections of *Festuca rubra* agg. (A-G) and *F. ovina* agg. (H-L).

GROWTH HABIT – TUFTED OR RHIZOMATOUS

Rhizomes always develop from extravaginal branches, but both intravaginal and extravaginal branches may remain close to the parent stem, resulting in a densely tufted habit. Hence the presence of rhizomes is diagnostic of *F. rubra* agg., but their absence is not diagnostic of *F. ovina* agg. Some rhizomes exist even on plants of *F. rubra* agg. that are very densely tufted, except in *F. heterophylla* Lam. and some specimens of *F. rubra* subsp. *commutata*. Mat-forming plants are almost always rhizomatous to some degree.

## AURICLES – CONSPICUOUS OR INCONSPICUOUS

Auricles are developed in many grasses at the top of the leaf-sheath, on either side of its point of junction with the leaf-blade and ligule. In some species, such as *Festuca pratensis* Hudson, these are very conspicuous and developed as pointed projections. In the *F. rubra* aggregate auricles are virtually absent (Fig. 1), but in the *F. ovina* aggregate they are present as distinct rounded extensions (Fig. 1). This difference is clear-cut and unequivocal when the two types are viewed together but it is a comparative rather than absolute character and should be used only after experience with the ranges exhibited by both aggregates.

## LEAF ANATOMY – PATTERN OF SCLERENCHYMA

The pattern of sclerenchyma distribution as seen in transverse section of tiller leaves is a very important character in the genus *Festuca*. Knowledge of the range of patterns found in the *F. rubra* and *F. ovina* aggregates (Fig. 2) can be used to distinguish between them.

Sclerenchyma bundles are usually found in the subepidermal position opposite each of the veins (including the midrib) on the abaxial side, and in the subepidermal position at the leaf margins (e.g. Fig. 2B, G, J). Sometimes smaller subepidermal bundles are found opposite the veins on the adaxial side (e.g. Fig. 2A, E, F), and sometimes a girder of sclerenchyma connects the abaxial bundle with its adjacent vein (e.g. Fig. 2E, F). In some cases the abaxial sclerenchyma bundles extend laterally to form a band of sclerenchyma, in extreme cases forming a continuous zone from leaf-margin to leaf-margin (e.g. Fig. 2F, H).

Both the continuous and the discrete patterns of sclerenchyma occur in both the *F. rubra* and *F. ovina* aggregates, but in the case of each pattern the two aggregates can, with practice, be distinguished. The continuous/discontinuous band is almost always accompanied by some girders connecting with the veins and/or by some small adaxial sclerenchyma bundles in the case of *F. rubra* agg., but never in the case of *F. ovina* agg. In addition the sclerenchyma at the leaf-margins and abaxially to the midrib is often much thicker than elsewhere in *F. ovina* agg. (e.g. Fig. 2J, K), but not in *F. rubra* agg. The discrete abaxial sclerenchyma bundles are usually of approximately equal size and are sometimes accompanied by small adaxial bundles in *F. rubra* agg. (e.g. Fig. 2B), whereas in *F. ovina* agg. adaxial bundles are always absent and the marginal and midrib abaxial bundles are usually conspicuously larger (e.g. Fig. 2J) than the others (or there are no others, e.g. Fig. 2L) in *F. ovina* agg. In addition, when the sclerenchyma is in discrete bundles, the leaf outline is much more angular in *F. rubra* agg. (e.g. Fig. 2B, C, G) than in *F. ovina* agg. (e.g. Fig. 2J, L).

## SUMMARY

Only two characters can be used with complete success in distinguishing the *Festuca ovina* and *F. rubra* aggregates in the British Isles. Other characters vary in usefulness from being helpful after considerable experience to being highly misleading. The two diagnostic characters are summarized in the following couplet:

Sheaths of young tiller-leaves fused into tube almost up to top; some or all tillers extravaginal ... *F. rubra* agg.  
 Sheaths of young tiller-leaves with at least the upper 40% with free, overlapping margins; all tillers intravaginal ..... *F. ovina* agg.

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