

UNITED STATES NATIONAL MUSEUM

CONTRIBUTIONS

FROM THE

UNITED STATES NATIONAL HERBARIUM

VOLUME X, PART 1

NORTH AMERICAN SPECIES
OF FESTUCA

By CHARLES V. PIPER



WASHINGTON
GOVERNMENT PRINTING OFFICE
1906

SMITHSONIAN INSTITUTION
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BULLETIN OF THE UNITED STATES NATIONAL MUSEUM:

ISSUED MARCH 30, 1906.

PREFACE.

The revisions of genera, descriptions of new species, and other systematic papers on grasses emanating from the Office of the Agrostologist of the Department of Agriculture have heretofore been published as Bulletins of the Bureau of Plant Industry in that Department. In view, however, of the transfer of the grass herbarium to the Office of the Botanist, the Agrostologist has suggested that the accompanying manuscript entitled "North American Species of *Festuca*," by Professor Charles V. Piper, be published in the series of Contributions from the United States National Herbarium. This suggestion has been adopted. The author of the manuscript regrets that it was not possible to consult all the type specimens of the American species, several of which are in European herbaria, but he considered it preferable to offer his work for publication now rather than to delay it indefinitely.

FREDERICK V. COVILLE,
Curator of the United States National Herbarium.



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NORTH AMERICAN SPECIES OF FESTUCA.

By CHARLES V. PIPER.

INTRODUCTION.

This treatment of the North American species of *Festuca* is based primarily on the material in the National Herbarium, but through the courtesy of those having the collections in charge, we have been able to examine the material in the Gray Herbarium, the New York Botanical Garden, the Academy of Natural Sciences of Philadelphia, the California Academy of Sciences, the Michigan Agricultural College, and the Geological and Natural History Survey of Canada. To all of these grateful acknowledgment is made.

We have taken especial care to point out clearly the material basis for our interpretations of the various species that have been proposed. In the cases of *Festuca ovina* and *Festuca rubra* reliance is placed mainly on the classic work of Hackel in his *Monographia Festucarum Europæarum*, aided by a fine series of authentic specimens distributed by him. It is worthy of note that of the 30 native species of the genus in North America, here recognized, 3 have been collected but once, 2 others but twice, and a sixth species, *F. rigescens*, has been found but once north of South America. We have cited specimens only for special reasons, and have usually included only specimens of historic interest, or from numbered sets generally distributed.

HISTORY OF THE GENUS.

The name *Festuca* first appears in botanical literature, according to Trinius, in Dodoens's work entitled "Stirpium historiae pemptades sex, sive libri XXX Antwerpiæ, ex officina Christophori Plantini," published in 1583. Dodoens's plant "*Festuca altera*" is, according to Trinius, *Bromus secalinus* L. Later pre-Linnæan authors used the name in various ways, mostly, however, for species of *Bromus*.

In the first edition of the *Genera Plantarum*, 1737, Linnæus cites two plates, namely, Dillenius, *Catalogus Plantarum*, plate 3, which is evidently some species of *Bromus*, and Scheuchzer, plate 5, figures

13 to 16, inclusive, which represent, respectively, *Bromus erectus*, *B. sterilis*, *B. arvensis*, *B. asper*, *Festuca gigantea*, and *F. elatior*.

In the fifth edition of the same work, 1754, the description, with a few very insignificant changes, is the same as in the first edition, but the citations of Dillenius and of Scheuchzer are omitted.

In the first edition of Linnaeus's *Species Plantarum*, 1753, from which the genus must by common acceptance date, eleven species are described in the following sequence: *F. ovina*, *F. duriuscula*, *F. rubra*, *F. amethystina*, *F. myuros*, *F. maritima*, *F. decumbens*, *F. elatior*, *F. fluitans*, and *F. cristata*.

Of these species *F. decumbens* is the type of the genus *Sieglingia* of Bernhardt; *F. fluitans* is *Panicularia fluitans* Kuntze, and *F. cristata* is the type of the genus *Koeleria* of Persoon.

The remaining species are generally included by authors in the genus *Festuca*, so that whether we accept the first species, *F. ovina*, as the type of the genus, or follow the historic method of residues, the result in this genus is practically the same.

Numerous other genera have, however, been proposed for species usually included in, or first referred to, *Festuca*. Chronologically considered these are as follows:

Vulpia Gmel. *Fl. Bad.* 1: 8. 1805.

Only one species included, *V. myuros* (*Festuca myuros* L.).

Schedonorus Beauv. *Agrost.* 99. 1812. (Spelled "Schenodorus" in the index of the same work.)

Based on seven species, of which the first is *Festuca elatior* L. Beauvois' plate also seems to be of this species, but if so it is very faulty.

Sclerochloa Beauv. *Agrost.* 97, 177. 1812.

Based on *Poa dura* L., *Poa procumbens* Schreb., and *Poa divaricata* Beauv., all of which are *nomina nuda*, though "*Poa dura* L." (*Cynosurus durus* L.) is evidently an error for *Poa dura* Scop. Beauvois figures *S. dura*.

Technically, perhaps, *Sclerochloa* is not published by Beauvois, in which view the genus would date from Beauvois in Reichenbach, *Icones Florae Germanicae* 1: 23. 1834, where the first species is likewise *S. dura*.

This genus is generally accepted.

Tragus Panzer, *Denkschr. Acad. Münch.* 1813: 296. 1814.

Nine species were included by the author, none of which are figured. The first in position is *T. elatior* (*Festuca elatior* L.).

There is an older *Tragus* of Haller, 1768.

Mygalurus Link, Enum. Hort. Berol. 1: 92. 1821.

Six species included, none figured, all annuals, of which the first, *M. caudatus*, is *Festuca myuros* L.

De[s]mazeria Dumort. Comm. Bot. 26. 1822.

One species, *D. sicula*, based on *Poa sicula* Jacq.

Chloammia Raf. Neogenyt. 4. 1825.

Two species cited, namely, *Festuca tenella* and *F. bromoides*. The "*Festuca bromoides*" of Michaux which is *F. tenella* Willd. is probably intended.

Dasiola Raf. Neogenyt. 4. 1825.

Based on *Festuca monandra* Ell. (*Dasiola elliotae* Raf.). This is in all probability *Festuca sciurea* Nutt.

Nardurus Reichenb.

Incidentally mentioned under *Brachypodium tenellum* Beauv. in Flora Germanica Excursoria 19. 1830. but apparently first properly published in Godron, Flore de Lorraine 3: 187. 1844.

Godron included two species in this sequence, *Nardurus tenellus*, generally known as *Festuca unilateralis* Schrad. and *N. lachenalii*, usually called *Festuca lachenalii* Spenn.

Bucetum Parnell, Grasses of Scotland 8, 104. 1842.

Four species were included in the following sequence: *B. loliaceum*, *B. pratense*, *B. elatius*, and *B. giganteum*. These are respectively *Festuca loliacea*, *F. elatior*, *F. elatior*, and *F. gigantea*. The first is *Festuca loliacea* Curtis, a hybrid between *Festuca elatior* and *Lolium perenne*. The species are all figured in the above sequence.

Micropyrum Link, Linnæa 17: 397. 1843.

Based on the single species *M. tenellum* Link, which is based on *Triticum tenellum* L. (*Festuca lachenalii* Spenn.).

Festucaria Link, Linnæa 17: 398. 1843.

Two species included, neither figured, *Festucaria tenuicula* and *F. psilantha*, both of which are now considered subspecies of *Festuca unilateralis* Schrad. The name *Festucaria* has also been used for a genus based on *Festuca fluitans* L. by Heister in Fabr. Enum. ed. 2, 373. 1763.

Catapodium Link, Linnæa 17: 398. 1843.

Based on *Triticum loliaceum* Smith (*Poa loliacea* Huds.).

This genus is reduced to *Festuca* by Bentham and Hooker, but maintained by Hackel.

Scleropoa Griseb. Spic. Fl. Rumel. 2: 431. 1844.

One species, *S. rigida* Griseb., based on *Poa rigida* L.

Maintained as a genus by many authors, reduced to *Festuca* by others.

Castellia Tineo, Pl. Rar. Sic. 2: 17. 1846.

Based on a single species, *C. tuberculata* Tineo, which is *Festuca tuberculosa* (Moris) Richter.

Ctenopsis De Notaris, Ind. Sem. Hort. Gen. 352. 1847.

A single species, *C. pectinella* De Notaris. (*Festuca pectinella* Delile.) Retained as a genus by Bentham and Hooker, but reduced to *Festuca* by Hackel.

Leucopoa Griseb. in Ledeb. Fl. Ross. 4: 383. 1853.

One species, *L. sibirica* Griseb. Bentham and Hooker reduce this to *Poa*, and Hackel to *Festuca*.

The species is clearly closely related to the West American *Poas* of the *fendleriana* group. Its only distinctive character is the awn-like excurrent midrib of the lemma, which character is approached by *Poa subaristata* Scribner. The genus, if not maintained, belongs with *Poa* and not with *Festuca*.

Amphigenes Janka, Linnaea 30: 619. 1860.

Based on *Festuca carpathica* Dietr.

Prosphysis Dulac, Fl. Haut. Pyr. 67. 1867.

The author quotes *Nardurus* Reichenb. as a synonym and includes but one species, *P. tenellus*, based on *Nardurus tenellus* Reichenb. This plant is considered by Ascherson and Graebner to be the same as *Festuca maritima* L.

Synaphne Dulac, Fl. Haut. Pyr. 90. 1867.

The only species is *S. rigida* (*Scleropoa rigida* Griseb.)

Distomomischus Dulac, Fl. Haut. Pyr. 91. 1867.

The author quotes *Vulpia* Gmel. as a synonym and includes four species in this sequence: *D. sciuroides* (*Festuca sciuroides* Roth), *D. myuros* (*Festuca myuros* L.), *D. ciliatus* (*Festuca ciliata* Danth.) and *D. subuniqlumis* (*Festuca bromoides* L.). None of these species are figured.

Drymonaetes Ehrh.

This name occurs in Ehrhart, Beiträge 4: 147. 1789, but is first technically published as a genus in a paper by Fourreau, Ann. Soc. Linn. Lyon n. s. 17: 187. 1869. The only species is based on *Festuca gigantea* (L.) Vill.

Loretia Duval-Jouve, Rev. Sci. Nat. II. 2: 38. 1880.

Four species were described by the author as belonging to this genus, arranged as follows: *Loretia setacea* based on *Festuca setacea* Guss.; *L. incrassata* based on *Bromus incrassatus* Lam.; *L. geniculata* based on *Bromus geniculatus* L.; and *L. ligustica* based on *Bromus ligusticus* All. No figures are published by Duval-Jouve, but he cites plates for each of the above species.

Helleria Fourn. Mex. Pl. 2: 128. 1886.

Based on *Bromus lividus* H. B. K. (*Festuca livida* Willd.). Included in *Festuca* by Bentham and Hooker and by Hackel.

An examination of the list of names shows that seven genera have been proposed for varying groups of perennial *Festucas* (excluding *Leucopoa*), and that fifteen names have been proposed for varying groups of the annual species. Of the former class none has received wide acceptance. In regard to the latter class there has been much difference of opinion.

In the great modern works on plant genera the following views are maintained: Hackel, in Engler and Prantl's *Pflanzenfamilien*, recognizes *Festuca*, *Sclerochloa*, *Catapodium*, and *Scleropoa* as distinct, merging the remaining proposed genera, including *Ctenopsis* and *Leucopoa*, into *Festuca*. Bentham and Hooker include *Catapodium* and *Scleropoa* in *Festuca*, unite *Leucopoa* with *Poa*, but maintain *Sclerochloa* and *Ctenopsis*. Baillon follows Bentham and Hooker.

Atropis (*Puccinellia*) is maintained as a genus by Hackel, but reduced to a section of *Glyceria* (*Panicularia*) by Bentham and Hooker and by Baillon. Ascherson and Graebner, in their recent treatment in *Synopsis der Mitteleuropäischen Flora*, unite *Atropis* with *Festuca*, into which they also merge *Sphenopus* and *Cutandia*.

We accept Hackel's delimitation of the genus, but exclude *Leucopoa*.

DISTRIBUTION.

The genus *Festuca* is represented in all parts of the world, but principally in temperate or mountain regions. In Europe there are, according to Hackel,^a 28 perennial species, but on a different species concept Richter^b increases this number to 103. The European annual species number about 26.

In North America we recognize 22 perennial and 12 annual species, two of each group introduced from Europe. In Mexico there are about 10 additional perennials, and in the remaining parts of tropical North America a few others.

Excluding known synonyms there are still accredited to Asia about 32 species, to Africa about 43 species, to Australasia about 10 species, and to South America about 75 species. It is altogether probable that many of these are synonyms.

^a *Monographia Festucarum Europæarum.*

^b *Plantae Europæae.*

ECONOMIC IMPORTANCE.

Several of the species of *Festuca* are of high agricultural value, both for grazing and for meadows. Among the former perhaps the most important is *Festuca ovina*, the sheep fescue, and its numerous subspecies, some of which are found native in most parts of the world. The most valuable American grass of this group is probably *Festuca ovina ingrata* Hackel, the "blue bunch grass" of stockmen, which ranges from British Columbia and Alberta to California and Colorado. In parts of the range country, notably the Columbia Basin, it is considered the second best of the range grasses. In Arizona and New Mexico this grass is replaced by the larger and coarser, but not less nutritious, Arizona bunch grass, *F. ovina arizonica* (Vasey) Hack. Other subspecies of *Festuca ovina* occur in alpine and subarctic regions, and furnish more or less abundant forage.

Festuca rubra L., the red fescue, occurs in abundance along both sea coasts in sandy soil, and in the West is plentiful in the mountains at low altitudes. In restricted areas it is an important forage grass.

Festuca altaica Trin. is abundant in Alaska, often covering large areas with its large tussocks. From very limited experience with it this grass seems to be quite as nutritious as its near allies.

Festuca viridula Vasey is the most nutritious grass in the mountain parks of the Cascade, Blue, and Bitter Root mountains. It often occupies large areas in nearly pure growth. Unfortunately it is unable to withstand severe grazing, and consequently where sheep have been herded this grass has well-nigh disappeared.

The annual species, especially *Festuca octoflora*, are of considerable value in semiarid grazing regions. They spring up very quickly when the rainy season begins in the fall, furnishing grazing when nothing else is available, and again in early spring they provide the first green forage.

Festuca elatior L., the tall fescue, a European species, is very valuable as a hay and pasture grass, but in this country is little grown as yet, except in the eastern portion of Kansas and Nebraska. A smaller form of it, the meadow fescue, used only in pastures and lawns, is sometimes known in this country as English bluegrass, or, technically, as *Festuca pratensis* Huds. or *Festuca elatior pratensis* Gray. According to the best European authorities, however, *F. elatior* L. and *F. pratensis* Huds. are exactly identical, so that, whatever be the distinction of the two forms agriculturally, the botanical names both belong with tall fescue.

PREVIOUSLY PUBLISHED ILLUSTRATIONS OF NORTH AMERICAN FESTUCAS.

I. In Bulletins of the Division of Agrostology:¹

<i>Festuca dasyclada</i> ,	Bulletin 17, Figure 576
<i>Festuca elatior</i> , as <i>Festuca elatior pratensis</i> ,	7, 288
<i>Festuca elatior arundinacea</i> ,	3, 42
	14, 45
	7, 287
<i>Festuca subulata</i> , as <i>F. jonesii</i> ,	17, 575
<i>Festuca confinis</i> , all as <i>F. kingii</i> ,	5, 12
	12, 23
	13, 19
	17, 573
<i>Festuca pacifica</i> , as <i>F. microstachys</i> ,	17, 578
<i>Festuca myuros</i> ,	17, 581
<i>Festuca shortii</i> , as <i>F. obtusa</i> ,	17, 574
<i>Festuca octoflora</i> ,	17, 580
<i>Festuca ovina</i> ,	5, 27
	17, 577
	12, 7
<i>Festuca rubra</i> ,	5, 28
<i>Festuca rubra glaucescens</i> ,	3, 43
	14, 46
	7, 289
<i>Festuca hallii</i> , all as <i>F. scabrella</i> ,	3, 44
	5, 14
	14, 47
<i>Festuca sciurea</i> ,	17, 579

II. In Illustrations of North American Grasses, Bulletin 13, Division of Botany:^a

<i>Festuca pacifica</i> , as <i>F. microstachys</i> ,	Plate 91
<i>Festuca altaica</i> , as <i>F. subulata</i> ,	92
<i>Festuca viridula</i> ,	93

III. In Agricultural Grasses and Forage Plants of the United States, Special Bulletin, Division of Botany, 1889:¹

<i>Festuca elatior</i> ,	Plate 81
<i>Festuca ovina</i> ,	82
<i>Festuca hallii</i> , as <i>F. scabrella</i> ,	83

IV. In Britton & Brown, Illustrated Flora:

<i>Festuca octoflora</i> ,	Figure 497
<i>Festuca myuros</i> ,	498
<i>Festuca rubra</i> ,	499
<i>Festuca ovina</i> ,	500
<i>Festuca scabrella</i> , (=?)	501
<i>Festuca elatior</i> ,	502
<i>Festuca shortii</i> ,	503
<i>Festuca obtusa</i> (as <i>nutans</i>),	504

V. Tenth Ann. Rep. Mo. Bot. Gard.:

<i>Festuca rigescens</i> ,	Plate 43
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^a U. S. Department of Agriculture.

DESCRIPTIVE TERMINOLOGY.

We have taken the liberty to introduce the word *lemma*^a to apply to the "lower palet" or "outer palet" or "flowering glume" of authors, restricting the word "glume" to the "empty glumes." This is done purely for a practical reason, namely, to avoid the constant use of phrases for the members of the grass spikelet most used in technical descriptions.

The only other attempt to apply a single-word term to the "flowering glume" we have noticed is the word "floriglume," proposed by Prof. George Macloskie in volume 8 of the Report of the Princeton University Expedition to Patagonia. This term seems to us objectionable, because it is likely to lead to confusion with the word "glume," as applied to both empty glumes. The so-called third empty glume of some grasses is really a sterile lemma.

The use of a single distinctive name for each part of the grass spikelet seems much preferable to the employment of such general terms as bracts, bractlets, and scales.

SYNOPSIS OF UNITED STATES AND CANADIAN SPECIES.

FESTUCA L.

Festuca L. Sp. Pl. 1: 73. 1753.

Spikelets 2 to many-flowered, variously paniculate or sometimes racemose; rachilla articulate at the joints and above the glumes; florets all perfect, or the uppermost staminate; glumes 2, persisting, carinate, unequal or subequal, the lowest 1-nerved (rarely 3-nerved), the upper larger and 3-nerved (rarely 5-nerved); lemma lanceolate, usually narrow, commonly aristate, always 5-nerved, convex or subcarinate, firm in texture at least near the base, the apex and margins sometimes scarious, the callose base smooth or nearly so; palea bicarinate, oblong or lanceolate, obtuse, acute, acuminate, or bidentate at apex, usually about equaling the lemma; lodicules 2, about as long as the ovary, sometimes entire, usually bifid; stamens 3 in the perennial species, in the annuals often reduced to 1; ovary obovate, smooth or hispidulous at apex; styles very short, distinctly apical; stigmas plumose, the branches toothed; caryopsis linear or oblong, glabrous, convex dorsally, sulcate or rarely plane ventrally, often adhering to the palea; hilum linear.

KEY TO THE SPECIES.

Subgenus VULPIA. Annuals; stamens usually 1, sometimes 3, rarely becoming extruded; stigma plumose, the branches toothed, bilateral.

Spikelets densely 5 to 13-flowered; lemma without scarious margin. *l. octoflora.*

Spikelets loosely 1 to 5, rarely 6-flowered; lemma with narrow scarious margin.

Branches of the short panicle normally divergent, a pulvillus at the base of at least one of them.

Florets mostly 3 to 5 in each spikelet, only the principal panicle branches divergent.

^aλέμμα (λεμματ-), husk, scale.

Spikelets not at all hirsute.

Spikelets with glumes only hirsute.

Spikelets with lemma only hirsute.

Spikelets wholly hirsute.

Florets mostly 1 to 3 in each spikelet; all the spikelets divaricate.

Spikelets not at all pubescent.

Spikelets with only the lemma pubescent.

Spikelets wholly pubescent.

Branches of the narrow elongated panicle erect or appressed.

First glume one-third to one-half as long as the second.

Lemma not ciliate.

Lemma ciliate.

First glume two-thirds to three-fourths as long as the second.

Lemma smooth or scabrous.

Lemma pubescent.

2. *pacifica*.

3. *confusa*.

4. *eriolepis*.

5. *grayi*.

6. *reflexa*.

7. *microstachys*.

8. *eastwoodae*.

9. *myuros*.

10. *megalaria*.

11. *bromoides*.

12. *sciurea*.

Subgenus *EUFESTUCA*. Perennials, mostly tufted and never with scaly rootstocks; stamens 3, protruding in anthesis; stigmas bilaterally plumose, the branches toothed.

Plants densely tufted, or with narrow and involute blades, usually both; lemma awnless or awned.

Ligule short; collar and auricles not conspicuously bristly, or tomentose.

Blades not falling away from the sheaths; palea obtuse or bidentate at apex.

Innovations extravaginal; blades smooth; spikelets usually more or less glaucous.

Innovations intravaginal.

Tufts easily separable; blades closely involute; pulvilli none or faintly developed.

Awns longer than the membranous lemmas; blades soft, sulcate; ovary hispidulous at apex.

Awns not longer than the coriaceous lemmas; ovary glabrous.

Blades various, but when hard the lemma awned.

Blades smooth, firm, rigid; lemma awnless.

Tufts separable with difficulty; blades narrow, loosely involute or flat; lemma thin; a pulvillus at the base of each ray.

Lemma smooth, usually awnless, sometimes awn-pointed.

Lemma scabrous-puberulent, short-awned.

Blades at length falling away from the persisting sheaths; palea notched at apex.

Panicle rays spreading; spikelets shining; culm and loosely involute green blades smooth or nearly so.

Panicle rays erect or becoming so; spikelets dull; culm and closely involute glaucescent blades usually very scabrous.

Ligule short, ciliate; collar and auricles tomentose or bristly.

Ligule 4 to 9 mm. long, scarious.

13. *rubra*.

14. *occidentalis*.

15. *ovina*.

16. *rigescens*.

17. *viridula*.

18. *howellii*.

19. *altaica*.

20. *hallii*.

21. *aristulata*.

22. *thurberi*.

Plants less densely tufted; leaves flat, green, membranaceous.

Lemma indurated, not at all keeled.

Spikelets 5 to 10-flowered; lemma awnless or rarely short awned. 23. *elatior*.

Spikelets 3 to 6-flowered; lemma awnless.

Glumes scarious-margined, much shorter than the lemma; lemma not acuminate.

Lemma acute; spikelets loosely scattered. 24. *obtusa*.

Lemma obtuse; spikelets somewhat aggregated. 25. *shortii*.

Glumes without scarious margins, nearly as long as the lemma; lemma acuminate.

Spikelets glaucous, loosely 4 to 6-flowered; lemma often with a short awn; sheaths smooth. 26. *versuta*.

Spikelets green, closely 2 to 3-flowered; empty glumes scabrous; sheaths short-pubescent. 27. *johnsoni*.

Lemma awned, membranaceous, indurated only near the base and keeled at least above the middle.

Floret long-stipitate at base; awn terminal. 28. *subuliflora*

Floret not stipitate at base.

Lemma plainly 5-nerved; awn from a cleft apex.

Spikelets 5 to 9 mm. long, 2 to 4-flowered.

Panicle branches ciliate; awn shorter than the lemma. 29. *dasyclada*.

Panicle branches not ciliate; awn as long or longer than the lemma. 30. *elmeri*.

Spikelets 10 to 15 mm. long, 3 to 7-flowered. 31. *gigantea*.

Lemma 5-nerved, the intermediate nerves very obscure; awn terminal.

Awn much shorter than the lemma. 32. *fratercula*.

Awn as long as or longer than the lemma. 33. *subulata*.

Subgenus *HESPEROCHLOA*. Perennials, densely tufted but producing occasional stout extravaginal scaly stolons; leaf blades broad, flat, or rarely involute; stamens 3, protruding; stigmas elongate, the numerous short mostly simple branches arising from all sides.

A single species.

34. *confinis*.

Subgenus I. *VULPIA* (Gmel.) Hack.

Vulpia Gmel. Fl. Bad. 1: 8. 1805, as genus.

Vulpia Hack. in Engl. & Prantl, Nat. Pflanzenfam. 2²: 75. 1887, as subgenus.

Annuals; stamens usually only 1, sometimes 3; florets usually remaining unopened, and consequently self-pollinated; joints of the rachilla usually clavate; stigmas plumose, the branches toothed, bilateral.

Many of the species in this subgenus present slight but remarkably constant differences. In all probability this fact is connected with their close pollination.

1. *Festuca octoflora* Walt.

Festuca octoflora Walt. Fl. Car. 81. 1788.

According to Professor A. S. Hitchcock, there is no specimen to represent this species in the part of Walters's herbarium preserved in the British Museum. The brief original description probably refers to the plant generally understood.

Festuca tenella Willd. Sp. Pl. 1: 419. 1797. "Habitat in America boreali." We have not seen the type.

Festuca setacea Poir. Encyl. Suppl. 2: 638. 1811. Described from specimens grown in the Jardin du Val de Grace, France, the original source unknown. We have not seen the type.

Festuca parviflora Ell. Bot. S. C. & Ga. 1: 170. 1817. We have examined the type of this in Elliott's herbarium, and are inclined to consider it an immature shade form of *octoflora*. It is worthy of note, however, that all the specimens which match Elliott's type are from the Southern States. The type is in possession of the College of Charleston.

Festuca tenella glauca Nutt. Trans. Am. Phil. Soc. 5: 147. 1834. Type in the herbarium of the Philadelphia Academy, collected by Nuttall at Fort Smith, Ark. The plant is scarcely glaucous.

Festuca gracilentata Buckl. Proc. Acad. Phila. 1862: 97. 1863. Type from "northern Texas." It is exactly the same thing as *F. parviflora* Ell. The type specimen is in the herbarium of the Philadelphia Academy of Sciences.

Festuca pusilla Buckl. Proc. Acad. Phila. 1862: 97. 1863. Type from "northern California," preserved in the herbarium of the Philadelphia Academy. It is perfectly matched by many recent collections from the same region. The awns are about equal in length to the flowering glumes.

Festuca octoflora aristulata Torr.; L. H. Dewey, Contr. Nat. Herb. 2: 547. 1894. No type indicated, but the description of "awns equaling or somewhat exceeding the florets" calls for a different plant from the California specimen of Bigelow to which Torrey originally applied the name as a *nomen nudum*.

DESCRIPTION.

Culms slender, erect, sometimes geniculate at base, often tufted, 5 to 40 cm. high, glabrous or retrorsely puberulent, mostly 3-jointed; sheaths glabrous or pubescent, shorter than the internodes; ligule 0.5 to 1 mm. long, scarious, not decurrent; blades narrowly linear, involute or rarely flat, soft, erect or ascending, 2 to 10 cm. long; panicle narrow, erect, often reduced to a raceme or spike, 3 to 12 cm. long, sometimes secund; rays mostly solitary, 2 to 4 or sometimes even 8 mm. long, erect, rarely spreading, 3-angled, usually scabrous; spikelets oval or oblong, 5 to 9, or rarely 13 mm. long, 5 to 13-flowered; joints of the rachilla clavate, 0.5 to 0.7 mm. long; glumes subulate-lanceolate, the lower 1-nerved, 3 mm. long, the upper 3-nerved, 4 mm. long; lemma firm, convex, lanceolate, from glabrous to very scabrous, obscurely 5-nerved, 4 to 5 mm. long, attenuate into a scabrous straight awn 1 to 7 mm. long; palea lanceolate, acute, equaling the lemma, the nerves scabrous; stamen 1.

Festuca octoflora ranges throughout the United States, extending northward into British Columbia and Ontario and southward into lower California. We have seen no specimens from Mexico or from Central or South America, though it is reported from Brazil by Doell in Martius's Flora Brasiliensis as *F. tenella* Willd.

This species is very variable, as might be expected from its wide range, but for the most part the characters are too inconstant for nomenclatorial recognition. In Utah and California occur some puzzling approaches to *F. pacifica*, but otherwise there is no danger of confusing it with related species.

1a. *Festuca octoflora hirtella* subsp. nov.

Flowering glumes hirtellous; foliage more or less pubescent. Type specimen collected by C. L. Shear (no. 1962) in the Santa Catalina Mountains, Arizona, April 10, 1901. Other specimens are referred here as follows, viz:

ARIZONA:

- Tucson Mountains, *Griffiths* 2355.
- Tucson, *Toumey*, April 15, 1894.
- Santa Rita Forest Reserve, *Griffiths* 3815.
- Castle Rock, *Griffiths* 2333.

NEVADA:

- Vegas Wash, Lincoln County, *Coville & Funston* 419.

CALIFORNIA:

- Without locality, *Palmer* 654.
- Without locality, *Mrs. Bush*.
- San Bernardino Mountains, *Parish* 1530.
- Colorado Desert, *Orcutt* in 1889.
- Bishop, *M. E. Jones*, May 15, 1897.
- Old Wilson Trail, *Geo. B. Grant* 5419 in part.
- Sierra Nevada, *Lemmon* 4659.

LOWER CALIFORNIA:

- Mission Santa Gertrudis, *Orcutt*, March 10, 1899.
- Guadalupe Ranch, *Orcutt* 1432.
- Lagoon Head, *Palmer* 655.

2. *Festuca pacifica* sp. nov.

Culms slender, erect, or geniculate at base, glabrous, usually 30 to 50 cm. high, 3-jointed, solitary or loosely tufted; sheaths glabrous or puberulent, striate, the lower two about as long as their respective internodes, the upper much shorter than the peduncle; ligule very short but broader than the blade, decurrent; blades narrowly linear, very acute, soft, glabrous, loosely involute, 3 to 5 cm. long; panicle more or less secund, 5 to 12 cm. long; the lower branches solitary, divaricate, bearing spikelets on the lower side nearly or quite from the base; axis and branchlets sharply 2-angled, somewhat channeled, glabrous; pedicels clavate, flattened, mostly very short; spikelets 3 to 6-flowered; joints of the rachilla cylindrical, scabrous; lower glume subulate-lanceolate, 1-nerved, glabrous, 4 mm. long; upper glume lanceolate-acuminate, 3-nerved, glabrous, 5 mm. long; lemma lanceolate, scabrous excepting in the lowermost floret (this smooth), 6 to 7 mm. long, attenuate into a scabrous awn 10 to 15 mm. long; palea lanceolate, longer than the lemma, the inflexed sides half as wide as the scabrous internerve, the scabrous acuminate apex readily splitting into two awnlike teeth; perfect stamen usually one, sometimes three; grain dark-colored, lanceolate, deeply grooved, adherent to the glume and palea.

The rachilla readily breaks so that all the florets except the more persistent lowermost drop out when mature.

This is the commonest and most widespread species of the *microstachys* group, ranging from British Columbia to Lower California and Arizona, but apparently not occurring east of the Rocky Mountains. The type is Elmer's 262, collected June 20, 1896, at Pullman, Washington. Figure 91, Vol. II, Illustrations of North American Grasses, refers mainly to *Festuca pacifica*. The following collections are representative of this species:



FESTUCA CONFUSA PIPER.

WASHINGTON:

- Spokane, *Kreager* 4.
 Western Klickitat County, *Suksdorf* 1139.
 Rattlesnake Mountains, *Cotton* 472.
 Almota, *Piper* 1925.

IDAHO:

- Lewiston, *Sandberg, Heller, & MacDougal* 124.
 Lewiston, *Heller* 3000.

OREGON:

- The Dalles, *Sheldon* 10106.
 Harper's ranch, Malheur County, *Leiberg* 2074.
 Blue Mountains, *Griffiths & Hunter* 120.

CALIFORNIA:

- Yosemite Valley, *Bioletti* 11.
 Crescent City, *Dary & Blasdale* 5926.
 Pine Ridge, *Hall & Chandler* 298.
 San Bernardino, *Parish* 4674.
 San Diego, *Orcutt* 1174.

NEVADA:

- Trinity Mountains, *Watson* 1323.

ARIZONA:

- Tucson, *Toumey* in 1892.

LOWER CALIFORNIA:

- Guadalupe Ranch, *Orcutt*, April 6, 1886.

3. *Festuca confusa* sp. nov.

Habit of *F. pacifica*, differing in the following particulars: sheaths and blades pubescent, axis and branches of the panicle ciliate on the angles, spikelets 2 or 3-flowered; empty glumes hirsute. (PLATE I.)

The following specimens have been examined:

WASHINGTON:

- Western Klickitat County, *Suksdorf* 1140 (type).

OREGON:

- Grant's Pass, *Howell*, May 24, 1884.
 Without locality, *E. Hall* 639.

CALIFORNIA:

- Mount Diablo, *H. M. Hall* 1737, *Brewer* 1112, 1142.
 Santa Lucia Mountains, *Eastwood*, May 2, 1897.

E. Hall's 639 is the plant mentioned by Doctor Gray as *Festuca microstachys ciliata* (nomen nudum) in Proceedings of the American Academy 8: 410. It is not the plant so named and described by Beal, Grasses of North America 2: 585.

EXPLANATION OF PLATE.—Drawn from type specimen 1140 *Suksdorf*, Western Klickitat County, Washington. Plant one-half natural size; spikelets and dissections enlarged five times.

4. *Festuca erirolepis* Desv.

Festuca erirolepis Desv. in Gay, Fl. Chil. 6: 428. 1853. "En los campos de la Serena y en Argueros," Chile.

Festuca arida Elmer, Bot. Gaz. 36: 52. 1903. Type collected at North Yakima, Washington, by L. F. Henderson, no. 2196. A duplicate in the National Herbarium.

We have seen only one Chilean specimen, but this, together with the long description of Desvaux, leaves no doubt that *arida* must be reduced to synonymy.

DESCRIPTION.

Culms erect or decumbent at base, 10 to 30 cm. high, 2 or 3-jointed, loosely tufted; sheaths glabrous or pubescent, the lower inflated in dwarf plants and nearly as long as the internodes; ligule very short; blades soft, narrowly linear, loosely involute, glabrous or somewhat pubescent, 2 to 8 cm. long, erect or ascending; panicle 2 to 7 cm. long, erect, narrow, the rays at length divaricate; rays solitary, scabrous on the prominent angles; spikelets 3 to 5-flowered, 10 to 13 mm. long; joints of the rachilla 7 mm. long, cylindric, hairy; glumes lanceolate, glabrous, or the midnerve scabrous above, the lower 6 to 7 mm. long, 1-nerved, or at maturity with a pair of lateral nerves at base, the upper 3-nerved, 6.5 to 7.5 mm. long; lemma lanceolate, densely villous, 6 to 7 mm. long, attenuate into a scabrous awn nearly as long; palea as long as the lemma, lanceolate, the scabrous nerves meeting in the acuminate apex, the inflexed sides about one-fourth as wide as the internerve; stamen 1. (Plate II.)

The following specimens are referable here:

WASHINGTON:

- Coulee City, *Piper* 3915.
North Yakima, *Henderson* 2196.

NEVADA:

- Reno, *Hillman*, May, 1899; *Tracy* 246.
Smoke Creek, *Griffiths & Hunter* 514.

CALIFORNIA:

- Truckee, *Some* 7.
Ukiah, *Bolander* 6118.
Blue Lake to Jess Valley, *Griffiths & Hunter* 406.
Castella, *Piper* 6346.

EXPLANATION OF PLATE.—Right-hand plant drawn from *Henderson* 2196, North Yakima, Washington, whence also details; left-hand plant from *Piper* 3915, Coulee City, Washington. Plants one-half natural size; details enlarged five times.

5. *Festuca grayi* (Abrams).

Festuca microstachys ciliata Gray in Beal, Grasses N. Am. 2: 585. 1896. This is based on specimens collected by Howell at Grants Pass, Oregon, May 24, 1884. This collection is a mixture of *F. confusa* and *F. grayi*, but Beal's description refers clearly to the plant with pubescent lemmas. The type is in the herbarium of the Michigan Agricultural College; a duplicate in the National Herbarium.

Festuca microstachys grayi Abrams, Flora Los Angeles 52. 1904. Based on *Festuca microstachys ciliata* Gray.

The name *ciliata* is preoccupied in *Festuca ciliata* Danth., 1805.

DESCRIPTION.

Habit of *Festuca pacifica*, but somewhat stouter; sheaths and sometimes the blades pubescent. Inflorescence pubescent or puberulent throughout. Spikelets 3 to 5-flowered. (PLATE III.)

The following specimens have been examined:

OREGON:

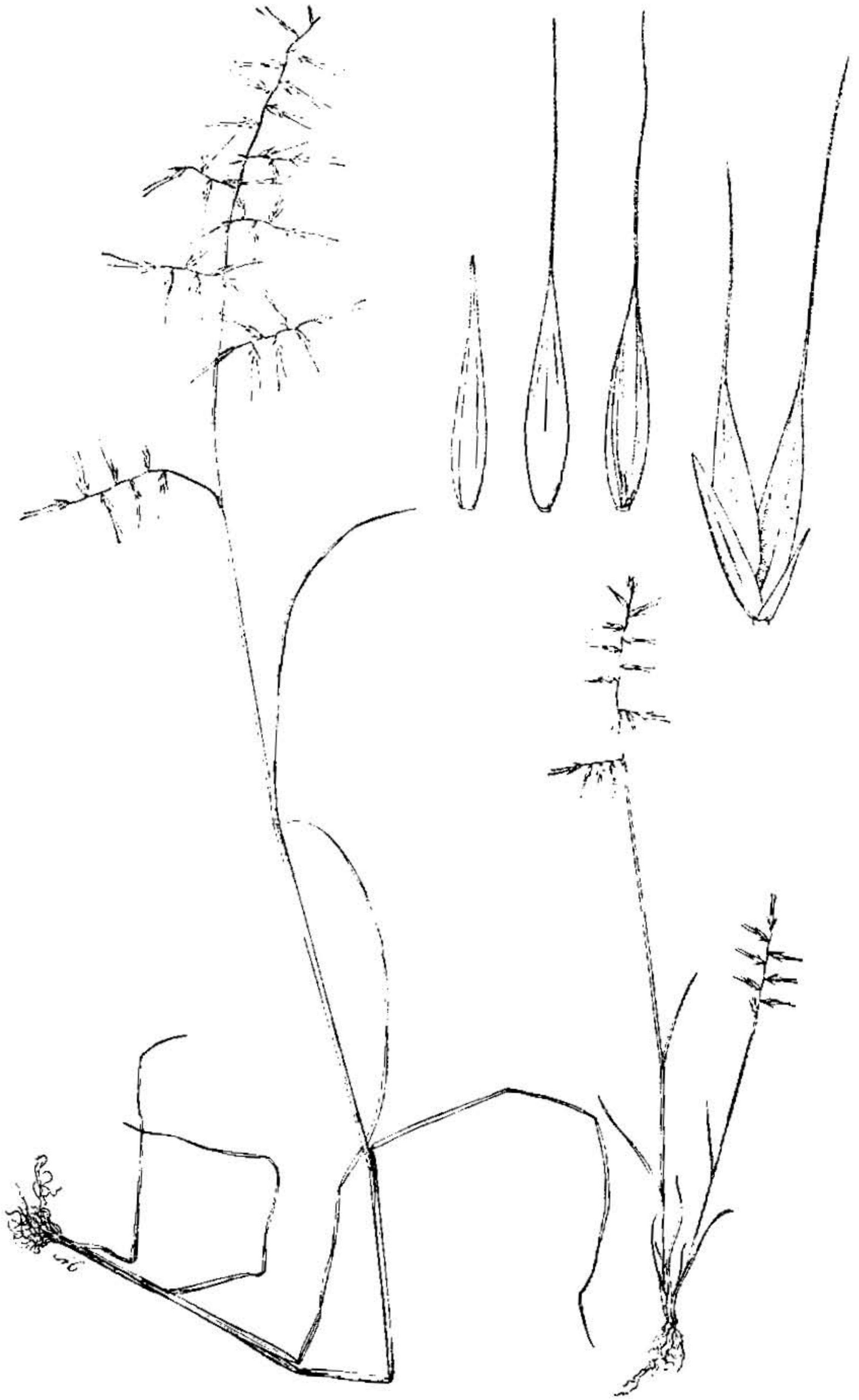
- Grants Pass, *Howell*, May 24, 1884 (in part), (type of *F. microstachys ciliata* Gray in Beal).

CALIFORNIA:

- New York Falls, Amador County, *Hansen* 632.
Ojai Valley, *Hubby* 40.
Pasadena, *Allen*, March 31, 1885.
Santa Lucia Mountains, *Eastwood*, May, 1897.
Geysers, *Bolander* 37.
Napa Valley, *Bigelow*.
Laguna, *Schoenfeldt* 3634.



FESTUCA GRAYI (ABRAMS) PIPER.



FESTUCA REFLEXA BUCKL.

ARIZONA:

Santa Catalina Mountains, *Shear* 1963.

Tucson, *Toumey*, in 1892.

Pima Canyon, *Griffiths & Shear* 2621.

Sabenio Canyon, *Griffiths* 2533.

A specimen collected at Los Angeles, California, by Dr. H. E. Hasse in 1888 is quite intermediate between *grayi* and *pacifica*.

EXPLANATION OF PLATE.—Drawn from Pringle's specimens from the Santa Catalina Mountains, Arizona (April 19, 1884). Plant one-half natural size; spikelet and dissections enlarged five times.

6. *Festuca reflexa* Buckl.

Festuca reflexa Buckl. Proc. Acad. Phila. 1862: 98. 1863. Type in the herbarium of the Philadelphia Academy, collected by Nuttall in "Upper California."

Festuca microstachys pauciflora Scribner in Beal, Grasses N. Am. 2: 586. 1896.

DESCRIPTION.

Culms erect, simple or few in a tuft, 20 to 50 cm. high, glabrous, 3-jointed; sheaths smooth or pubescent, the lower about as long as the internodes; ligule very short, membranaceous, truncate; blades narrowly linear, flat or loosely involute, 2 to 10 cm. long; panicle 5 to 12 cm. long, the rays solitary, these and the spikelets all at length divaricate; spikelets 1 to 3, or rarely 4 or 5-flowered, 5 to 7 mm. long; glumes glabrous, the lower subulate, 1-nerved, 2.5 to 4 mm. long, the upper lanceolate, acute, 3-nerved, 4.5 to 5 mm. long; lemma lanceolate, convex, 3-nerved above, glabrous or more or less scabrous, 4.5 to 6 mm. long, attenuate into a scabrous awn 2 to 12 (usually 5 to 8) mm. long; palea lanceolate, the two hispidulous nerves meeting at the acuminate apex, the inflexed sides narrow, the internerve scaberulous. (PLATE IV.)

This species is abundant throughout California, extending sparingly into Utah and western Oregon. Also on Vancouver Island, *Macoun*. Occasional specimens approach *F. pacifica* closely.

The following collections are representative:

NEVADA:

Mica Mine, *M. E. Jones* 5072 K.

CALIFORNIA:

Bakersfield, *Davy* 1898.

San Diego, *Orcutt* 1073.

Panamint Mountains, *Coville & Funston* 775.

Mendocino County, *Blankinship* 57.

Berkeley, *Michener & Bioletti* 102.

Mount Diablo, *Brewer* 1077.

UTAH:

Santa Clara Valley, *M. E. Jones* 5139 v.

Silver Reef, *M. E. Jones* 5163 aq.

EXPLANATION OF PLATE.—Taller drawing represents 71 *Brandegee*, Santa Inez Mountains, California; the shorter one, *Brewer* 1077, Mount Diablo, California, the details from the former. Plant one-half natural size; spikelets and dissections enlarged five times.

7. *Festuca microstachys* Nutt.

Festuca microstachys Nutt. Journ. Acad. Phila. n. s. 1: 187. 1847. "Pueblo de los Angeles, Upper California."

We have been unable to locate Nuttall's type specimen. It is not at Kew nor in the Philadelphia Academy of Sciences. Nuttall's description, however, is so complete that it is hardly possible to mistake the plant.

DESCRIPTION.

Stems erect, glabrous, 20 to 50 cm. high, 2 or 3-jointed; sheaths smooth or pubescent, the lower nearly equaling the internodes; ligule nearly obsolete; blades flat or loosely involute, narrowly linear, glabrous or pubescent, 3 to 10 cm. long; panicle erect, 4 to 10 cm. long, the solitary rays and the spikelets all at length divaricate; spikelets 1 to 3-flowered, 5 to 7 cm. long; glumes unequal, the lower subulate, 1-nerved, 3 to 4 mm. long, the upper lanceolate, 3-nerved, 4 to 5 mm. long; lemma lanceolate, convex, 4 to 6 mm. long, pubescent, attenuate into a scabrous awn as long or shorter; palea acuminate, equaling the lemma.

The following specimens have been examined:

OREGON:

Grave Creek, *Howell*, May 20, 1884 (in part).

CALIFORNIA:

Salt Creek, Tulare County, *Eastwood*, May, 1894.

South Pasadena, *Allen*, April 4, 1885.

Napa City, *Jepson*, April, 1893.

Lake County, *Blankinship*, June 3, 1893.

8. *Festuca eastwoodae* sp. nov.

Culm erect, glabrous, 4-jointed, 30 cm. high; lower sheaths equaling or exceeding their respective internodes, puberulent or glabrous; ligule very short; blades soft, loosely involute, sharply acute, puberulent or glabrous; panicle open, 10 cm. long, pubescent throughout; rays and spikelets all divaricate; glumes lanceolate, the lower 1-nerved, 2 to 2.5 mm. long, the upper 3-nerved, 3.5 mm. long, hirsute; lemma lanceolate, hirsute, 4 or 5 mm. long, tipped with a straight scabrous awn as long or longer.

Collected by Miss Alice Eastwood, May, 1897, at Milpitas ranch, Santa Lucia Mountains, Monterey County, California, and by an unknown collector at Volcano, May, 1886.

Differs from *F. microstachys* Nutt. essentially in its hirsute glumes.

9. *Festuca myuros* L.

Festuca myuros L. Sp. Pl. 1: 74. 1753. "Habitat in Anglia, Italia."

DESCRIPTION.

Stems erect, sometimes geniculate at base, solitary or forming small tufts, usually 20 to 60 cm. high, glabrous, 3-jointed, usually completely concealed by the sheaths; sheaths always smooth, exceeding the internodes; ligule very short, truncate; blades smooth, linear, involute or rarely flat; panicle long and narrow, 7 to 20 cm. long, the branches appressed, the tips usually bending over; rays solitary; spikelets pale green, 4 or 5-flowered, 8 to 11 mm. long, on stalks 1 to 2 mm. long; joints of the rachilla cylindric, smooth; glumes glabrous, very unequal, the lower 1-nerved, 1.5 to 2 mm. long, the upper 4 to 5 mm. long, with two small lateral nerves; lemma linear-lanceolate, obscurely 5-nerved, scabrous above, not ciliate, attenuate at apex into a scabrous awn about twice its length; palea lanceolate, shorter than the lemma, the nerves hispidulous; stamen 1.

This European plant is commonly introduced in the eastern United States, but as yet it is rare in the interior and on the Pacific slope. Indistinguishable from it so far as we can see is the South American *Festuca muralis* Kunth, Syn. Pl. 218. 1822.



FESTUCA MEGALURA NUTT.

Kunth himself first referred this plant to *F. myuros* L. (H. B. K. Nov. Gen. et Sp. 1: 155.), remarking: "Non video quo caractere distinguenda sit a *Festuca myuro* Linn.?" Nevertheless, he later names the plant *F. muralis*, without pointing out wherein it differed. Kunth's figure in H. B. K. shows no character whatever by which his plant can be differentiated from *F. myuros*. The interesting question at once arises as to whether Kunth's plant is native or not. His type came from garden walls in Quito, Ecuador, and might well have been introduced there prior to 1815. The question is somewhat complicated by Jameson's no. 232, also collected at Quito in 1856, in sandy places and on garden walls. The sheet of this number in the Gray Herbarium is a mixture of *myuros* and *megalura*. It is hardly possible that Kunth's type can be the latter species, as he would surely have noticed the bristly cilia, especially as he was trying to differentiate his plant from *F. myuros*. As both the species grow at Quito, it will require an examination of Kunth's type to settle definitely what his *F. muralis* is, but it is altogether probable that it is true *F. myuros*, and not *F. megalura*. It may further be added that the Jameson specimen and one collected on Mount Iztaccihuatl, Mexico, by Charles Deam (no. 22), are the only American specimens of *F. myuros* which we would hesitate to consider introduced.

10. *Festuca megalura* Nutt.

Festuca megalura Nutt. Journ. Acad. Phila. n. s. 1: 188. 1847. Type from Santa Barbara, Cal., but we have been unable to locate it in any American herbarium, nor is it in the British Museum. Nuttallian specimens of this species, with a different unpublished name, are in the Philadelphia Academy and in the British Museum. Nuttall's description is so good, however, that there can be no doubt regarding the plant.

Vulpia myuros hirsuta Hack. Cat. Gram. Port. 24. 1880. Type from Portugal.

Festuca myuros hirsuta Asch. & Graebn. Syn. Mitteleur. Fl. 2: 558. 1901.

DESCRIPTION.

Very similar in all respects to the preceding species; panicles usually longer; lemma sparsely ciliate on its upper half. (Plate V.)

This plant is abundant on the Pacific slope from British Columbia and Idaho to Mexico and Lower California. It also recurs in Ecuador, Peru, Bolivia, and Chile. The evidence points very strongly to its being native and not introduced. In Europe it has been found only in Portugal, and that in comparatively recent years, so that it is more likely an introduction there than vice versa. It was collected in British Columbia by Lyall in 1859, in Washington by Doctor Cooper in 1853 and by Tolmie much earlier, in California by Gambell before 1847, in Nevada by Anderson in 1865, in Ecuador by Jameson in 1856, in Peru by the Wilkes expedition in 1839, and in Chile by Gay about 1850. This widespread range along the Pacific slope of both North and South America at such early dates, taken in contrast with its very local distribution in Europe, points to its being a West American native. Nevertheless, in eastern Washington and Idaho it is a plant of very recent introduction, and in its rapid spread behaves like many weedy plants of undoubted European origin.

Most of the South American specimens referred to *Festuca muralis* Kunth belong to *F. megalura*, and authentic material from Gay shows that such was the case with the specimens on which the *F. muralis* of the Flora Chilensis was based.

The character by which *megalura* is distinguished from *myuros* is very slight, but surprisingly constant. It has been mistaken by some recent California collectors for the European *Festuca ciliata* Danth. (*F. myuros ciliata* Cosson).

The following collections are representative:

BRITISH COLUMBIA:

Victoria, *Macoun* 185.

WASHINGTON:

Clallam County, *Elmer* 1914.

Seattle, *Piper* 836.

Walla Walla, *Shear* 1587.

Waitsburg, *Horner* 557.

IDAHO:

Lewiston, *Heller* 3232.

Clearwater River, *Sandberg, Heller, & MacDougal* 291.

OREGON:

Hoover Canyon, Gilliam County, *Leiberg* 150.

Silverton, *Hall* 637.

Portland, *Sheldon* 10505.

CALIFORNIA:

San Bernardino, *Parish* 4761.

San Francisco, *Torrey* 576.

San Diego, *Brandege* 97.

Monterey, *Dary* 7245.

Santa Barbara, *Elmer* 3832.

Santa Rosa, *Heller* 5681.

San Diego, *Grant* 896a.

Mendocino, *Brown* 762.

Humboldt Bay, *Chandler* 1120.

ARIZONA:

Fort Huachuca, *Palmer* 465.

MEXICO:

Foothills of Iztaccihuatl, *Deam* 22.

Nachoguero Valley, Lower California, *Schoenfeldt* 3442.

EXPLANATION OF PLATE.—DRAWN from 150 *Leiberg*, collected in Oregon. Plant one-half natural size; details enlarged five times.

11. *Festuca bromoides* L.

Festuca bromoides L. Sp. Pl. 1: 75. 1753. "Habitat in Anglia, Italia."

Festuca sciuroides Roth, Cat. Bot. 2: 11. 1800.

DESCRIPTION.

Stems erect, rarely geniculate at base, 10 to 30, rarely 40 cm. high, glabrous, 3-jointed; sheaths smooth, longer than the internodes; ligule very short; blades linear, glabrous, flat or loosely involute; panicle usually dense, narrow, 5 to 10 cm. long, seldom longer; rays solitary, rather short, appressed; spikelets pale green, 4 or 5-flowered, 9 to 12 mm. long, on stalks 2 to 5 mm. long; glumes unequal, the lower 1-nerved, 4 to 4.5 mm. long, the upper 3-nerved, 6 to 7 mm. long; lemma lanceolate, scabrous above, 7 to 8 mm. long, attenuate into an awn 10 to 13 mm. long; palea lanceolate, obtuse at the very apex, the nerves hispidulous; stamen 1. (Plate VI.)

This plant is abundantly introduced on the Pacific coast from Vancouver Island to southern California, but apparently not elsewhere in North America. The oldest specimens we have seen bear the date of 1886. Collectors have for the most part labeled it *myuros* or *microstachys*. From the former it is easily distinguished by its different glumes. Normal forms of *F. pacifica* are easily distinguished by the divaricately branching panicle, but shade or diminutive forms simulate *bromoides* closely. The best distinction in such cases is furnished by the palea. In *pacifica* the inflexed



FESTUCA BROMOIDES L.



FESTUCA SCIUREA NUTT.

sides of the palea are half as wide as the internerve; in *bromoides* they are much narrower. Furthermore the sheaths of *bromoides* are always perfectly glabrous; in *pacifica* they are often puberulent.

The following are representative collections:

BRITISH COLUMBIA:

Vancouver Island, *Macoun* 17, 44.

Nanaimo, *Macoun* 186.

WASHINGTON:

Montesano, *Heller* 3890.

Morrison, *Leckenby* 104.

Seattle, *Howell* 203.

Tacoma, *Flett* 2234 in part.

OREGON:

Portland, *Sheldon* 10669, 10801.

Seaside, *Shear & Scribner* 1721.

CALIFORNIA:

Santa Cruz Island, *Brandege* 67.

Fort Bragg, *Davy* 6132.

Marin County, *Palmer* 2041.

Berkeley, *Blankinship* 12; *Davy* 7870.

Santa Rosa, *Heller* 5221.

EXPLANATION OF PLATE.—DRAWN from 7870 *Davy*, Berkeley, California. Plant one-half natural size; spikelets, details, and dissections enlarged five times.

12. *Festuca sciurea* Nutt.

Festuca sciurea Nutt. Trans. Am. Phil. Soc. II. 5: 147. 1837. Type in the herbarium of the Philadelphia Academy of Sciences, collected by Nuttall in Arkansas.

There are two older names which in all probability refer to this species. One of these is *F. quadriflora* Walt. Fl. Car. 81. 1788. There seems to be no type or authentic specimen of this in existence, and the brief description of Walter is insufficient. But *sciurea* seems to be a commoner grass in South Carolina even now than *F. myuros*, to which *quadriflora* is usually referred, and it would seem that Walter must have known the plant. There is an older *Festuca quadriflora* Honck., 1782.

The other name is that of *F. monandra* Ell.^a Elliott mentions this name under a description headed *Festuca myuros*, stating that he once considered his plant distinct from the latter, adding moreover that "the only circumstances which still occasion any doubt, the hairy corolla and solitary filaments," are omitted by Lamarck in the description of *F. myuros* in the Encyclopedie Methodique. Upon *Festuca monandra* Ell., Rafinesque founds his *Dusiola elliottea*, Neogenyt. 4. 1825.

There is no specimen to be found in Elliott's herbarium labeled either *F. myuros* or *F. monandra*, but his character of hairy corolla points clearly to *F. sciurea* as the plant he had before him. The other distinctive characters of *sciurea*, the empty glumes and small florets, are not brought out in Elliott's description.

DESCRIPTION.

Culms erect, slender, glabrous, 15 to 50 cm. high, solitary or in small tufts, 2-jointed; sheaths smooth, shorter than the internodes; ligule scarious, short, truncate; blades setaceous, soft, involute, 1 to 10 cm. long; panicle narrow, erect, 5 to 20 cm. long; rays solitary or the lower in twos or threes, smooth, sharply angled; spikelets 4 to 6-flowered, 4 to 5 mm. long; glumes smooth, the lower 1-nerved, 2 mm. long, the

^a Elliott, Bot. S. C. & Ga. 1: 170. 1821.

upper 3-nerved, 3.5 mm. long; lemma linear-lanceolate, faintly 5-nerved, 3 to 3.5 mm. long, sparsely short-pubescent, attenuate into a slender awn 6 to 11 mm. long; palea lanceolate, obtuse or acutish, nearly as long as the lemma, ciliate at the apex; stamen 1. (PLATE VII.)

This species ranges from Norfolk County, Virginia (Kearney), south to Florida, thence westward to Texas and northward into Arkansas and Indian Territory (Palmer).

EXPLANATION OF PLATE.—DRAWN from Reverchon's Texas specimen collected in 1882. Plant one-half natural size; details enlarged five times.

Subgenus II. EUFESTUCA Griseb.

Eufestuca Griseb. Spic. Fl. Rumel. 2: 432. 1844.

Perennials, often densely tufted; stamens and stigmas projecting during anthesis; stigmas plumose, the branches toothed, bilateral.

13. *Festuca rubra* L.

Festuca rubra L. Sp. Pl. 1: 74. 1753. "Habitat in Europae pratis siccis."

Festuca vallicola Rydb. Mem. N. Y. Bot. Gard. 1: 57. 1900. Type in the Herbarium of the New York Botanical Garden; a duplicate in the National Herbarium, collected at Silver Bow, Montana, by Rydberg (no. 2108).

DESCRIPTION.

Stems from elongated or sometimes short creeping rootstocks, in the latter case somewhat tufted; culms erect, very smooth, 40 to 90 cm. high, 3 or 4-jointed; sheaths very smooth, shorter than the internodes; ligule scarious, short and truncate; blades very smooth, soft, the basal ones loosely involute, those of the culm typically flat, but in American forms usually folded or involute; panicle 5 to 20 cm. long, usually contracted and narrow; rays mostly erect, narrow, scabrous on the angles, the lower ones usually with a short basal branch; spikelets usually 4 to 6-flowered, rarely 10-flowered, mostly 7 to 8 mm. long, pale green or more or less glaucous, often purple-tinged; joints of the rachilla smooth; glumes smooth, the lower 1-nerved, shorter than the 3-nerved upper one; lemma linear-lanceolate, convex, obscurely 5-nerved, 5 to 7 mm. long, smooth or scabrous toward the apex, bearing a scabrous awn rarely as long, usually about half as long.

Festuca rubra is much less rich in subspecies than is *F. ovina*, and these subspecies are for the most part but ill defined. It necessarily results, therefore, that under the species proper must be grouped plants of somewhat diverse aspect. Indeed, it may be a more philosophical treatment to reduce most of the subspecies to the species, instead of keeping them up as is done by most European botanists. The problem is complicated by the fact that much of the North American *rubra* differs from the typical plant of Europe, more especially in the fact that the culm leaves tend to be involute rather than flat, in this respect approaching *F. rubra trichophylla* (Ducros) Gaud. This slight difference is surely not sufficient, however, to justify the erection of a new species for the Rocky Mountain form as proposed by Doctor Rydberg, even were the character constant, which is not the case.

Festuca rubra ranges in North America along the Atlantic seaboard from Greenland to Virginia; on the Pacific side it is abundant along the seashore from Alaska to California, and inland to the Rocky Mountains south as far as Colorado.

The specimens referred to as *F. ovina trachyphylla* Hack., *F. ovina duriuscula* (L.) Hack., *F. ovina borderii* Hack., *F. amethystina* L., and *F. rubra trichophylla* Gaud. by Doctor Beal in Grasses of North America, clearly are *Festuca rubra*. Of the specimens referred to *F. rubra fallax* Hack., the Anderson specimen is *F. ovina ingrata* Hack.; the Howell specimen, *F. rubra*.

The American forms may be recognized by the following key:

KEY TO THE SUBSPECIES OF FESTUCA RUBRA.

Spikelets glabrous or merely scaberulous.

Blades of the innovations involute, of the culm flat or folded; panicle not densely congested.

Leaves and usually the spikelets green.

Florets not proliferous.

Spikelets 7 to 8 mm. long.....*rubra*.

Spikelets 10 to 12 mm. long.....*rubra megastachys*.

Florets proliferous.....*rubra prolifera*.

Leaves and spikelets glaucescent.....*rubra glaucodea*.

Blades all plane.

Spikelets green; lemmas lanceolate.....*rubra multiflora*.

Blades all involute, rather rigid; panicle very dense.

Leaves green; spikelets glabrous or glaucous.....*rubra densiuscula*.

Leaves and spikelets very glaucous.....*rubra pruinosa*.

Spikelets pubescent with short hairs.....*rubra kitaibeliana*.

Spikelets villous, often somewhat woolly.....*rubra lanuginosa*.

13a. *Festuca rubra megastachys* Gaud.

Festuca rubra megastachys Gaud. Fl. Helv. 1: 287. 1828. Type from Switzerland.

Festuca rubra diversifolia Gaud. op. cit. 288. Type from Switzerland.

Festuca oregona Vasey, Bot. Gaz. 2: 126. 1877. Type specimen in the National Herbarium from Oregon.

Festuca rubra grandiflora Hack. Mon. Fest. 139. 1882. Based on *F. rubra diversifolia* Gaud.

The following specimens are referred here:

CANADA:

Point Seche, Gaspé, *Macoun* 37.

NEW JERSEY:

Absecum, *Commons* 185.

ALASKA:

Attah Island, *Macoun* 22806.

BRITISH COLUMBIA:

Nanaimo, *Macoun* 29682.

WASHINGTON:

Klickitat County, *Suksdorf* 1140.

Klickitat River, *Suksdorf* 1147.

OREGON:

Sauvies Island, *Howell*, June 15, 1882.

13b. *Festuca rubra prolifera* subsp. nov.

The plant of the White Mountains which has been referred to *F. ovina vivipara* L. is in reality a viviparous form or state of *F. rubra*, differing only in its viviparous spikelets. It is said to be the only form of the plant occurring in the White Mountains, and while properly a state rather than a subspecies, may be named as above. It seems surprising that no similar form occurs in Europe.

The type is a specimen in the National Herbarium collected on Mount Washington by Pringle in 1877.

13c. *Festuca rubra glaucodea* nom. nov.

Festuca glaucescens Hegetschwein & Heer, Fl. Schweiz. 93. 1840. Type locality, Switzerland. Not *F. glaucescens* Roth, Nov. Pl. Sp. 78. 1821, nor *F. ovina glaucescens* Link, Hort. Berol. 2: 266. 1813.

Festuca rubra glaucescens Hack. Mon. Fest. 139. 1882.

The following specimens are referred here:

TENNESSEE:

Nashville, *Guttinger*.

NORTH CAROLINA:

Buncombe County, *Biltmore Herbarium* 1848b.

WYOMING:

Johnson County, *Williams & Griffiths* 177.

OREGON:

McMinnville, *Shear* 1771.

MEXICO:

Sierra Madre, near Colonia Garcia, *Townsend & Barber* 114.

13d. *Festuca rubra multiflora* (Hoffm.) Asch. & Graebn.

Festuca multiflora Hoffm. Deutschl. Fl. ed. 2. 1: 50. 1800. Type from Germany.

Festuca rubra multiflora Asch. & Graebn. Syn. Mitteleur. Fl. 2: 499. 1900; op. cit. Index 43. 1903.

The following specimens are referred here:

MAINE:

Fort Kent, *Fernald* 2186.

WYOMING:

North Fork Clear Creek, *Williams & Griffiths* 91, 146, 135a.

CALIFORNIA:

Without locality, *Kellogg & Harford* 1118.

Lake Tahoe, *Hitchcock*, July, 1901.

Bear Valley, *Lemmon* 5434.

WASHINGTON:

Spangle, *Suksdorf* 119.

13e. *Festuca rubra densiuscula* Hack. subsp. nov.

Leaves all involute, smooth, rigid, green; panicle dense, 3 to 5 cm. long; spikelets glabrous, often glaucous.

The following specimens are in the National Herbarium:

CALIFORNIA:

Crescent City, *Dury & Blasdale* 5931 (type), 5932.

OREGON:

Tillamook Bay, *Howell* 74.

FRANCE:

Cherbourg, *L. Corbiere*, June 6, 1886.

13f. *Festuca rubra pruinosa* Hack.

Festuca rubra pruinosa Hack. in Rep. Bot. Exchange Club Brit. Isles 119. 1884. Type specimens from the Isle of Skye.

Festuca rubra littoralis Vasey; Beal, Grasses N. Am. 2: 607. 1896. Type in herbarium Michigan Agricultural College, collected at Tillamook Bay, Oregon, by Howell, "on sand dunes by the sea." A duplicate specimen is in the National Herbarium.

The following specimens have been examined:

CALIFORNIA:

Fort Bragg, *Davy & Blasdale* 6117.

Point Reyes Peninsula, *Davy* 6811.

OREGON:

Tillamook Bay, *Howell*, July, 1882.

13g. *Festuca rubra kitaibeliana* (Schultes).

Festuca barbata Schrank, Prim. Fl. Salisb. 46. 1792, not L. 1759.

Festuca pubescens Willd.; Link, Enum. 1: 91. 1821, not Zea; R. & S. Syst. 2: 728. 1817. "In Hungaria."

Festuca rubra subvillosa Mert. & Koch in Röhling, Deutschl. Fl. ed. 3. 1: 654. 1823, not *F. duriuscula subvillosa* op. cit. 648.

Festuca rubra villosa Mert. & Koch in Röhling, Deutschl. Fl. ed. 3. 1: 654. 1823, not *F. ovina villosa* Schrad. Fl. Germ. 1: 320. 1806.

Festuca kitaibeliana Schult. Mant. 2: 398. 1824. New name proposed for *F. pubescens* Willd.

Bromus secundus Presl, Rel. Haenk. 1: 280. 1830. Type specimen from Nootka Sound, Vancouver Island, collected by Haenke; a duplicate in the herbarium of the Missouri Botanical Garden.

Festuca rubra barbata Hack. Mon. Fest. 139. 1882. Based on *F. barbata* Schrank.

Festuca rubra pubescens Vasey; Beal, Grasses N. Am. 2: 607. 1896. Type in herbarium Michigan Agricultural College, collected in Oregon by Howell.

Festuca rubra secunda Scribner, Rep. Mo. Bot. Gard. 10: 39. 1899. Based on *Bromus secundus* Presl.

This much-named plant ranges in North America from Alaska to Greenland, southward to Oregon, Wyoming, Ontario, and New Brunswick. Specimens from South Burlington, Vermont (*Jones*), and Andover, New Hampshire (*Briggs*), are probably introduced. Viviparous forms occur occasionally. Some Alaskan specimens have exceptionally large spikelets nearly 2 cm. long, but otherwise show no differences.

13h. *Festuca rubra lanuginosa* Mert. & Koch.

Festuca dumetorum Rafn. Danm. Holst. Fl. 1: 549. 1796, not L. 1762.

Festuca arenaria Osbeck in Retz. Suppl. Prim. Fl. Scan. 1: 4. 1805, not Lam. 1791.

Festuca rubra arenaria Fries, Fl. Halland. 28. 1818.

Festuca villosa Schweigg, in Hagen, Chlor. Boruss. 35. 1819, not *F. ovina villosa* Schrad. 1806.

? *Festuca oraria* Dum. Agrost. Belg. 105. 1823.

Festuca rubra lanuginosa Mert. & Koch in Röhling, Deutschl. Fl. ed. 3. 1: 654. 1823. "Auf magerm Flugsande am Gestade des Meeres in Hinterpommern und Ostpreussen (der Kurischen Nehrung)."

Festuca baltica Homann, Fl. Pomm. 1: 56. 1828.

Festuca lanuginosa Scheele, Flora 1: 63. 1844.

Festuca richardsoni Hook. Fl. Bor. Am. 2: 250. 1840. Type from "the Arctic sea-coast" of North America, collected by Richardson. Specimens in the Gray and Torrey Herbaria are probably duplicate types.

The Richardson specimens are quite identical with Arctic European specimens, and correspond to *F. rubra arenaria* forma *arctica* Hack. Mon. Fest. 140. Specimens from Port Clarence, Alaska, Doctor Yemans, August, 1884, are identical. Specimens collected on Unimak Island, Alaska, by Macoun (22801) are taller and agree with the ordinary European plant.

14. *Festuca occidentalis* Hook.

Festuca occidentalis Hook. Fl. Bor. Am. 2: 249. 1840. "Plains and elevated grounds of the Columbia near the sea. Dr. Scouler. Douglas." Authentic specimens from Hooker are in the Gray Herbarium.

Festuca ovina polyphylla Vasey; Beal, Grasses N. A. 2: 597. 1896. Type specimen in herbarium Michigan Agricultural College, collected in the Cascade Mountains, Oregon, by Howell, in 1885.

DESCRIPTION.

Densely tufted and perfectly glabrous up to the inflorescence; culms slender, shining, 50 to 80 cm. high, 2-jointed; leaf blades filiform-involute, numerous, bright green, soft, becoming longitudinally sulcate when dry, 5 to 20 cm. long, acute at the very apex; ligule very small, truncate; sheaths smooth, very long, but shorter than the internodes, in young plants often wholly concealing the stem; panicle loose, subsuccund, flexuous, 8 to 20 cm. long, often somewhat drooping above; rays scabrous on the sharp angles, solitary or the lowest paired and very unequal; spikelets green, oblong, loosely 3 to 5-flowered, 6 to 10 mm. long, mostly on slender stalks, pale green, or rarely purplish; glumes unequal, variable, even on the same plant, usually sharply acute or acuminate, sometimes obtuse or obtusish, the lower 1-nerved, 2 to 2.5 mm. long, the upper 3-nerved, about one-half longer, both usually puberulent near the apex and margins; lemma oblong-lanceolate, rather thin in texture, 5 to 6.5 mm. long, scaberulous toward the apex, attenuate into a slender awn about as long; palea linear-lanceolate, acutish, scabrous on the nerves, the inflexed sides meeting in the middle when flattened; ovary hispidulous at apex. PLATE VIII.

This species has been generally misunderstood, principally owing to the character assigned to the glumes of being short, obtuse, and ciliate. The Gray Herbarium specimens agree perfectly with Hooker's characterization in this respect, as do some recent specimens, for example, E. C. Smith's 936, Seattle, Washington; Macoun's 85, Burrard Inlet, British Columbia, and Heller's 3932, Montesano, Washington. This character is, however, unreliable, most specimens having longer and usually acute glumes. It is a very different plant from the Japanese *Festuca pauciflora* Thunb. to which it was referred by Thurber. Thurber's description in the Botany of California applies not to Hooker's species, but to *Festuca subulata* Trin. (*F. jonesii* Vasey.)

Festuca occidentalis is an abundant species in open woods from British Columbia to middle California, and eastward to Montana, Wyoming, and the Great Lakes. It is always densely tufted, never showing any trace of rootstocks.

In Beal's Grasses of North America the specimens referred to *Festuca rubra heterophylla* (Lam.) Hack., and to *F. rubra longisetata* (Hegetschw.) Hack. are all *F. occidentalis* Hook.

The following are representative specimens:

BRITISH COLUMBIA:

Chilliwack Valley, *Macoun* 26115, 26112.

Victoria, *Macoun* 171.

Comox, *Macoun* 173.

Yale, *Macoun* 88.

WASHINGTON:

Blue Mountains, *Horner* 561.

Cascade Mountains, *Vasey* in 1889.

Olympia, *Henderson* 2198, 2177.

Seattle, *Piper* 834.

Mount Rainier, *Piper* 850.

Nisqually Valley, *Allen* 50.

Grays Harbor, *Lamb* 1128.



FESTUCA OCCIDENTALIS HOOK.

WASHINGTON—Continued.

- Rock Creek, Spokane County, *Suksdorf* 1141.
 Olympic Mountains, *Elmer* 1917.
 Montesano, *Heller* 3932.

OREGON:

- Without locality, *Hall* 641.
 Portland, *Howell* 15.
 Wallowa Mountains, *Cusick* 2211.
 Blue Mountains, *Shear* 1682, 1809, 1676.

CALIFORNIA:

- Mendocino County, *Dary* 6607.
 Mount Shasta, *Brown* 373.
 Marin County, *Palmer* 2044.
 Long Valley, *Kellogg & Harford* 1116.
 Without locality, *Bolander* 6704.
 El Volcan, *Brandege* 104.

IDAHO:

- Cœur d'Alene Lake, *Sandberg, Heller, & MacDougal* 544.
 Cedar Mountain, Latah County, *Piper* 3930, 1917.
 Cedar Mountain, Latah County, *Henderson* 2835.

MONTANA:

- Summit, *Griffiths & Lange* 209, 192.

WYOMING:

- Nez Perces Creek, *Nelson* 6216.
 Yellowstone Park, *Bolley* 1898.

MICHIGAN:

- Keweenaw County, *Farwell* 531.
 Thunder Bay, *Wheeler*, July 18, 1895.

EXPLANATION OF PLATE.—DRAWN from 4908 *Piper*, Vancouver, Washington. Plant one-half natural size; ovary and stigmas enlarged ten times, other details five times.

15. *Festuca ovina* L.

Festuca ovina L. Sp. Pl. 1: 73. 1753. "Habitat in Europae collibus apricis aridis vulgatissimum."

Festuca ovina vulgaris Koch, Syn. 2: 812. 1837.

DESCRIPTION.

Densely tufted; culms erect, 3-jointed, mostly 15 to 60 cm. high, smooth or somewhat scabrous near the panicle; sheaths smooth, shorter than the internodes; ligule very short, 1 mm. or less; blades pale green, strongly involute, firm, narrow, cylindrical, scabrous on the margins, the basal ones 5 to 12 cm. long, those of the culm often very short; panicle contracted after blooming, commonly 5 to 10 cm. long; rays ascending, scabrous on the angles; spikelets ovate or oblong, usually 5 to 7.5 mm. long, 3 to 6 or rarely 9-flowered, pale green, or sometimes purplish tinged; florets rather close; joints of the rachilla smooth; glumes unequal, linear-lanceolate, acute, the lower 1-nerved, about 2 mm. long, the upper 3-nerved, about 2.5 mm. long; lemma lanceolate, thick and firm, convex, obscurely 5-nerved, smooth or more or less scabrous, 3 to 3.5 mm. long, attenuate in a scabrous awn 1 mm. long or more.

This species in its typical form occurs native in North America in the Rocky Mountains from Alberta to New Mexico, in the Black Hills, and about the Great Lakes. Through cultivation it is more or less commonly introduced in many localities. The specimen referred by Beal, Grasses N. Am. 2: 600, to *F. hystrix* Boiss. is true *F. ovina*.

Perhaps no other species of grass is so polymorphous as *Festuca ovina*, the Old World forms of which have been classified into numerous categories. The North American forms are far less numerous, and may be distinguished by the following key:

KEY TO THE SUBSPECIES OF *FESTUCA OVINA*.

Leaf blades firm, cylindric or terete even when dried.

Lemmas awned.

Leaf blades capillary .3 to .6 mm. broad.

Plants 20 to 60 cm. high; panicle 2 to 12 cm. long.

Lemmas usually scabrous or pubescent *ovina*.

Lemmas hispidulous *ovina sciaphila*.

Lemmas foliaceous, the spikelets proliferous *ovina vivipara*.

Plants 12 to 30 cm. high; panicle 2 to 4 cm. long *ovina supina*.

Leaf blades broader 0.7 to 1 mm. broad, 7 nerved *ovina duriuscula*.

Lemmas awnless *ovina capillata*.

Leaf blades smooth, green, soft, becoming longitudinally sulcate in drying.

Culms 20 to 45 cm. high; sheaths closed only at base *ovina pseudovina*.

Culms 5 to 10 cm. high; sheaths closed their whole length or nearly.

..... *ovina brachyphylla*.

Leaf blades pale or glaucescent, firm, usually harshly scabrous.

Sheaths long-persistent on the innovations, becoming brown and papery.

..... *ovina calligera*.

Sheaths not becoming brown and papery.

Awns long, nearly equaling the lemma; sheaths not becoming explanate at base *ovina ingrata*.

Awns short, one-fifth to one-third as long as the lemma; sheaths becoming explanate at base *ovina arizonica*.

15a. *Festuca ovina sciaphila* (Schur) Asch. & Graebn.

Festuca sciaphila Schur, Enum. Pl. Transs. 787. 1866. "In Laubwäldern bei Hermannstadt. Schuler, Piatra-mare bei Kronstadt. 3,000'. Kalk."

Festuca ovina sciaphila Asch. & Graebn. Syn. Mitteleur. Fl. 2: 468. 1900; op. cit. Index 41. 1903.

Festuca ovina hispidula Hack. Mon. Fest. 87. 1882. "Transsylvania (Kronstadt), Silesia (Breslau), Austria inf. (St. Pölten)."

The following specimens have been examined:

NEW YORK:

Ithaca, Coville, June 12, 1886.

ONTARIO:

Galt, Herriott, no. 21144.

BRITISH COLUMBIA:

Esquimalt, Macoun 29732.

The last two are in the Herbarium of the Geological and Natural History Survey of Canada.

15b. *Festuca ovina vivipara* L.

Festuca ovina vivipara L. Sp. Pl. ed. 2. 1: 108. 1762. "Habitat in Alpibus Lapponiae, Helvetiae, Scotiae."

Festuca vivipara Smith, Fl. Brit. 1: 114. 1800. This occurs in North America from Greenland and Iceland to Labrador and Newfoundland. The plant of the White Mountains heretofore referred here is *F. rubra prolifera*.

15c. *Festuca ovina supina* (Schur) Hack.

Festuca supina Schur, Enum. Pl. Transs. 784. 1866. "Auf Felsen und Gerölle der Hochalpen: Fogaraser-Arpaser-Kerzesorer-Rodnaer Alpen, Glimmerschiefer; Kronstädter Alpen: Butsets, Königstein, Kalk, Hunyader Alpen, Retyezat. 6000'-7000'."

Festuca ovina supina Hack. Bot. Centralb. 8: 405. 1881.

This subspecies ranges from Greenland southward to the White Mountains, and in the west occurs from British Columbia and Alberta south in the Cascades and Sierras to California, and in the Rockies to Arizona. Apparently it does not occur in Alaska.

This plant has been generally confused by American botanists with *F. ovina brachyphylla*, from which it is often separable with difficulty.

15d. *Festuca ovina duriuscula* (L.) Koch.

Festuca duriuscula L. Sp. Pl. 1: 74. 1753. "Habitat in Europae pratis siccis."

Festuca ovina duriuscula Koch, Syn. 812. 1857.

Judging from herbarium material this subspecies is but sparingly introduced in America. Most specimens so named are *F. rubra*.

15e. *Festuca ovina capillata* (Lam.) Hack.

Festuca capillata Lam. Fl. Fr. 3: 597. 1778. Type locality, France.

Festuca tenuifolia Sibth. Fl. Oxon. 44. 1794. Type locality, Oxford, England.

Festuca ovina capillata Hack. Bot. Centralb. 8: 405. 1881.

This very distinct-appearing subspecies is introduced in many places in the eastern United States.

15f. *Festuca ovina pseudovina* Hack.

Festuca ovina pseudovina Hack. Bot. Centralb. 8: 405. 1881. Hackel's name is proposed for the Austrian grass mistaken for true *F. ovina* L. by Host, Gram. Austr. 2: pl. 86.

This subspecies occurs native in North America in the Rocky Mountains of Wyoming, Colorado, and Utah. Specimens from Clarke, Indiana, collected by Umbach, are probably introduced.

15g. *Festuca ovina brachyphylla* (Schultes).

Festuca brevifolia R. Br. App. Parry's Voy. Suppl. 289. 1824. Type from Melville Island. A duplicate in the Gray Herbarium.

Festuca brachyphylla Schultes, Mant. 3: 646. 1827. Proposes new name on account of the older *F. brevifolia* Muhl. 1817.

Festuca ovina brevifolia Hack. Bot. Centralb. 8: 406. 1881.

This subspecies ranges in North America from the Arctic regions southward to Labrador, and in the Rocky Mountains to Arizona, and recurs in the Sierras of California; apparently absent in the Cascades, but present in the Blue Mountains of Oregon.

15h. *Festuca ovina calligera* nom. nov.

Festuca amethystina asperrima Hack.; Beal, Grasses N. Am. 2: 601. 1896, not *F. asperrima* Link, Enum. 2: 270. 1822. Type in the National Herbarium, collected in Arizona by Rusby (no. 901).

Plants densely tufted, pale green, 15 to 50 cm. high; stems covered at base by the brown scarious persistent sheaths; leaf-blades filiform, longitudinally sulcate, scabrous, 5 to 15 cm. long, each bearing at its junction with the sheath a small callus on each side; lemma awned; palea bidentate.

The following specimens belong here:

UTAH:

Aquarius Plateau, *L. F. Ward* 502, altitude 3,500 m.

Brigham Peak, *Jones* 5955, altitude 3,700 m.

ARIZONA:

Mount Agassiz, *Lemmon*, September, 1884.

White Mountains, *Griffiths* 5338, 5243.

Hart's Little Spring, *Toumey*, July 13, 1892.

San Francisco Peaks, *Leiberg* 5957, altitude 2,800 m.

Without locality, *Rusby* 901.

CALIFORNIA:

Plumas County, *Lemmon* 4653.

15i. *Festuca ovina ingrata* Hack.

Festuca ovina ingrata Hack.; Beal, Grasses N. Am. 2: 598. 1896. Type specimen in the National Herbarium, collected by Howell in Oregon.

Festuca ovina columbiana Beal, op. cit. 599. Type in Herbarium Michigan Agricultural College, published as from Pullman, Washington, but really collected in the Blue Mountains of Columbia County, Washington, by Lake and Hull.

Festuca ovina oregona Hack.; Beal, op. cit. 599, not *Festuca oregona* Vasey. Type in the National Herbarium, collected by Cusick in Oregon (no. 753).

Festuca idahoensis Elmer, Bot. Gaz. 36: 53. 1903. Type specimens from Smiths Valley, Shoshone County, Idaho, collected by Abrams. We have examined a duplicate in Elmer's herbarium. The leaves of this specimen are unusually smooth.

This is the "blue bunch grass" of stockmen, and is an important range grass. It occurs from British Columbia and Alberta south to California and Colorado.

It is the American analogue of the Old World *Festuca ovina valesiaca* (Schleich.) Koch, and has sometimes been referred to the European *F. ovina sulcata* Hack.

The following are representative collections:

WASHINGTON:

Pullman, *Elmer* 299, 826.

Falcon Valley, *Suksdorf* 1142.

Clark Springs, *Kreager* 41, 68.

Mount Carlton, *Kreager* 241.

OREGON:

Grizzly Butte, *Leiberg* 276.

Without locality, *Cusick* 2507.

CALIFORNIA:

Plumas County, *Lemmon* 4653.

Highland Springs, *Davy* 6647.

ALBERTA:

Sheep Mountains, *Macoun* 13148.

BRITISH COLUMBIA:

Deer Park, *Macoun* 52.

MONTANA:

Spanish Basin, *Rydberg & Bessey* 3676.

Lima, *Rydberg* 2070; *Shear* 320.

IDAHO:

Beaver Canyon, *Rydberg* 2061; *Shear* 305.

Little Potlatch River, *Sandberg, Heller, & MacDougal* 451.

Viola, *Sandberg, Heller, & MacDougal* 504.

Lake Waha, *Heller* 3318, 3288.

WYOMING:

Nash Fork, *Nelson* 7746.

UTAH:

Crazy Womans Creek, *Williams* 2751.

COLORADO:

Chicken Creek, *Tracy, Earl, & Baker* 344.

Routt County, *Cronquist* 539.

Veta Pass, *Shear* 824.

South Park, *Wolf* 295a.

NEVADA:

Summit Lake, *Griffiths & Morris* 303.

Pine Forest Mountains, *Griffiths & Morris* 215.

15j. *Festuca ovina arizonica* (Vasey) Hack.

Festuca arizonica Vasey, *Contr. Nat. Herb.* 1: 277. 1893. Type specimen in the National Herbarium, collected by S. M. Tracy near Flagstaff, Arizona (no. 118).

Festuca ovina arizonica Hack.; *Beal, Grasses N. Am.* 2: 598. 1896. Reduces the above to subspecific rank.

Festuca vaseyana Hack.; *Beal, op. cit.* 601. Type collected at Veta Pass, Colorado, by Dr. George Vasey in 1884.

Festuca scabrella vaseyana Hack.; *Beal, op. cit.* 605. Type from "Colorado (Veta Pass), Vasey, at an altitude of 9,300 feet."

The type specimens of the last two were in Professor Scribner's herbarium, according to Doctor Beal. The National Herbarium specimens show that Doctor Vasey collected both *arizonica* and *ingrata* at Veta Pass, but Doctor Beal's descriptions were certainly based on the *arizonica* specimens in the case of *Festuca scabrella vaseyana* and probably so in the case of *Festuca vaseyana*.

Festuca ovina arizonica occurs in Southern Colorado, Arizona, and New Mexico. A specimen from Oregon, Hoover Creek, Gilliam County (*Leiberg* 137), seems also referable here.

16. *Festuca rigescens* (Presl) Kunth.

Diplachne rigescens Presl, *Reliq. Haenk.* 1: 260. 1830. "Hab. in montanis Peruviae huanoccensibus." Type probably in Presl's herbarium in the University of Prague; a duplicate in Bernhardi's herbarium, now in the possession of the Missouri Botanical Gardens.

Festuca rigescens Kunth, *Enum. Pl.* 1: 403. 1833. Transfers the above to *Festuca*. The only North American specimen we have seen was collected by S. M. Tracy "in open pine woods, 4 miles northeast of Flagstaff, Arizona, June, 1887."

DESCRIPTION.

Densely tufted, smooth and glabrous up to the inflorescence; culms 2-jointed, hard and polished, rigid, 30 to 50 cm. high; sheaths smooth, shorter than the internodes, the basal ones much broadened and somewhat explanate; ligule nearly obsolete, ciliate; blades involute, cylindric, rigid, erect, smooth, pungent at the apex, 8 to 12 cm. long, 1 to 2 mm. in diameter; panicle narrow, erect, 5 to 10 cm. long; rays few, solitary, erect, sparingly branched, angled, nearly smooth; spikelets rather closely 3-flowered, 6 to 7 mm. long; joints of the rachilla cylindric, smooth; glumes thick and firm, the lower 1-nerved, acute, 2 mm. long, the upper 3-nerved, a little longer, both scabrous toward the tips; lemma ovate, thick, convex, somewhat carinate toward the acuminate apex, awnless or very short-awned, scabrous near the tip, 4 to 4.5 mm. long, 5-nerved, the lateral nerves disappearing above the middle; palea as long as the lemma, obtuse, the nerves hispidulous.

This plant is easily distinguishable from any of the North American forms of *F. ovina*. Some European subspecies, however, as *F. ovina vaginata* and *F. ovina psammophila*, have, like the American plant, the combination of rigid leaves and awnless lemmas. It may therefore be necessary to reduce our plant to subspecific rank.

17 *Festuca viridula* Vasey.

Festuca viridula Vasey, Ill. N. A. Grasses 2: 93. 1893. Type in the National Herbarium, collected in California by Bolander.

In the original description Doctor Vasey gives "California" as the locality for the species. At that time he had before him, from California, two specimens from Bolander and one from Lemmon, all of which he labelled *Festuca viridula* in his own handwriting, adding in the case of one Bolander specimen a mark of doubt. Inasmuch as part at least of the accompanying illustration is drawn from a Bolander specimen, the one so marked without mark of doubt is selected as type. This specimen was received from the Thurber herbarium, labelled *Festuca gracillima* Hook., and is doubtless the basis of Doctor Vasey's statement to the effect that Thurber was in error in identifying the species in the Botany of California as *Festuca gracillima* Hook.

In a later publication^a Doctor Vasey cites a specimen collected by Suksdorf on Mount Adams, Washington, as the type, but this statement is incompatible with the original description.

Bolander's specimens probably all came from Summit Station, in the Sierras. At least the second specimen above mentioned is ticketed as being from that place.

DESCRIPTION.

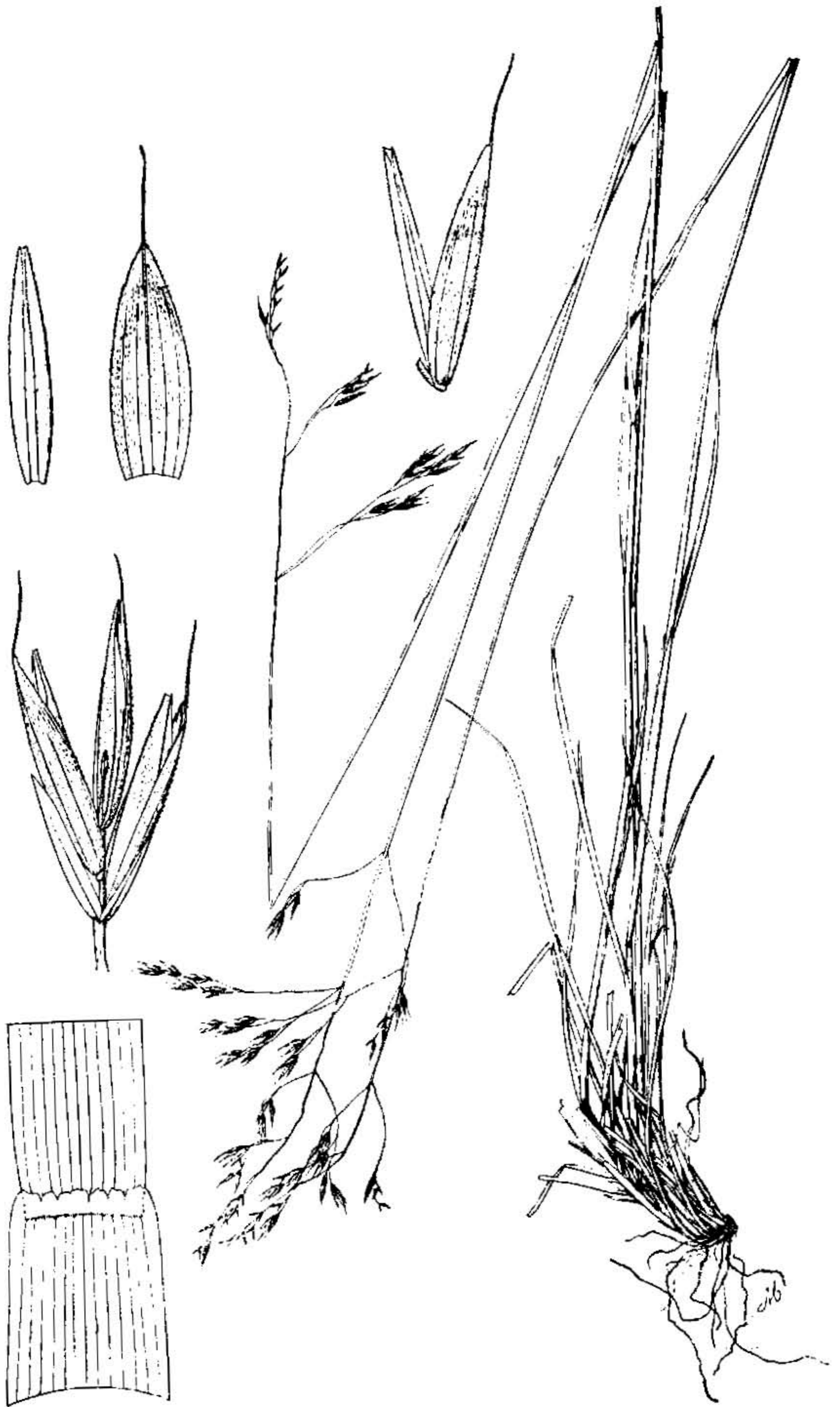
Densely tufted, the coarse roots much interwoven, and the tufts, therefore, difficult to separate; culms erect, smooth, shiny, 3-jointed, 50 to 100 cm. high; sheaths smooth, striate, shorter than the internodes; ligule very short, truncate; blades erect, narrowly linear, acute at the apex, soft, scaberulous above, strictly 7-nerved, the basal ones usually involute, 10 to 30 cm. long, those of the culm shorter, flat or loosely involute; panicle loose and open, suberect, 10 to 15 cm. long; rays faintly angled, swollen at base, scabrous, the upper solitary, the lower in pairs and 5 to 8 cm. long, branched and spikelet-bearing near the tip; spikelets oblong, 3 to 6-flowered, 10 to 12 mm. long, pale green or more commonly purple; joints of the rachilla scabrous, cylindric, 1 to 2 mm. long; glumes membranous, smooth or nearly so, the lower lanceolate, 1-nerved, about 2.5 mm. long, the upper ovate, subacute, 3-nerved, scarious-margined; lemma firm, membranaceous, keeled toward the apex, 5-nerved, oblong-lanceolate, acute, or somewhat mucronate, often somewhat denticulate near the apex, smooth or nearly so, shining rather than dull, 6 to 7 mm. long; palea about equaling the lemma, obtuse, the nerves ciliate.

The species is common in subalpine meadows in Washington, Oregon, and Idaho, and ranges south in the Sierras to middle California.

18. *Festuca howellii* Hack.

Festuca howellii Hack.; Beal, Grasses N. Am. 2: 591. 1896. Type in Herbarium Michigan Agricultural College, collected by Thomas Howell, in the mountains at the head of Deer Creek, Josephine County, Oregon, July 5, 1887; a duplicate in the National Herbarium. No other specimens than those of the type collection are known.

^a Contr. Nat. Herb. 1: 279.



FESTUCA HOWELLII VASEY.

DESCRIPTION.

Densely tufted, with coarse matted roots; culms erect or geniculate at base, 3-jointed, 60 to 70 cm. high; sheaths smooth, mostly shorter than the internodes; ligule very short; blades loosely involute, shining, narrowly linear, scabrid above, 8 to 15 cm. long, about 4 mm. wide, acute at apex; panicle loose and open, 8 to 10 cm. long; lower rays in pairs, the upper solitary, each pulvillus-bearing at base, subterete, scaberulous, naked below; spikelets oblong, 8 to 12 mm. long, 4 or 5-flowered, purple-tinged; joints of the rachilla cylindrical, scaberulous, 1 mm. long; glumes lanceolate, glabrous or nearly so, the lower 1-nerved, 2 to 3 mm. long, the upper 3-nerved, about 4 mm. long; lemma membranaceous, linear-lanceolate, strongly 5-nerved, appressed-hispidulous, 6 mm. long, attenuate into a straight scabrous awn about 2 mm. long; palea obtuse, about equaling the lemma, somewhat scabrous.

PLATE IX.

EXPLANATION OF PLATE.—Drawn from duplicate type from 248 *Howell*, collected in Deer Creek Mountains, Oregon. Plant one-half natural size; details magnified five times.

19. *Festuca altaica* Trin.

Festuca altaica Trin. in Ledeb. Fl. Alt. 1: 109. 1829. "In summa alpe ad fontem fl. Acjulae rarissima."

Festuca scabrella Torr.; Hook. Fl. Bor. Am. 2: 252. 1840. Type probably at the British Museum, collected in the Rocky Mountains by Drummond. Duplicates of the same are in the Torrey Herbarium and in the Gray Herbarium.

The Drummond specimens are most nearly matched in recent collections by plants collected on Mount Albert, Gaspé, by Allen in 1881 and 1882. No recent collection seems to have been made near the type locality. Hooker's figure shows a panicle with ascending rays, but the Gray Herbarium specimens show spreading rays as in most northern material. The nearly smooth and loosely involute leaves are likewise characters which ally the plant to *altaica* proper, rather than to the more scabrous plant of the United States, which, however, it resembles in its rather dull spikelets.

DESCRIPTION.

Densely tufted, with numerous basal leaves; culms erect, smooth or nearly so, 2-jointed, 30 to 90 cm. high; sheaths striate, smooth or the uppermost scabrous; ligule very short; blades mostly involute, smooth or scabrous beneath, especially toward the apex, hispidulous above; panicle ample, loose and open, erect, 10 to 20 cm. long; rays mostly in pairs in about 6 verticels, slender, flexuous, naked below the middle, branched above, pulvillate-thickened at base; spikelets broadly oblong, 3 to 5-flowered, 12 to 15 mm. long, yellowish-green, or more commonly coppery or purple; florets close, nearly parallel to the rachilla; joints of the rachilla cylindrical or slightly clavate, scabrous, 2 to 3 mm. long; glumes smooth, or scabrous near the apex, the lower oblong-lanceolate, obtusish, 1-nerved, 6 to 7 mm. long, the upper ovate-lanceolate, acute, 3-nerved, 8 to 9 mm. long; lemma lanceolate-ovate, attenuate-acute, 5-nerved, finely and densely scabrous, somewhat shiny, 10 to 12 mm. long, firm-membranaceous; palea oblong-lanceolate, notched at apex, the inflexed sides more than half as broad as the internerve, the nerves hispidulous.

The species ranges through Siberia, and in North America occurs in Alaska, Yukon, and on Mount Albert, Quebec.

20. *Festuca hallii* (Vasey).

Melica hallii Vasey, Bot. Gaz. 6: 296. 1881. Type specimens in the National Herbarium, collected in the Rocky Mountains, latitude 39° to 41°, by Hall & Harbour (no. 621), in 1862. These specimens have a narrow strict panicle, and are evidently from high altitudes.

Festuca scabrella major Vasey, Contr. Nat. Herb. 1: 278. 1893. Type specimen in the National Herbarium, collected in Spokane County, Washington, by Suksdorf (no. 118), June 18, 1884. This is a much larger plant than the type of *Melica hallii*, with a larger and looser panicle. Most of the United States material is quite intermediate between the two.

Festuca campestris Rydb. Mem. N. Y. Bot. Gard. 1: 57. 1900. Proposes a new name for the above, on account of the older *Festuca nutans major* Vasey, which latter, however, is a technically unpublished name.

DESCRIPTION.

Densely tufted, the broad leaves numerous; culms erect, 2-jointed, smooth or scabrous, 30 to 90 cm. high; upper sheaths scabrous, closely enveloping the stem, the lower smooth, exceeding the internodes, enlarged and somewhat explanate at base; ligule small; blades hard and strongly involute, pale or glaucous, 10 to 30 or even 50 cm. long, pungently acute, usually very scabrous, the basal ones deciduous from the persisting sheaths; panicle narrow and rather close, often subsecund, 3 to 15 cm. long, rays solitary or in pairs, very scabrous, usually ascending or appressed, spikelet-bearing near the end, the longest less than half the panicle, often pulvillate-thickened at base; spikelets oblong 8 to 12 mm. long, 4 to 6-flowered; glumes unequal, smooth, or scabrous near the apex, the lower lanceolate, 1-nerved, 7 to 8 mm. long, the upper ovate-lanceolate, 3-nerved, 8 to 9 mm. long; lemma firm, dull, 5-nerved, keeled near the apex, densely and finely scabrous, 8 to 10 mm. long, acute or rather abruptly mucronate or short-awned; palea about as long as the lemma, notched at the apex, pubescent on the nerves, the inflexed sides more than half as broad as the internerve.

Festuca hallii ranges from British Columbia to North Dakota, Colorado, and Washington. We would also refer here two specimens from Dawson, Yukon, namely, R. S. Williams, July 13, 1899, and John McClean, no. 84.

The species as thus delimited includes rather diverse-looking material, but in the light of the specimens at hand we can suggest no better disposition. There are good reasons, indeed, for considering it a mere subspecies of *F. altaica*.

21. *Festuca aristulata* (Torr.) Shearns.

Bromus kalmii aristulatus Torr. Pac. R. Rep. 4: 157. 1856. Type in the National Herbarium, collected on Mark West Creek, California, April 30, 1854, by Dr. J. M. Bigelow.

Festuca californica Vasey, Contr. Nat. Herb. 1: 277. 1893. Type in the National Herbarium, collected on hills about Oakland, California, by Bolander (no. 1505) in 1862.

DESCRIPTION.

A coarse tufted grass with numerous basal leaves; culms erect, stout, 2-jointed, about 60 to 120 cm. high, striate, scabrous; sheaths somewhat scabrous, often purplish, the lower long-persisting, the collar and auricles white-pilose; ligule ciliate, very short; blades flat or involute, hard, densely beset with minute scarcely rough granulations, 8 to 40 cm. long, acute at the apex, 2 to 5 mm. broad, inclined to be deciduous from the sheaths; panicle ample, usually loose, 10 to 30 cm. long; rays slender, usually elongated, terete or angled, scabrous, in about 4 whorls of 2 to 3 each, pulvillate-thickened basally; spikelets 8 to 18 mm. long, broadly oblong, compressed, mostly 5-flowered; joints of the rachilla cylindric, scabrous, 2 to 3 mm. long; glumes oblong-lanceolate, firm, smooth, except the scabrous midnerve, the lower 1-nerved, about 5 to 7 mm. long, the upper 3-nerved, 6 to 8 mm. long; lemma 8 to 10 mm. long, lanceolate, convex, firm, 5-nerved, finely and evenly scabrous, acuminate or short-



FESTUCA ARISTULATA (TORR.) SHEAR.



FESTUCA THURBERI VASEY.

awned; palea about as long as the lemma, notched at apex, the nerves hispidulous, the inflexed sides one-third as broad as the internerve. (Plate X.)

This species ranges from middle California northward into Oregon, but only west of the Sierras and Cascades.

EXPLANATION OF PLATE.—Drawn from Howell's no. 26 from Oregon and Bolander's California specimens. Plant natural size; spikelet magnified five times.

21a. *Festuca aristulata parishii* subsp. nov.

Sheaths and the lower part of the stem covered with short retrorse pubescence; leaf blades short, 10 to 25 cm. long.

Mill Creek Falls, San Bernardino Mountains, California, collected by S. B. Parish (no. 5036, type), June 20, 1901, and no. 2490, July 4, 1892.

22. *Festuca thurberi* Vasey.

Festuca thurberi Vasey in Rothrock, Prel. Rep. Botany Cent. Colo. 56. 1874. Type in the National Herbarium, collected by John Wolf (no. 1154) in South Park, Colorado.

Poa festucoides M. E. Jones, Proc. Cal. Acad. 11. 5: 724. 1895. Type from Mount Ellen, Henry Mountains, Utah. A duplicate in the National Herbarium.

Poa kaibensis M. E. Jones, Erythea 4: 36. 1896. Proposes a new name for the above on account of the older *Poa festucoides* Lam.

DESCRIPTION.

Densely tufted with numerous narrow basal leaves; culms erect, hard, scabrous or smooth, 60 to 90 cm. high, 3-jointed; sheaths striate, usually scabrous, shorter than the internodes; ligules scarious, often lacerate, 2 to 4 mm. long, decurrent; blades closely involute, narrowly linear, 6 to 20 cm. long, acute at apex, usually harshly scabrous; panicle 10 to 15 cm. long, loose, slightly drooping; rays solitary, occasionally in twos or threes, scabrous on the angles, spreading or ascending, commonly pulvillate at base, the longest half to two-thirds as long as the panicle, spikelet-bearing only above the middle; spikelets lanceolate, acute, 3 to 6-flowered, 8 to 12 mm. long; joints of the rachilla cylindric, 1 to 1.5 mm. long, scabrous or nearly smooth; glumes membranaceous, smooth or scabrous on the keels, subequal, the lower 1-nerved, 2 mm. long, acute, the upper 3-nerved, 2.5 mm. long, obtusish; lemma elliptic-lanceolate, faintly 5-nerved, convex, rather firm in texture, finely scabrous near the margins or glabrous, cuspidate-acuminate; palea nearly equaling the lemma, oblong, obtuse, the nerves scabrous, the inflexed sides half as broad as the internerve. (PLATE XI.)

Colorado, Wyoming, and Utah.

EXPLANATION OF PLATE.—Drawn from specimens collected by Pammel above Beaver Camp, Colorado, July 3, 1896. Plant one-half natural size; details enlarged five times.

23. *Festuca elatior* L.

Festuca elatior L. Sp. Pl. 1: 75. 1753. "Habitat in Europae pratis fertilissimis."

Festuca pratensis Hudson, Fl. Angl. 37. 1762. Type locality, England.

Festuca poaeoides Michx. Fl. Bor. Am. 1: 67. 1803. "Hab. ad ripas maritimas fluminis S. Laurentii." A fragment of the type is in the Torrey Herbarium.

Festuca poaeoides americana Pers. Syn. 1: 94. 1805. Based on the preceding.

Festuca americana F. G. Dietr. Vollst. Lex. Gaertn. 3: 332. Based on the preceding.

DESCRIPTION.

Loosely tufted, often with short creeping rootstocks; culms smooth, 50 to 120 cm. high, smooth and glabrous, 3 or 4-jointed, erect or geniculate only at the very base; sheaths shorter than the internodes; ligule nearly obsolete; blades 10 to 60 cm. long,

4 to 8 mm. wide, flat, rather firm, smooth beneath, scabrous above, auriculate at base; panicle erect, 10 to 20 cm. long, contracted after blooming, varying from nearly simple to much branched; rays in 3 to 6 sets, rather short, scabrous on the angles, spikelet-bearing nearly to the base; spikelets oblong or lanceolate, 3 to 13, usually 6 or 8-flowered, 9 to 11 mm. long, pale green or more or less purplish; joints of the rachilla smooth, 1 to 1.5 mm. long; glumes lanceolate, the lower 1 to 3-nerved, about 3 mm. long, the upper 3 to 5-nerved, about 4 mm. long; lemma oblong-lanceolate, coriaceous, faintly 5-nerved, 5 to 7 mm. long, scabrid toward the apex, the scarious apex acutish or rarely short-awned; palea about equaling the lemma, oblong, slightly notched at apex, the nerves scabrous, the inflexed sides one-third as broad as the internerve.

Cultivated and more or less established throughout the United States and southern Canada.

23a. *Festuca elatior arundinacea* (Schreb.) Celak.

Festuca arundinacea Schreb. Spic. Fl. Lips. 57. 1771.

Festuca elatior arundinacea Celak. Prod. Fl. Böhm. 51. 1869.

This subspecies is rather sparingly introduced. It is larger and coarser than *F. elatior*, and is conveniently distinguishable by its firmer thicker leaves, the nerves of which are prominent on both surfaces, while in *F. elatior* the nerves are prominent only above.

24. *Festuca obtusa* Spreng.

Festuca nutans Spreng. Fl. Hal. Mant. 34. 1807. "E. Pennsylvania, Muhlenb." Not *Festuca nutans* Moench, Meth. 191. 1794.

Festuca obtusa Spreng. loc. cit. "E. Pennsylvania, Muhlenb." In Muhlenberg's Herbarium in the Philadelphia Academy of Sciences are specimens labeled *Festuca nutans*, and *Festuca sylvatica obtusa*. Apparently both these are herbarium names of Muhlenberg, which were first published by Sprengel. Both these specimens are clearly referable to the common eastern plant which has so long gone under the name of *Festuca nutans*.

Festuca nutans palustris Muhl. Gram. 166. 1817. From Muhlenberg's brief description this is merely a form of *F. obtusa*. It can scarcely be *Festuca shortii* to which Wood^a referred it. There is nothing so labeled in Muhlenberg's Herbarium.

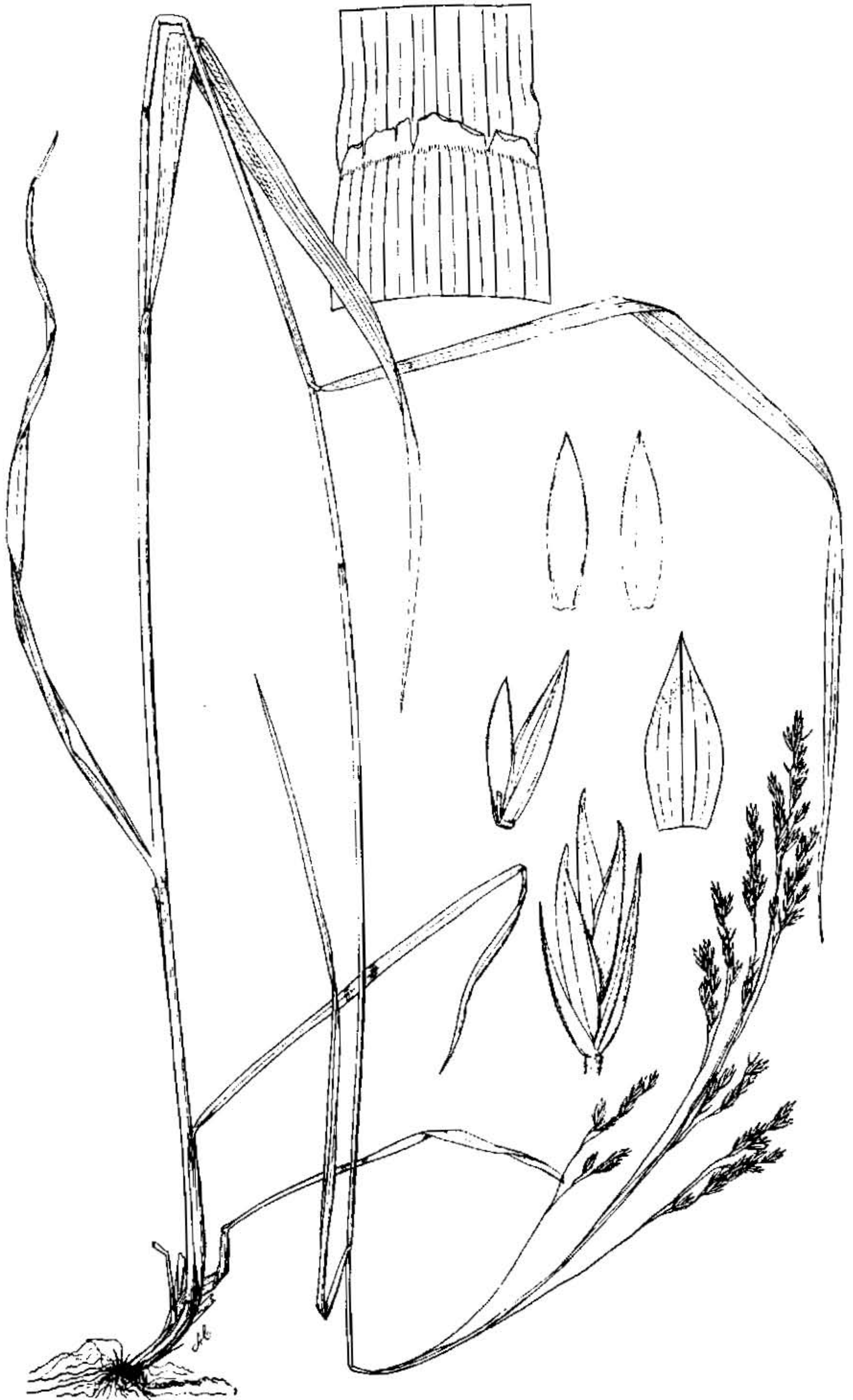
Poa nutans Link, Enum. 1: 86. 1821. Based on *Festuca nutans* Spreng.

DESCRIPTION.

Culms erect, 40 to 120 cm. high, glabrous or sometimes pubescent, 3 or 4-jointed; sheaths striate, shorter than the internodes, glabrous or pubescent; ligule very short; blades dark green, flat, 10 to 30 cm. long, 4 to 7 mm. wide, smooth or scabrous beneath, paler and scabrous or sometimes puberulent above, acute, auriculate at base; panicle very loose, 10 to 20 cm. long, often more or less secund, erect or but little nodding; rays in 3 to 5 sets, mostly in twos, pulvillate at base, scabrous on the prominent angles, sparingly branched and bearing a few spikelets near the end, at first erect, then spreading; spikelets pale green, lanceolate, 3 to 5-flowered, 5 to 7 mm. long; joints of the rachilla cylindric, glabrous, about 5 mm. long; glumes rather firm, scabrid on the nerves, the lower 1-nerved, about 3 mm. long, the upper 3-nerved, about 4 mm. long; lemma coriaceous, smooth, convex, oblong-ovate, acute or acutish, 4 mm. long, the narrow margin hyaline, obscurely 5-nerved, the nerves very obscure; palea firm, equaling the lemma, acute.

Vermont, Ontario, and Minnesota to Georgia and Texas.

^a Bot. & Flor. 399. 1873.



FESTUCA JOHNSONI VASEY.

25. *Festuca shortii* Kunth.

Festuca shortii Kunth; Wood, Class-book 794. 1861. No locality cited under the original very brief description, but a specimen in Short's herbarium in the Philadelphia Academy of Sciences bears the legend, "Barrens of Meade County, Kentucky." The type of Wood is probably in his herbarium preserved in the New York College of Pharmacy Herbarium.

Festuca nutans shortii Beal, Grasses N. Am. 2: 589. 1896. Reduces above to sub-specific rank.

Festuca nutans major Vasey; Beal, l. c., as synonym.

DESCRIPTION.

Culms 60 to 120 cm. high, erect, glabrous, smooth, 3-jointed; sheaths smooth or striate, glabrous, much shorter than the internodes; ligule very short; blades firm, flat, or loosely involute, 10 to 40 cm. long, 3 to 7 mm. broad, smooth or nearly so beneath, scabrous above, auriculate at base; panicle erect, 10 to 20 cm. long, bearing many spikelets; rays in 3 to 5 sets, mostly in twos, ascending or spreading, scabrous on the angles, spikelet-bearing above the middle; spikelets pale green, oblong-lanceolate, 5 to 7 mm. long, 3 to 6-flowered; joints of the rachilla, cylindrical, smooth; glumes firm, scabrous on the nerves above, the lower 1-nerved, 4 mm. long, the upper 3-nerved, 5 mm. long; lemma oblong, coriaceous, smooth, obtusish, obscurely 5-nerved, 4 to 4.5 mm. long; palea firm, smooth, acute, about equaling the lemma.

This species ranges from Illinois and Iowa to Georgia and Texas.

26. *Festuca versuta* Beal.

Festuca texana Vasey, Bull. Torr. Club 13: 119. 1886. Type in the National Herbarium, collected by J. Reverchon (no. 1618), "shades, upper Llano."

Festuca versuta Beal, Grasses N. Am. 2: 589. 1896. Proposes a new name on account of the older *F. texana* Steud. Syn. Pl. Glum. 310. 1855.

Known only from Texas, there collected by Buckley and by Reverchon.

DESCRIPTION.

Stems erect, glabrous or somewhat glaucous, nearly concealed by the sheaths, about 80 cm. high, 3-jointed; sheaths striate, smooth; ligule very short; blades firm, flat, 20 to 25 cm. long, 4 to 6 mm. wide, auriculate at base, nearly smooth beneath, scabrous above; panicle loose, erect, 15 to 18 cm. long, nearly as broad; rays in 3 or 4 sets, slender, pulvillate at base and spreading, scabrous on the angles, bearing a few branchlets near the tips; spikelets oblong-ovate, glaucous, 3 to 5-flowered, 8 to 11 mm. long; joints of the rachilla cylindrical, somewhat scabrous; glumes nearly glabrous, subequal, the lower 1-nerved, 5 mm. long, the upper 3-nerved, 6 mm. long; lemma oblong-lanceolate, acute or apparently acuminate, coriaceous, smooth or nearly so, glaucous, faintly 5-nerved, 6 to 7 mm. long; palea firm, acute, about equaling the lemma.

27. *Festuca johnsoni* (Vasey).

Festuca nutans johnsoni Vasey, Contr. Nat. Herb. 2: 548. 1894. Type in the National Herbarium, collected at Harrison City, Tex., in 1886, by Mr. Johnson. No other specimens have been seen.

DESCRIPTION.

Culms stout, erect, smooth, nearly concealed by the sheaths, about 80 cm. high; sheaths striate, sparsely puberulent; ligule very short; blades flat, rather thick, acuminate, 20 to 30 cm. long, 6 to 10 mm. wide, scabrous on both sides, auriculate at base; panicle loose, erect, 10 to 25 cm. long; rays in 3 to 5 sets, mostly in twos.

slender, scabrous on the angles, flexuous, ascending, sparingly branched, spikelet-bearing above the middle, scarcely pulvillate at base; spikelets green, 2 or 3-flowered, 5 to 7 mm. long; joints of the rachilla short, smooth; glumes firm, scabrous all over, the lower 1-nerved, 4 to 5 mm. long, the upper 3-nerved, 5 to 6 mm. long; lemma lanceolate-oblong, acute or apparently acuminate, 5-nerved, coriaceous, smooth except the scabrid apex, about 5 mm. long; palea nearly equaling the lemma, firm, acute. (PLATE XII.)

EXPLANATION OF PLATE.—Drawn from type specimen. Plant one-half natural size; details enlarged five diameters.

28. *Festuca subuliflora* Scribner.

Festuca subuliflora Scribner in Macoun, Cat. Can. Pl. 5: 396. 1890. Type collected at Goldstream, Vancouver Island, by Macoun (no. 7). It was in the herbarium of Professor Scribner, since destroyed. A duplicate in the herbarium of the Geological and Natural History Survey of Canada has been examined.

Festuca ambigua Vasey, Contr. Nat. Herb. 1: 277. 1893. Type in the National Herbarium, collected by Thos. Howell in Oregon in 1881.

Festuca denticulata Beal, Grasses N. Am. 2: 589. 1896. Changes name of above on account of the earlier *Festuca ambigua* Le Gall.^a

DESCRIPTION.

Culms erect, rather slender, striate, glabrous, 60 to 90 cm. high, 3 or 4-jointed; basal leaves few, those of the culms 3 or 4; sheaths shorter than the internodes, striate, sparsely hispidulous; ligule very short, ciliate; blades green, rather soft, flat or loosely involute, glabrous beneath, hirsutulous above, 10 to 20 cm. long, 3 to 6 mm. broad, acute at the apex; panicle very loose, flexuous, somewhat drooping, 10 to 20 cm. long; rays slender, solitary or rarely in twos, scabrous on the angles, pulvillate at base, the longest about half as long as the panicle, naked below the middle; spikelets pale green or purplish, loosely 3 or 4-flowered, 8 to 12 mm. long; joints of the rachilla hirsute; glumes subulate, glabrous, each 1-nerved, the lower about 3 mm., the upper 4 mm. long; lemma lanceolate, 5-nerved, scabrous toward the apex, keeled half way or more, 6 to 8 mm. long, tipped with a more or less flexuous awn 10 to 15 mm. long, abruptly narrowed at base into a hispid tubular structure encircling the rachilla, which apparently disarticulates halfway between the florets; palea lanceolate, as long as the lemma, the scabrous nerves uniting in the acuminate apex, the inflexed sides one-third as broad as the internerve. (PLATE XIII.)

A very remarkable species, possessing a form of lemma peculiar to itself. The stipitate base of the lemma might better be considered a downward elongation of the callus, surrounding and becoming grown to the rachilla, which has likewise become elongated so that the joint is still at the base of the callus. This conception makes more apparent the relation of the plant to *F. subulata*.

The following specimens belong to this much-confused species:

VANCOUVER ISLAND:

Without locality, Fletcher, June 16, 1885.

WASHINGTON:

San Juan County, *Henderson* 2197.

Seattle, *Piper* in 1889.

Montesano, *Heller* 3998.

Olympia, *Henderson* 2179.

OREGON:

Astoria, *Piper* 6455.

Portland, *Sheldon* 10479.

Without locality, *Howell*, June, 1886.

^a Fl. Morbihan 731. 1852.



FESTUCA SUBULIFLORA SCRIBNER.



FESTUCA ELMERI SCRIBN. & MERR.

CALIFORNIA:

Humboldt Bay, *Chandler* 1184.

Crescent City, *Dary & Blasdale*.

Kneeland, Humboldt County, *Blankinship* 7.

EXPLANATION OF PLATE.—Drawn from 19 *Howell*, collected in Oregon; plant one-half natural size; details magnified five times.

29. *Festuca dasyclada* Hack.

Festuca dasyclada Hack.; Beal, Grasses N. Am. 2: 602. 1896. This well-marked species has been collected only by Dr. C. C. Parry in 1875, somewhere in the Rocky Mountains, "in Utah," according to Beal. The type was the specimen in the herbarium of Professor Scribner, now destroyed. A duplicate in the National Herbarium has no locality given on the label.

DESCRIPTION.

Culms erect or somewhat geniculate, 20 to 40 cm. high, nearly smooth, 3-jointed; sheaths shorter than the internodes, striate, glabrous; ligule very short; blades narrow, soft, folded, glabrous, acute, 5 to 15 cm. long; panicle open, erect, the rays in twos, threes, or fours, ciliate on the prominent angles, mostly branched, a pulvillus at the base of each ray and branch; spikelets pale green, oblong-lanceolate, long-stalked, 2-flowered, 6 to 7 mm. long; joints of the rachilla 1.5 mm. long, scabrous; glumes lanceolate, glabrous, except on the keel, the lower 1-nerved or faintly 3-nerved, 4 mm. long, the upper 3-nerved, 6 mm. long; lemma lanceolate, green, membranous, 5-nerved, somewhat keeled, scabrous-puberulent all over the back, about 6 mm. long, the apex cleft, a scabrous awn 3 mm. long arising from between the teeth; palea a little shorter than the lemma, obtuse at apex, the nerves ciliate-scabrous.

30. *Festuca elmeri* Scribn. & Merrill.

Festuca elmeri Scribn. & Merrill, Bull. Torr. Club 29: 468. 1902. Type in the National Herbarium, collected by A. D. E. Elmer (no. 2101), at Stanford University, California.

DESCRIPTION.

Loosely tufted, the slender culms 40 to 100 cm. high, glabrous, faintly striate, 3-jointed; sheaths striate, nearly smooth, shorter than the internodes; ligule short, ciliate; blades flat or loosely involute, nearly glabrous beneath, scabrous or pubescent above, 20 to 40 cm. long, those of the culm 2 to 4 mm. wide, the basal ones narrower; panicles 10 to 20 cm. long, pale green, loose and open; rays slender, angled, mostly in pairs, smooth or nearly so, pulvillate at base, spikelet-bearing above the middle; spikelets 7 to 10 mm. long, 3 or 4-flowered; joints of the rachilla hispidulous, 1.5 mm. long; glumes unequal, lanceolate, glabrous or nearly so, the lower 1-nerved, 2 to 2.5 mm. long, the upper 3-nerved, 3 to 4 mm. long; lemma lanceolate, green and membranous, 5-nerved, 6 to 6.5 mm. long, minutely hispidulous, cleft at the apex and bearing from between the short teeth a scabrous awn 2 to 8 mm. long; palea narrowly lanceolate, a little longer than the lemma, the two scabrous nerves meeting in the acuminate apex, the inflexed sides very narrow. (Plate XIV.)

This perfectly distinct species has been much confused, there being really considerable material in all the larger herbaria. The following specimens belong here:

CALIFORNIA:

Mendocino County, *Bolander* 6463.

Ukiah, Mendocino County, *Dary & Blasdale* 5029.

Highland Springs, Lake County, *Dary* 6648.

Tassajara Hot Springs, Monterey County, *Elmer* 3322.

CALIFORNIA—Continued.

Stanford University, *Abrams* 1646.

Without locality, *Kellogg & Harford* 1116.*

Santa Cruz, *Anderson* in 1887.

Santa Cruz, *Anderson* in 1888.*

San Francisco, *Bolander* 1507.

Oakland, *Bolander*, June 1, 1866.

Templeton, San Luis Obispo County, *Dary* 7584.

Lake County, *Blankinship* 8.

Marysville Buttes, *Heller* 5562.

OREGON:

Eight Dollar Mountain, Josephine County, *Piper* 3512.

The specimens marked with an asterisk were cited by Doctor Vasey under the original description of *Festuca ambigua*, but the real type of that is a very different plant.

EXPLANATION OF PLATE.—DRAWN from type specimen 2101 *Elmer*, collected at Stanford University, California. Plant one-half natural size; parts enlarged five diameters, except the ovary, which is enlarged ten diameters.

30a. *Festuca elmeri luxurians* nom. nov.

Festuca jonesii conferta Hack.; Beal, Grasses N. Am. 2: 593. 1896. The type was in the herbarium of Professor Scribner, since destroyed by fire. A duplicate is in the National Herbarium. It is from San José Normal School, California, the collector unknown.

Typical *Festuca elmeri* has a very loose panicle and 3 or 4-flowered spikelets. The subspecies has a rather close panicle and 5 or 6-flowered spikelets. The following specimens are in the National Herbarium.

CALIFORNIA:

Stanford University, *Elmer* 2133, 2103.

Without locality, *Bolander* 6073.

Without locality, *Lemmon* 4654.

The name *conferta* has been previously used as *Festuca arundinacea conferta* Hack. Mon. Fest. 157. 1882.

31. *Festuca gigantea* (L.) Vill.

Bromus giganteus L. Sp. Pl. 1: 77. 1753. "Habitat in Europae sylvis siccis."

Festuca gigantea Vill. Hist. Pl. Dauph. 2: 110. 1787. Transfers the species to *Festuca*.

This European species is sparingly introduced in the Eastern States.

DESCRIPTION.

Stems erect, striate, glabrous, 3 to 5-jointed, usually nearly concealed by the sheaths, 60 to 120 cm. high; sheaths smooth or somewhat scabrous; ligule very short, truncate; blades flat, linear-lanceolate, 12 to 40 cm. long, 5 to 15 mm. broad, acute, prominently auriculate at base, dark green and smooth beneath, paler and slightly roughened above, very scabrous on the margins; panicle oblong-ovoid, 10 to 40 cm. long, at length spreading, somewhat drooping; rays slender, mostly in twos, elongate, very scabrous on the angles, each pulvillate at base; spikelets pale green, oblong-lanceolate, 10 to 13 mm. long, 5 to 9-flowered; joints of the rachilla cylindric, scabrous; glumes very acute, glabrous, the lower 1-nerved, 5 to 6 mm. long, the upper 3-nerved, 6 to 7.5 mm. long, broadly hyaline-margined; lemma lanceolate, convex, 5-nerved, sparsely scabrous, especially on the nerves above, 7 to 9 mm. long, bidentate at the scarious apex, bearing a scabrous awn more than twice as long as itself; palea oblong-lanceolate, acute or somewhat notched at the apex, the nerves scabrous, the inflexed sides half as broad as the internerve.

32. *Festuca fratercula* Rupr.

Festuca fratercula Rupr.; Fourn. Mex. Pl. 2: 124. 1881.^a Type collected on Mount Orizaba, Mexico, at 3,500 to 3,580 meters altitude, by Galeotti.

DESCRIPTION.

A loosely tufted, glabrous perennial, 60 to 90 cm. high; stem erect, slender, very smooth and shining, with 3 nodes; offshoots few, extravaginal, rather short; sheaths smooth, much shorter than the internodes; ligule very short, truncate; blades thin, flat, spreading, linear, 10 to 25 cm. long, 3 to 6 mm. wide, quite smooth, scabrous on the margins, attenuate-acuminate to the convolute apex; panicle slender 10 to 15 cm. long, flexuous and somewhat nodding; rays mostly solitary, some in pairs, very slender, scabrous on the angles, usually branched below the middle, the longest 10 cm. long, ascending, flower-bearing in the upper third; spikelets oblong, 3 to 5-flowered, 7 to 12 mm. long; glumes membranous, green, the lower 1-nerved, ovate-lanceolate, acute, 1.5 to 2 mm. long, scarious-margined, scabrous on the keel; the upper oblong, 3-nerved, subacute, scarious-margined, scabrous on the keel; lemma 6 to 9 mm. long, 3-nerved, or with 2 additional faint intermediate nerves, lanceolate, keeled to the base, scabrous, and bearing at apex an awn 0.5 to 2 mm. long; palea linear-lanceolate, acute, scabrous on the nerves, 6 to 6.5 mm. long, the inflexed sides one-third as broad as the internerve; apex of ovary obtuse or emarginate and slightly hairy, the stigmas rather distant; lodicules oblique, entire or lacinate, as long as the ovary or shorter.

The following specimens are somewhat doubtfully referred to this species:

ARIZONA:

Rincon Mountains, *Nealley* 177.

COLORADO:

Pagosa Peak, *Baker* 178, 177, 36, 75, 94.

Durango, *Turvedy* 393a.

33. *Festuca subulata* Trin.

Festuca subulata Trin. in Bong. Mem. Acad. St. Petersburg. VI. 2: 173. 1832. Type from the neighborhood of Sitka, collected by Mertens. Presumably it is in the St. Petersburg Academy of Science. We have seen no authentic specimen, but the ample description accords so well with plants from near the type locality that there is scarcely room to question the identity of the species.

Festuca jonesii Vasey, Contr. Nat. Herb. 1: 278. 1893. Type in the National Herbarium, collected by M. E. Jones "in southern Utah," but Mr. Jones notes that the locality is really in the "Wasatch Mts., City Creek Canyon, above Salt Lake City."

We can find no characters by which *F. jonesii* can be kept distinct from *F. subulata*, even as a subspecies. The two type specimens are from almost the extremes of the range of the species. Contrasted with the Alaska specimens, the type of *F. jonesii* has slightly narrower leaves, and somewhat smaller spikelets, with its florets closer together, and the joints of the rachilla less scabrous. All manner of intergrades occur, however, and in such numbers that no satisfactory line of separation can be drawn.

DESCRIPTION.

Stems erect, obscurely striate, retrorsely scaberulous, 40 to 120 cm. high, 2 to 4-jointed; sheaths striate, nearly smooth, elongate but shorter than the internodes; ligule scarious, about 1 mm. long; blades dark green above, paler beneath, flat, thin, 10 to 30 cm. long, 3 to 10 mm. broad, auriculate at base, usually sharply scabrous on both faces, many-nerved, lax and spreading; panicle very loose and somewhat drooping, 15 to 40 cm. long; rays in 3 to 5 sets, mostly in twos, all pulvillate at base,

^aThe original description is given on p. 46.

slender, flexuous, angled, scabrous, few-branched above the middle; spikelets pale green, sometimes purplish-tinged, oblong-lanceolate, 3 to 5-flowered, 7 to 12 mm. long; joints of the rachilla cylindric, usually curved, scabrous, 1 to 2 mm. long; glumes subulate, glabrous, the lower 1-nerved, 2 to 3 mm. long, the upper 3-nerved, 3 to 4 mm. long, each sparsely scabrous near the apex; lemma green, membranaceous, narrowly lanceolate, 3-nerved, somewhat keeled for its whole length, scabrous toward the apex, 5 to 7 mm. long, attenuate into a scabrous slender awn, 5 to 20 mm. long; palea as long as the lemma or slightly longer, lanceolate, acute, the inflexed sides one-third as broad as the internerve, the nerves scabrous.

The species ranges from southeastern Alaska to northern California, and in the Rocky Mountains to Wyoming and Utah.

The following collections are representative:

ALASKA:

Foggy Bay, *Coville & Kearney* 2572.

Howkan, *Evans* 120.

Cape Fox, *L. J. Cole*, July 26, 1899.

BRITISH COLUMBIA:

Queen Charlotte Island, *Newcombe*, July 24, 1897.

Agassiz, *Macoun* 89.

Chilliwack Valley, *Macoun* 26113.

WASHINGTON:

Klickitat County, *Suksdorf* 170.

Seattle, *Piper* 938, 957.

Clallam County, *Elmer* 1918, 1916.

Blue Mountains, *Horner* 559.

Clark Springs, Spokane County, *Kreager* 38.

OREGON:

Wallowa Mountains, *Cusick* 2507.

Eagle Creek, *Cusick* 2434.

CALIFORNIA:

Moulton, Warner Mountains, *Griffiths & Hunter* 473.

IDAHO:

Lake Cœur d'Alene, *Sandberg, Heller, & MacDougal* 542.

WYOMING:

Welcome, *Williams* 2685.

UTAH:

Ogden, *Tracy* 363.

MONTANA:

Bozeman, *Shear* 465.

Columbia Falls, *Blankinship* 1042.

Subgenus III. HESPEROCHLOA subgen. nov.

Perennials, densely tufted, but producing occasional stout extravaginal stolons, stigmas elongate, the numerous short branches arising from all sides, simple or but little dentate; ovary deeply sulcate near the apex anteriorly, sparsely hispidulous above; caryopsis beaked and bidentate at apex; hilum linear.

34. *Festuca confinis* Vasey.

Poa? kingii Wats. Bot. King. Explor. 387. 1871. Type in the National Herbarium, collected by Watson in the East Humboldt Mountains, Nevada, July, 1868, altitude, 8,000 feet.



FESTUCA CONFINIS VASEY.

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Festuca confinis Vasey, Bull. Torr. Club, 11: 126. 1884. Type in the National Herbarium, collected by Dr. George Vasey at Penn Gulch, Colorado, altitude 8,000 feet.

Festuca kingii Scribner, U. S. Dept. Agr. Div. Agrost. Bull. 5: 36. 1897. Transfers *Poa? kingii* Wats.

Festuca watsoni Nash in Britt. Man. 148. 1901. Proposes a new name for *Poa? kingii* Wats. on account of the older *Festuca kingiana* Endl.

DESCRIPTION.

Perennial, pale green, usually densely tufted, but occasionally producing stout, scaly, extravaginal stolons; culms stout, striate, glabrous, 40 to 100 cm. high, mostly 2-jointed; sheaths smooth, striate, about half as long as the internodes; ligule scarious, ciliate 1 to 7 mm. long; blades firm, flat, or loosely involute, coarsely striate, acute, 10 to 30 cm. long, 3 to 6 mm. wide; panicle narrow, erect, 8 to 20 cm. long; rays short, appressed, scabrous, in 6 to 8 sets of 1 to 3 each, floriferous nearly to the base; spikelets rather turgid, 3 to 5-flowered, 6 to 10 mm. long; joints of the rachilla cylindrical, 1 to 2 mm. long, scabrous on the basal half; glumes broadly lanceolate, sub-scarious, nearly smooth, shining, the lower 1-nerved, 3 to 4.5 mm. long, the upper 3-nerved, one-half longer; lemma ovate, acuminate, convex, faintly nerved, scabrous all over the back, 5 to 8 mm. long; palea broadly lanceolate, obtuse, scabrous-ciliate on the keels, shorter than the lemma, the inflexed sides one-third as broad as the internerve; ovary sparsely hispidulous at apex, the stigmas 3 or 4 times as long. (PLATE XV.)

This species occurs in California, Nevada, southeastern Oregon, Utah, Wyoming, Montana, and Idaho.

EXPLANATION OF PLATE.—DRAWN from specimen collected on Stone Prairie, Larimer County, Colorado, by Osterhout, June 23, 1897; plant one-half natural size; ovary enlarged ten diameters, the other parts five diameters.

34a. *Festuca confinis rabiosa* subsp. nov.

Leaves narrow, closely involute; lemma short-awned.

Collected on a branch of Crazy Womans Creek, Wyoming, at 2,700 meters altitude, by Williams and Griffiths (no. 25), July 3, 1898.

UNIDENTIFIED SPECIES.

Festuca? delawarica (Link) Kunth, Rev. Gram. 1: 129. 1829. (*Poa delawarica* Link, Hort. Berol. 1: 174. 1827.) Type from Delaware. Evidently a Puccinellia.

Festuca glabra Spreng. Syst. 1: 353. 1824. Type from "Long Island, Amer. Bor." Probably a Puccinellia.

Festuca pseudodurinuscula Steud. Syn. Pl. Gram. 312. 1854. Based on Drummond's 398 from Texas. An unnamed variety of the above is mentioned, based on Drummond's 389, also from Texas. A specimen of the latter in the Gray Herbarium is *Festuca obtusa* Spreng., but this is not consistent with Steudel's description.

Festuca texana Steud. Syn. Pl. Gram. 310. 1854. Based on Drummond's 387 from Texas.

Festuca villiflora Steud. Syn. Pl. Gram. 313. 1854. Type from Labrador. Probably *F. rubra kitaibeliana* ex char.

SPECIES EXCLUDED.

Festuca acutiflora Bigel. Fl. Bost. 37. = *Panicularia acutiflora*.

Festuca agrostidea La Pylaie, Mem. Soc. Linn. Par. 4: 421, nom. nud.

Festuca aquatica Bosc; R. & S. Syst. 2: 615, as synonym. = *Leptochloa fascicularis*.

Festuca bicornis Schreb.; Steud. Nom. ed. 2. 1: 628, as synonym. = *Panicularia acutiflora*.

Festuca borealis Mert. & Koch in Röhling, *Deutschl. Fl.* ed. 3. 1: 664. = *Graphephorum arundinaceum*.

Festuca borealis Hook. *Fl. Bor. Am.* 2: 251. = *Graphephorum festucaceum*.

Festuca brevifolia Muhl. *Gram.* 167. = *Triplasis purpurea*.

Festuca caroliniana Steud. *Syn. Pl. Gram.* 312. = *Triplasis purpurea*, ex char.

Festuca cepacea Phil. *Linnaea* 33: 297. = *Melica cepacea* Scribner.

Festuca clandestina Muhl. *Gram.* 162. = *Leptochloa fascicularis*.

Festuca decumbens L. *Sp. Pl.* 1: 75. = *Triodia decumbens*.

Festuca diandra Michx. *Fl. Bor. Am.* 1: 67. pl. 10. = *Korycarpus diandrus* Kuntze.

Festuca distans Kunth, *Rev. Gram.* 1: 129. = *Puccinellia distans*.

Festuca distichophylla Michx. *Fl. Bor. Am.* 1: 67. = *Distichlis spicata*.

Festuca fascicularis Lam. *Tab. Encycl.* 1: 189. = *Leptochloa fascicularis*.

Festuca filiformis Lam. *Tab. Encycl.* 1: 191. = *Leptochloa mucronata*.

Festuca fluitans L. *Sp. Pl.* 1: 75. = *Panicularia fluitans*.

Festuca grandiflora Lam. *Tab. Encycl.* 1: 84. = *Arundinaria macrosperma* fide Steudel, *Nom.* ed. 2. 1: 630.

Festuca grandiflora Lam. *Tab. Encycl.* 1: 191. = *Panicularia acutiflora*.

Festuca macrostachya Torr. & Gr. *Pac. R. Rep.* 2^d: 177, nom. nud. = *Scleropogon brevifolius*, staminate plant, fide specimen in Herb. Gray.

Festuca multiflora Walt. *Fl. Car.* 81. = *Leptochloa mucronata*.

Festuca neogaea Steud. *Syn. Pl. Gram.* 313. Through the kindness of Mons. Raymond Le Bey we have received some spikelets of the type of this plant preserved in the University of Caen. The species is unquestionably *Poa eminens* Presl (*Poa glumaris* Trin.).

Festuca nervosa Hook. *Fl. Bor. Am.* 2: 251. = *Poa nervosa*.

Festuca ? nuttalliana Kunth, *Rev. Gram.* 1: 129. = *Puccinellia airoides*.

Festuca obtusiflora Willd.; Spreng. *Syst.* 1: 356. = *Leptochloa dubia*.

Festuca polystachya Michx. *Fl. Bor. Am.* 1: 66. = *Leptochloa fascicularis*.

Festuca procumbens Muhl. *Gram.* 160. = *Leptochloa fascicularis*.

Festuca prostrata Muhl.; Merrill, *Div. Agrost. Circ.* 27: 5. = *Leptochloa fascicularis*.

Festuca purpurea F. Newell, *Sel. Pl. Indust. Cult.* 88. = *Triplasis purpurea*.

Festuca purpurea Schreb.; Steud. *Nom.* ed. 2. 1: 632. = *Triodia cuprea*.

Festuca rigida (L.) Kunth, *Rev. Gram.* 1: 129. 1829. = *Scleropoa rigida*.

Festuca spicata Nutt. *Gen.* 1: 72. = *Distichlis spicata* ex char.

Festuca spicata Pursh, *Fl. Am. Sept.* 1: 82. = *Agropyron divergens* Nees.

Festuca triticea Lam. *Tabl. Encycl.* 1: 190. = *Distichlis spicata*.

Festuca triticoides Lam.; R. & S. *Syst.* 2: 596. = *Distichlis spicata*.

Festuca unioloides Willd. *Enum. Hort. Berol.* 1: 3. pl. 3. = *Bromus unioloides*.

Festuca virgata Lam. *Ill.* 1: 189. = *Leptochloa virgata*.

NOTES ON MEXICAN SPECIES.

The Mexican species of *Festuca* are too poorly known and too sparsely represented in our herbaria to permit of satisfactory treatment at present. The following notes give our present knowledge concerning them:

Festuca octoflora Walt.

The following Mexican specimens have been examined:

Guadalupe Island, *Palmer* 657.

Hanson's ranch, *Orcutt*, July 9, 1884.

Guadalupe Ranch, *Orcutt* 1432 in part.

San Martin Island, *Anthony* 214.

Todos Santos Island, *Anthony* 195.

Festuca octoflora hirtella Piper.

See page 12.

Festuca pacifica Piper.

See page 12.

Festuca myuros L.Near Toluca, State of Mexico, *Rose & Painter* 6786.Mount Iztaccihuatl, *Deam* 22.**Festuca megalura** Nutt.

See page 17.

Festuca rubra glaucodea Piper.

See page 22.

Festuca ovina elliptica (Beal).

Festuca amplissima elliptica Beal, *Grasses N. Am.* 2: 603. 1896. Type collected in the Sierra Madre, Chihuahua, by Pringle (no. 1438). Also collected in the State of Durango, by Rose (no. 2358).

This plant is closely allied to *F. ovina arizonica* Hack., differing in its broader, loosely involute leaves, which are scabrous above and smooth beneath, and perhaps in a taller habit. Some specimens of Pringle's 1438 are awnless, others are short-awned.

Festuca hephaestophila Nees.

Festuca hephaestophila Nees; *Steud. Syn. Pl. Gram.* 310. 1854. Type Hartweg's no. 629 from Volcan de Agua, Guatemala.

DESCRIPTION.

Densely tufted, the underground portions of the stems erect or decumbent, densely covered by the persisting brown scarios sheaths; culms erect, 10 to 40 cm. high, smooth, 2-jointed; sheaths of the culm elongated, extending halfway to the panicle or more, smooth, somewhat glaucous; ligule very short; blades straight or curved, closely involute, firm, glaucous, acute at apex, slightly scabrous on the margins, 2 to 6 cm. long; panicle purple, erect, narrow, usually close, 2 to 5, rarely 8, cm. long; rays short, solitary, scabrous on the angles, floriferous nearly to the base; spikelets 3 or 4-flowered, 5 to 6 mm. long, somewhat glaucous; joints of the rachilla cylindrical-clavate, nearly smooth, 1 mm. long; glumes unequal, smooth or scabrous on the keels, scarios-margined, the lower subulate-triangular, 1-nerved, 2 to 3 mm. long, the upper 3-nerved, rarely 5-nerved, 4 to 4.5 mm. long; lemma firm, convex, faintly nerved, ovate-oblong, acuminate, smooth, 3 to 5 mm. long; palea oblong, shorter than the lemma, bifid at apex, the nerves scabrous; ovary glabrous at apex.

The following specimens have been examined:

Mount Orizaba, *Liebmann* 409.

Mount Orizaba, *Pringle* 8588.

Nevada de Toluca, *Pringle* 4221.

Iztaccihuatl, *Purpus* 228.

Festuca liebmanni Fourn.

Festuca liebmanni Fourn. *Mex. Pl.* 2: 124. 1881.

"Foliis scaberrimis longissimis lineari-lanceolatis, summo paniculam superante, ligula brevi fimbriata; panicula racemosa erecta, axillis glabris, radiolis appressis scabris; spiculis 4-5-floris, flore terminali abortivo; glumis valde inaequalibus, superiore fere

duplo majore obtusa; palea inferiore 5-nervi apice potissimum et in mesonervo prominente scabra, secus marginem erubescens, apice longe mucronata; palea superiore angusta brevior bidentata.

"Absque loco (Liebm. n. 517)."

This species is unknown to us.

Festuca toluensis H. B. K.

Festuca toluensis H. B. K., together with its supposed synonyms *F. multiculmis* Steud., and *F. aequipaleata* Fourn., belong to a group of Mexican species that we are unable to clear up with the evidence and material at hand. The group differs from other Mexican species by the leaves possessing large ligules and the palea being bifid. The species are allied to *F. thurberi* Vasey, but differ in the bifid palea and awned lemma.

The following are the original descriptions:

Festuca toluensis H. B. K. Nov. Gen. & Sp. 1: 153. 1815.

"*F. culmis, vaginis foliisque scabris, setaceo-triquetris; panicula simplici, laxa, ramis alternis, rhachique scabris; spiculis obovato-oblongis, compressis, subsexfloris; glumis paleisque scabris; arista brevi.*

"*Crescit in montosis, scopulosis, apricis regni Mexicani, inter Islahuuca et Toluca, alt. 1380 hexap. ♀ Floret Septembri.*

"*Radix fibrosa. Culmi caespitiosi, erecti, bipedales, simplices, striati, scabriusculi. Folia convoluto-setacea, triquetra, apice subulata, scabra. Vaginae striatae, carinatae, scabrae. Ligula ovata, obtusa, glabra. Panicula simplex, laxa, quadri- aut quinquepollicaris, ramis alternis, adscendenti-patulis, triquetris, scabris, distantibus. Rhachis triquetra, scabra. Spiculae obovato-oblongae, quinque- aut sexflorae, floribus distantibus. Glumae ovato-lanceolatae, acuminato-subulatae, carinatae, purpurascens, scabrae, inaequales, inferior dimidio brevior et angustior, superior spicula dimidio brevior. Paleae lanceolatae, purpurascens, scabrae, apice bidentatae, inferior superiore paullo longior, inter dentes breviter aristata, superior bicarinata.*"

Festuca multiculmis Steud. Syn. Pl. Gram. 310. 1854.

"*Radice validule fibrosa, caespitifera, caespitibus constantibus e plurimis culmis sterilibus foliiformi convolutis rigidis basi vaginatis et foliiferis culmum fertilem (solitarium, an semper) aequantibus; vaginis striatis foliis brevibus convolutis; culmi floriferi foliis inferioribus sterilibus similibus, superioribus planiusculis angustissimis; vaginis scabriusculis; panicula simplici (2-3-pollicari) laxa; radiis solitariis alternis inferioribus 3- superioribus uni-spiculatis; spiculis ovatis patulis laxis (3''' et ultra longis) sub-5-floris glumis inaequalibus flosculis brevioribus; valvula inferiore scabra fusco purpurea infra lutescenti-albida obscure nervosa simpliciter acuminata vel ex apice brevissime bidentula aristulata. An *F. toluensis* H. B. var.? Heller Hrbr. nr. 306. Mons Toluco Mexico.*"

Festuca aequipaleata Fourn. Mex. Pl. 2: 125. 1881.

"*Differt a *F. Toluensi* foliis retrorsum scabris, paleis aequalibus, inferiore breviter mucronata, superiore profunde bifida.*

"*In monte Orizabensi, 14,000' (Liebm. n. 511, 513).*"

In the National Herbarium are two sheets of specimens from Fournier, one of no. 511, Liebmann, the type of *F. aequipaleata* Fourn., the other no. 510, Liebmann, referred by Fournier to *F. toluensis* H. B. K. Both of these sheets are mixtures, each containing apparently two species, representing in all three species, or else three forms of one variable species. The specimens all agree in having large ligules awned lemmas, and bidentate paleae, but differ in the form of the panicle, the size of the spikelets, and the shape of the florets. To complicate matters still more the remaining sheets examined all differ more or less, while retaining the essential char-

acters of tufted habit, narrow involute leaves, long ligule, and awned lemma. Additional material is necessary before any satisfactory conclusion can be reached.

Specimens have been examined as follows:

Nevada de Toluca, *Rose & Painter* 7983.

Mount Orizaba, *Scaton* 193, 228.

Without locality, *Liebmann* 510, 511.

San Luis Potosí, *Parry & Palmer* 924.

Near Cima, *Rose & Painter* 7208.

Festuca rosei sp. nov.

Perennial, tufted; culms stout, over 1 meter high, 4 or 5-jointed, smooth and glabrous; sheaths smooth, those of the lower internodes equaling or exceeding them; ligule short, ciliate; blades of the numerous basal leaves filiform and involute, smooth, 30 to 40 cm. long, those of the culm stouter; panicle narrow, erect, about 20 cm. long; rays in about 5 sets, solitary, but nearly all with a short basal branch, somewhat scabrous on the angles; spikelets purplish, somewhat glaucous, oblong, 7 to 9 mm. long, 3 to 5-flowered; joints of the rachilla nearly smooth, cylindrical; glumes unequal, firm in texture, scabrous on the nerve above, the lower lanceolate, 1-nerved, 3 to 4 mm. long, the upper oblong, 3-nerved, 4 to 5 mm. long; lemma firm in texture, with a very narrow scarious margin, ovate-lanceolate, acuminate, obscurely glaucous, 6 to 7 mm. long; palea lanceolate, bidentate, scabrous on the nerves, the inflexed sides less than half the internerve.

Type specimen collected near Cima, State of Mexico, by J. N. Rose and J. H. Painter (no. 7210), September 19, 1903.

This species is readily distinguished from any other known to us by its very slender leaves, stout culms, short ligules, and awnless lemmas.

Festuca willdenowiana Schultes.

Festuca mexicana Willd.; Spreng. Syst. 1: 356. 1825.

"*F. panicula nutante pauciflora, ramis flexuosis, spiculis 3-floris strigoso-hispidis aristatis, foliis linearibus angustissimis. Mexico.*"

Festuca willdenowiana Schultes, Mant. 3: 650. 1825. Changes name of above, owing to the older *Festuca mexicana* R. & S. Syst. 2: 732. 1817.

Fournier, followed by Hemsley, refers to this species a specimen collected by Schaffner without locality.

We have seen no authentic material of this species, but we would refer to it with little doubt the following specimens: *Scaton* 227 B, collected on Mount Orizaba, 4,200 meters altitude, August 7, 1891, and *Pringle* 4484, Sierra de las Cruces, State of Mexico, August 12, 1893. The former specimen is the type of *Festuca rubra pauciflora* Scribner.^a

DESCRIPTION.

A tufted perennial; culms slender, erect, smooth and shining, 3-jointed, about 60 cm. high; sheaths striate, glabrous, shorter than the internodes; ligule nearly obsolete; blades narrow, pale green, rather soft, very smooth, loosely involute, 10 to 45 cm. long, acute at the apex; panicle narrow, 10 to 15 cm. long, nodding; rays slender, solitary, ascending, in about 3 sets, scabrous on the angles, pulvillate at base; spikelets pale green or somewhat purplish, lanceolate, 3 or 4-flowered, 8 to 10 mm. long; joints of the rachilla cylindrical, scabrous, 1 to 1.5 mm. long; glumes glabrous, unequal, the lower subulate-lanceolate, 1-nerved, 2 to 3 mm. long, the upper

^a Proc. Am. Acad. 28: 123. 1893.

3-nerved, 4 mm. long; lemma lanceolate, plainly 5-nerved, convex, the whole back appressed-scabrous or nearly hirtellous, about 7 mm. long, acuminate or often short-awned; palea linear-lanceolate, cleft at apex, about equaling the lemma, the nerves scabrous, the inflexed sides half as broad as the internerve.

***Festuca fratercula* Rupr.**

Festuca fratercula Rupr.; Fourn. Mex. Pl. 2: 124. 1881.

"Culmo fere tripedali scabro; foliis 3''' latis, retrorsum scabris, longis, planis, apice longe convolutis; ligula brevissima; panícula libera effusa fere pedali folium summum longe superante, radiis geminis divaricatis inaequalibus parce divisis; spiculis 3-floris cum terminali quarto abortivo; glumis inaequalibus acutis, floribus teretibus remotis, palea inferiore acuta potissimum in floribus summis breviter mucronata, glabra; squamulis lanceolatis ovarium aequantibus.

"In humidis inter Pinos montis Orizabensis, 11-12000' (Gal. n. 5778); *Cumbre de Estepa*, agosto (Liebm.)"

We have seen no Mexican specimens of this species, but have referred to it several collections from the United States.^a

***Festuca amplissima* Rupr.**

Festuca amplissima Rupr.; Fourn. Mex. Pl. 2: 125. 1881.

Type collected by Galeotti, "Secus rivulos pr. Vaqueria del Jacal in monte Orizabensi," 3.225 meters.

DESCRIPTION.

Culms stout, 1 to 1.5 meters high, smooth or scabridulous, firm, 4 or 5-jointed; sheaths glabrous, striate above, shorter than the internodes, the lowermost becoming fibrous when old; ligule very short, truncate; blades flat or loosely involute, 6 to 12 mm. broad, 30 to 50 cm. long, slightly scabrous on each side; panicle 30 to 50 cm. long, erect, diffuse; rays in about 8 sets of 2 or 3 each, scabrous, branched; spikelets green or purplish, long-stalked, oblong-elliptic, flattened, 5 to 9-flowered, 9 to 13 mm. long; joints of the rachilla scabrous, about 1 mm. long; glumes unequal, glabrous, the lower 1-nerved, 3 to 3.5 mm. long, the upper broader, 3-nerved, 5 to 6 mm. long; lemma 6 to 7 mm. long, lanceolate, finely scabrous, subcarinate, the nerves rather prominent, acute; palea acute, a little shorter than the lemma, the nerves scabrous, the inflexed sides about half the width of the internerve.

Readily recognized by its stout habit and ample floribund panicle.

The following specimens have been examined:

Sierra de Ajusco, *Pringle* 9555.

Sierra de San Felipe, *C. L. Smith* 924.

Mount Zempoaltepec, *Nelson* 648.

Mountains near Patzcuaro, *Pringle* 3945.

Mount Orizaba, *Liebmunn* (ex Fournier).

Desierto Viejo, *Bourgeau* 1307 (ex Fournier).

***Festuca livida* (H. B. K.) Willd.**

Bromus lividus H. B. K. Nov. Gen. & Sp. 1: 150. *pl.* 689. 1815. "Crescit in alta planitie Toluca, alt. 1380 hexap."

Schedonorus lividus R. & S. Syst. 2: 707. 1817.

Festuca livida Willd. in Spreng. Syst. 1: 258. 1825.

Helleria livida Fourn. Mex. Pl. 2: 129. 1881. All of these are based on *Bromus lividus* H. B. K.

Festuca grandiflora Steud. Syn. Pl. Gram. 311. 1854. Based on Heller's 315 from Volcano de Toluca.

^aSee p. 39 above.

DESCRIPTION.

Densely tufted; culms smooth, 10 to 20 cm. high, nearly covered by the overlapping sheaths; sheaths smooth, about 6 to each culm; ligule truncate, scarious, 0.5 mm. long; blades closely involute, very smooth, erect, 5 to 8 cm. long; panicle consisting of few to several (2 to 15) large purple spikelets; spikelets 10 to 14 mm. long, 2 to 4-flowered; joints of the rachilla hispidulous, 1 to 1.5 mm. long; glumes subequal, lanceolate, smooth or minutely scabrous, 10 to 15 mm. long, nearly equaling the spikelet; lemma minutely scabrous, elliptic-lanceolate, 8 to 10 mm. long, bearing a short, straight awn; palea shorter than the lemma, bidentate at apex, scabrous on the nerves, the inflexed sides half as broad as the internerve.

A very peculiar species upon which Fournier founded the genus *Helleria*, which, however, seems not distinct enough from *Festuca*. The species was poorly figured by H. B. K., but has been finely plated by Hemsley.^a

The following specimens have been examined:

Crater of Nevado de Toluca, *Pringle* 4304, *Rose & Painter* 8017.

Iztaccihuatl, *Purpus* 27.

Perote, *Nelson* 45.

Volcano Toluca, *Nelson* 3.

Mount Orizaba, *Liebmann*.

***Festuca procera* H. B. K.**

Festuca procera H. B. K. Nov. Gen. & Sp. 1: 154. 1815. "Crescit locis alsis, subfrigidis regni Quitensis prope Chillo, San Antonio de Lulumbamba et Lloa, inter alt. 1280 et 1470 hexap."

Diplachne procera Spreng. Syst. 1: 351. 1825. "Quito." *Festuca orgyalis* Willd. in herbarium and *F. procera* Humb. are cited as synonyms.

Festuca orgyalis Willd.; Fourn. Mex. Pl. 2: 124. 1886. Based on *Diplachne procera* Spreng.

Fournier cites as a Mexican specimen Bonpland's no. 2285 in Herbarium Mus. Par. "absque loco, e Nova-Hispania," and further remarks that it differs from *F. procera* H. B. K. especially in its smooth culm, implying that *F. orgyalis* is distinct from that. Hemsley cites *F. orgyalis* as from South Mexico—on the authority of Humboldt and Bonpland. But *F. orgyalis* is founded on the name *Diplachne procera* Spreng. and on nothing else; and this in turn seems clearly founded on *Festuca procera* H. B. K., notwithstanding that Sprengel says "culmo procero glabro," while H. B. K. have it "culmo scabro." The literary evidence indicates that the supposed Mexican specimen of Bonpland is probably some of the original material of *Festuca procera*. The species is unknown to us.

***Festuca mirabilis* sp. nov.**

Densely tufted; culms very stout, 1 to 2 meters high, 4-jointed, cylindric, smooth, faintly striate; sheaths striate, scabrous, mostly shorter than the internodes; blades pale-green, firm, mostly folded, 3 to 5 mm. broad, striate and scabrous on both sides, 50 to 80 cm. in length, long-attenuate to the apex; ligule scarious, truncate, short on the basal leaves, 4 to 5 mm. long on the culm leaves; panicle 20 to 30 cm. long, rather loose, usually secund, somewhat drooping, equaled or overtopped by the uppermost leaf; axis smooth below, scabrous above; rays in about seven series, usually in twos, slender, scabrous, simple or with but few branches, spikelet-bearing at the tips; spikelets yellowish-green, strongly flattened, 5 to 7-flowered, 1.5 to 2 cm. long; joints of the rachilla cylindric, 1 to 2 mm. long, strongly scabrous-hirtellous; glumes subulate, the lower 1-nerved, 7 mm. long, the upper 3-nerved, 10 mm. long;

^aBiol. Centr. Am. Bot. 3: 528. pl. 102 b.

lemma sparsely scabro-hirtellous all over, the lower 12 to 15 mm. long, firm, green, strongly keeled nearly to the base, bifid at apex, and bearing a scabrous awn 3 to 4 mm. long; callus prominent, smooth; palea lanceolate, sparsely hirtellous, bifid at apex, equaling or a little exceeding the lemma, the inflexed sides half as broad as the internerve; stamens yellow, linear, 5 mm. long; ovary smooth.

Collected at Alvarez, about 2,700 meters altitude, State of San Luis Potosi, Mexico, by Dr. Edward Palmer, July, 1904.

This remarkable species is larger and coarser than any other native North American or Mexican species.

The following notes have been contributed by the discoverer, Dr. Edward Palmer:

"This grass is called 'zacate yerba,' and causes concern to owners of domestic animals. It grows in low, rich lands in large bunches 3 to 4 feet high, and has a yellowish cast. Domestic animals once injured by eating this grass, and having recovered, are said to avoid it afterwards. Three jackasses were poisoned by it at the time of my visit to Alvarez. They quickly became dizzy and helpless. Doses of oil and beans were promptly administered, which relieved two, but the third died. The animal which died had been on the place for a long time. It is commonly supposed that only animals new to the country eat this grass. It is probable that if the beans had been pounded fine before administering, a more rapid action would have resulted. There was so much good grass this year that it was not necessity that drove the animals to eat this rough, rasp-leaved plant. It is a question whether death resulted from some poisonous quality or from mechanical injury to the stomach caused by the rough leaves."

MEXICAN SPECIES EXCLUDED.

- Festuca fascicularis* Lam. Tabl. Encyc. 1: 189. = *Leptochloa fascicularis* Gray.
Festuca fournieriana Hemsl. Biol. Cent. Am. 3: 581. = *Gouinia polygama* Fourn.
Festuca mexicana R. & S. Syst. 2: 732. = *Brachypodium mexicanum* Link.
Festuca obtusiflora Willd; Spreng. Syst. 1: 356. = *Leptochloa dubia* Nees.
Festuca pendulina Steud. Syst. 1: 356. = *Bromus pendulinus* Sessé.
Festuca pilosa Willd; Spreng. Syst. 1: 356. = *Megastachya panamensis* Presl.
Festuca scabra Lag. Gen. et Sp. 4. = *Brachypodium mexicanum* Link.
Festuca virgata Lam. Ill. 1: 189. = *Leptochloa virgata* Beauv.