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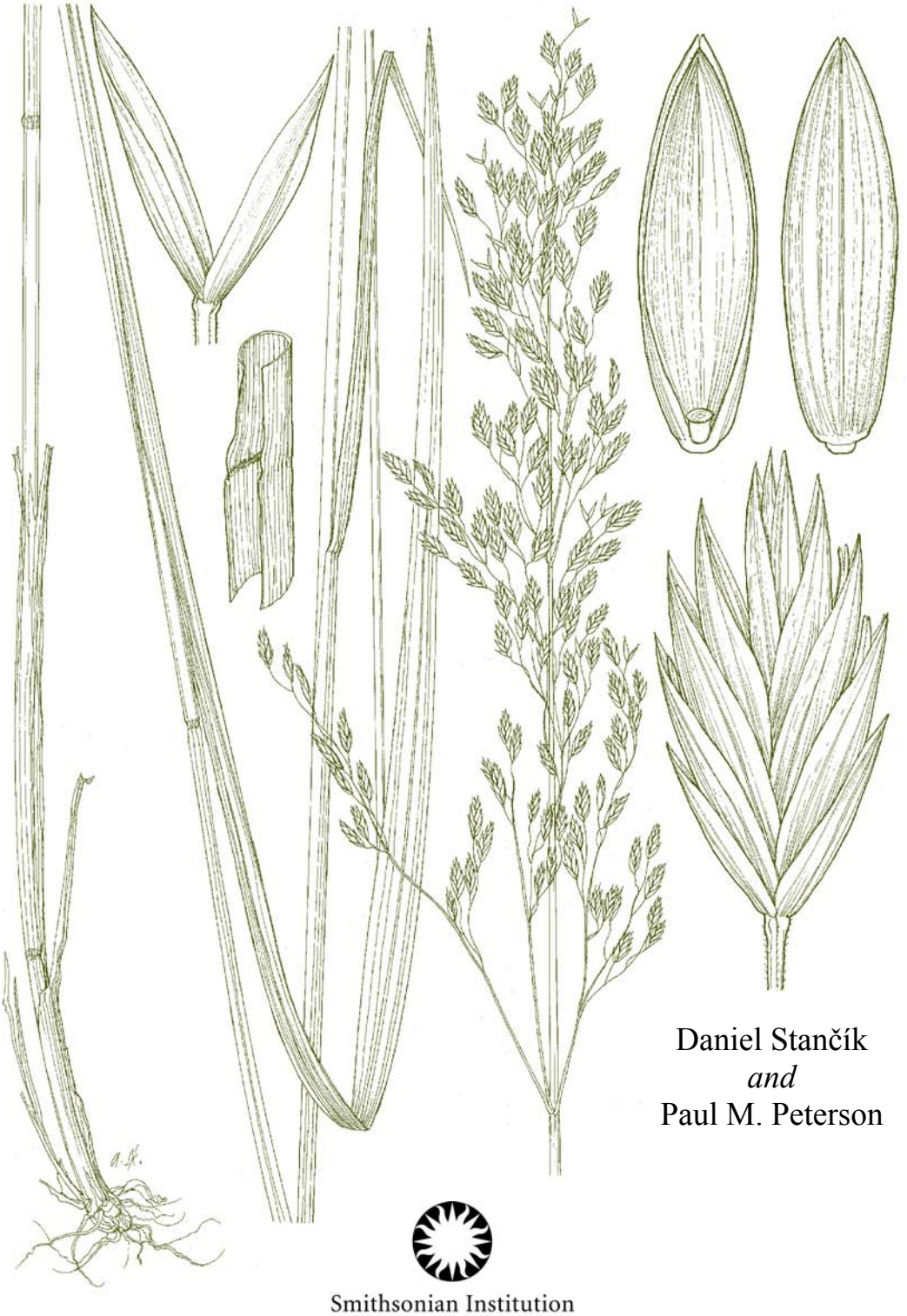
A Revision of *Festuca* (Poaceae: Loliinae) in South American Paramos



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ABSTRACT

Stančík, Daniel and Paul M. Peterson. A revision of *Festuca* (Poaceae: Loliinae) in South American paramos. *Smithsonian Contributions from the United States National Herbarium*, Volume 56, 184 pages (including 97 figures). A taxonomic revision of *Festuca* L. for the South American paramos of Brazil, Colombia, Ecuador, northern Peru, and Venezuela is given. Fifty-six species and six subspecies of *Festuca* are recognized in the study area. Fifty-three species are native to the flora region and three are introduced and cultivated. Keys for determining the species, a classification, synonymies, descriptions, leaf anatomical descriptions, observations, distribution and habitat, specimens examined, illustrations, and leaf surface micrographs are provided. One species: ***F. turimiquirensis*** Stančík & P.M. Peterson, and one subspecies: ***F. tolucensis*** subsp. ***culata*** Stančík & P.M. Peterson, are newly described. The following three names were lectotypified: *Bromus caldasii* Kunth [≡*Festuca caldasii* (Kunth) Kunth], *Festuca fratercula* Rupr. ex E. Fourn. (=*Festuca amplissima* Rupr. subsp. *amplissima*), and *Festuca ovina* subvar. *jamesonii* St.-Yves (=*Festuca glumosa* Hack. ex E.B. Alexeev).

KEY WORDS: Anatomy, Brazil, Classification, Colombia, Ecuador, *Festuca*, Loliinae, Poaceae, Taxonomy, Venezuela.

RESUMEN

Stančík, Daniel and Paul M. Peterson. A revision of *Festuca* (Poaceae: Loliinae) in South American paramos. *Smithsonian Contributions from the United States National Herbarium*, xxx páginas (incluyendo 97 figuras). Se presenta una revisión taxonómica del género *Festuca* (Poaceae) para los paramos del Sudamérica cubriendo la región de Brazil, Colombia, Ecuador, norte del Perú y Venezuela. Se reconocen 56 especies y seis subespecies. Cincuenta y tres especies son nativas de la región, tres son introducidas y cultivadas. En el trabajo se presenta una clave para la determinación de las especies, una clasificación del género en la región estudiada, sinónimos, descripciones, descripción de la anatomía foliar, distribución y ecología de las especies, lista de los especímenes estudiados, ilustraciones y microfotografías de la epidermis foliar. Se describe una nueva especie: ***F. turimiquirensis*** Stančík & P.M. Peterson, y una subespecie ***F. tolucensis*** subsp. ***culata*** Stančík & P.M. Peterson. También se designan lectotipos para tres nombres: *Bromus caldasii* Kunth [≡*Festuca caldasii* (Kunth) Kunth], *Festuca fratercula* Rupr. ex E. Fourn. (=*Festuca amplissima* Rupr. subsp. *amplissima*) y *Festuca ovina* subvar. *jamesonii* St.-Yves (=*Festuca glumosa* Hack. ex E.B. Alexeev).

PALABRAS CLAVES: Anatomía, Brasil, Clasificación, Colombia, Ecuador, *Festuca*, Loliinae, Poaceae, Taxonomía, Venezuela.

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CONTENTS

A Revision of *Festuca* (Poaceae: Loliinae) in South American Paramos

Daniel Stančík[1] and Paul M. Peterson[2]

INTRODUCTION

Composed of more than 400 species, *Festuca* is one of the largest genera in the Poaceae (Clayton & Renvoize 1986; Watson & Dallwitz 1992). The genus has cosmopolitan distribution and it is an important component of grass ecosystems of the temperate zone as well as the alpine grasslands of the tropical zone. Although the diversity of the genus *Festuca* is centered in the Holarctic zone of Eurasia and North America, with about 140 species (Darbyshire et al. 2003), the South American Andes represent a significant center of *Festuca* diversity.

Historical overview.—In South America, taxonomic studies of *Festuca* have been concentrated in the southern part of the continent, i.e. Argentina, Bolivia, Chile, and Peru (Phillipi 1859−60, 1865; Pilger 1898, 1906; Hitchcock 1927; Saint-Yves 1927; Parodi 1935, 1953; Macbride 1936; Infantes 1952; Foster 1966; Türpe 1969; Vareschi 1970; Correa 1978; Matthei 1982; Tovar 1993; Brako & Zarucchi 1993; Zuloaga et al. 1994; Renvoize 1998; Soreng et al. 2003). Taxonomic information on *Festuca* in the paramo zone of South America (Venezuela, Colombia, Ecuador, N Peru, SE Brazil) has been quite sporadic, although botanical collections have increased in the last 50 years. The oldest specimens of *Festuca* from Venezuela were collected during 1906−1911 by A. Jahn, H. Pittier. The first list of Venezuelan grasses was published in 1937 (Anonymous 1937) and only two species of *Festuca* (*F. livida* and *F. tolucensis*) were listed. In 1942, Luces distinguished between the Mesoamerican and the Venezuelan populations of *F. livida* and described a new Venezuelan species, *F. fragilis* (Luces) Briceño. Two species (*F. fragilis* and *F. tolucensis*) were mentioned in the first Venezuelan paramo flora by Vareschi (1970). Later, Alexeev (1986) in his work on *Festuca* for Venezuela, Colombia, and Ecuador mentioned only one species from Venezuela (*F. tolucensis*). The recently published study of Briceño and Murillo (1994) treats *Festuca* in the state Mérida (Venezuela) and lists five native species (*F. pinetorum* Swallen, *F. elviae* Briceño, *F. tolucensis*, *F. fragilis*, *F. coromotensis* Briceño). Stančík and Peterson (2003) indicated that *F. pinetorum* was misidentified and therefore does not occur in Venezuela. In addition, Davidse et al. (1994) mentioned the species *F. amplissima* Rupr.; the only known Venezuelan specimen (Tillett & Hönig 746–765, MO) was collected in Serranía de Perijá on the Colombian-Venezuelan boundary. The earliest collections of *Festuca* from Ecuador and Colombia were made by A. von Humboldt and A.J.A. Bonpland (Expedition to Ecuador in 1802−1803; see Humboldt et al. 1816 and Jörgensen et al. 1999) and J.C. Mutis and F.J. Caldas (Real Expedición Botánica 1783−1808; see Pinto-Escobar 1976, 1985; and Blanco & del Valle 1991). Seven species are present in Humboldt´s collection, five of which were later described by C.S. Kunth as new (*F. andicola*, *F. caldasii*, *F. dasyantha*, *F. procera*, *F. quadridentata*). The *Festuca* specimens collected by T. Haenke (Expedición Malaspina 1789−1794) are of even earlier date, but none of them are from Ecuador or Colombia. The uncertain origin of the type specimen of *Festuca presliana* Hitchc. (= *Bromus depauperatus* J. Presl) is discussed in Stančík & Peterson (2003).

Hitchcock (1927), in his overview of grasses of Ecuador, Peru, and Bolivia, mentioned 17 species. The Ecuadorian species included *F. dasyantha*,

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F. ulochaeta, *F. eminens*, *F. procera*, *F. sublimes*, *F. andicola*, *F. dichoclada*, *F. dolichophylla*, *F. breviaristata. Festuca eminens* is also cited for Colombia. Hitchcock´s publication represents the first overview of grasses for this region but does not reflect the entire diversity, since more than 60 species are known from the region today. Additionally, the accepted "broad species" concept results in the inclusion of species (such as *F. ulochaeta*, *F. dichoclada*, *F. dolichophylla*), that do not appear in Ecuador.

The detailed work of Saint-Yves (1927) has little practical use for *Festuca* taxonomists in South America, as the work suffers from insufficient specimens studied and appears to be focused on minute details rather than estimating species variability and pointing out differences. The taxa were recognized in a confused system of varieties and forms. Later, descriptions of new species were published only occasionally (Swallen 1948) and as checklists of local floras and herbaria collections (Pinto-Escobar 1966, 1985; Acosta-Solís 1969; Burger 1981; Cleef 1981). There treatments mechanically accepted the conclusions of previous authors (principally of Hitchcock) and confusion surrounding species delimitations have continued (e.g., the citation of *F. dolichophylla* for Colombia).

New insight into the taxonomy of *Festuca* in northern South America was brought by Alexeev (1984, 1986), particularly in terms of lectotypification of previously described species and description of new taxa at sub-generic and specific levels. Alexeev (1986) cited 19 native species from Ecuador and Colombia. The work was based on the examination and revision of a limited number of herbarium specimens without the advantage of field work and it could not reflect the entire diversity of the genus in South America. Alexeev´s conclusions were reflected in the checklists of local floras published later (Jörgensen & Ulloa Ulloa 1994; Jörgensen & León Yánez 1999; Luteyn 1999; Rangel 2000). Interest in the study of the Brazilian paramo is recent (Safford 1999a, b).

Taxonomy and Diversity.—Fifty-three native and three introduced species are recognized in the study area. Among them: five species (*F. dinirica*, *F. guramacalana*, *F. hatico*, *F. turimiquirensis* and *F. venezuelana*) and two subspecies (*F. tolucensis* subsp. *culata* and *F. tolucensis* subsp. *perijae*) are recognized as new for Venezuela; twelve species (*F. boyacensis*, *F. chita*, *F. chitagana*, *F. cocuyana*, *F. hatico*, *F. monguensis*, *F. nereidaensis*, *F. pilar-franceii*, *F. toca*, *F. sanctae-martae, F. sumapana*, and *F. woodii*) and one subspecies (*F. amplissima* subsp. *magdalenaensis*) as new for Colombia; six species (*F. carchiense*, *F. holubii*, *F. imbaburensis*, *F. laegaardii*, *F. oroana*, and *F. soukupii*) and three subspecies (*F. chimborazensis* subsp. *micacochensis*, *F. parciflora* subsp. *loxana*, and *F. vaginalis* subsp. *cayambae*) as new to Ecuador; and, one species (*F. renvoizii*) as new to Peruvian jalca (i.e., humid alpine grass ecosystem of the northern Peru).

The species found in South America are attributed to the six subgenera and seven sections of the genus *Festuca*. About 80% of South American *Festuca* species belong to the large cosmopolitan subg. *Festuca*. Remarkably, three subgenera (*Festuca* subg. *Helleria*, subg. *Mallopetalon*, and subg. *Erosiflorae*) and three sections (*Festuca* sect. *Ruprechtia*, sect. *Glabricarpae*, and sect. *Cataphyllophorae*) are endemic or largely endemic to South America.

The distribution of species diversity is not homogeneous in South America. The Andes between central Peru and northern Argentina has the highest species concentration (almost 50% of all South American taxa). In the northern Andes, there are two areas with high species diversity, central Ecuador (Pichincha with 14 species, and Chimborazo with 13 species) and northern Colombia (Boyacá with 14 species). High levels of local endemicity were observed in regions with the highest species diversity, especially in Boyacá.

Similarity of species composition was also analyzed to elucidate the relationships among the South American regions. As expected, strong relationships exist between the *Festuca* species of Ecuador and Colombia, and the *Festuca* species from northern South America ("paramo group") are clearly distinct from the those of central and southern South America.

Biogeography.—The known range of several *Festuca* species is expanded contributing to a better understanding of the biogeography of the genus in South America.

Festuca amplissima was found in northern Colombia (Sierra Nevada de Santa Marta) and on the Colombian−Venezuelan boundary (Serranía de Perijá). This species represents the biogeographical

connection between Mesoamerican and South American flora. The species was originally known from Costa Rica, Guatemala, Mexico, and Panama.

Festuca fragilis was found in Nevado del Cocuy (Dept. Boyacá, Colombia) and was previously reported only from the state of Mérida in Venezuela, ca. 250 km from the Colombian locality.

Festuca ulochaeta was found in the Cordillera Oriental of the Colombian Andes as well as the northern Andes and Cordillera de la Costa of Venezuela, and in Costa Rica. Formerly, this species was known only from the region of Brazilian Shield of southeastern Brazil and northeastern Argentina. This information might be important in determining the origins and phylogeny of other South American species of *Festuca* sect. *Subulatae*.

The first collections of the genus *Festuca* in Colombian Cordillera Occidental are reported: *F. asplundii* (Farallones de Cali and Macizo de Tamaná), *F. sodiroana* (Páramo Frontino), and *F. andicola* (Páramo Frontino).

Festuca caldasii, *F. glumosa*, and *F. sodiroana*, which were formerly regarded as endemic to Ecuador, were confirmed in Colombia, showing the biogeographical relationship between Colombian Cordillera Central and Ecuadorian Andes. Similarily, *Festuca asplundii*, which was originally considered endemic to Colombia and Ecuador, was confirmed in the Andes of northern Peru.

Festuca dinirica and *F. guaramacalana* are the first records of the genus reported from the mountains of National Park Dinira and from the massif of National Park Guaramacal in Venezuela, respectively, and represent the most easterly Andean records of *Festuca*.

Important extra-Andean findings of *Festuca* in Venezuela were made in Cordillera de la Costa en Venezuela. The localities Colonia Tovar and Serranía de Turimiquire represent the most easterly, mountain forests that include *Festuca* in northern South America. These localities are located 250 km and 600 km east of the nearest Andean locality, respectively.

The following species that were formerly mentioned in the floras of Venezuela, Colombia, Ecuador, or Peru were not confirmed: *F. andicola* (excluded from Peru), *F. casapaltensis* Ball (excluded from Ecuador), *F. dasyantha* Kunth (excluded from Colombia), *F. dichoclada* Pilg. (excluded from Ecuador), *F. dolichophylla* J. Presl (excluded from Colombia and Ecuador), *F. ortophylla* Pilg. (excluded from Ecuador), *F. peruviana* Infantes (excluded from Ecuador), *F. pinetorum* (excluded from Venezuela), *F. quadridentata* Kunth (excluded from Colombia), *F. rigescens* (J. Presl) Kunth (excluded from Ecuador), *F. vaginalis* (Benth.) Laegaard (excluded from Colombia), and *F. ulochaeta* Nees ex Steud. (excluded from Ecuador).

MATERIAL AND METHODS

The work presented here summarizes the results of taxonomic and biogeographic research on the genus *Festuca* in paramos of South America that was carried out between 1998 and 2004. Extensive field and herbarium studies were performed to assess the diversity of the genus in this geographic area of South America. The area studied included Brazil, Colombia, Ecuador, northern Peru, and Venezuela. An exhaustive bibliographic search for literature on the taxonomy of *Festuca* was performed, with special focus on the genus in Mesoamerica and South America. The protologues, local floras, and monographs were consulted to document all reports of Fectuca from this area. More than 1,500 specimens of *Festuca* from the study area and 1,000 specimens from other Mesoamerican and South American countries were studied. Specimens are located at AAU, B, BA, BAA, BOG, BOL, CAUP, C, CAR, COL, CUVC, CTES, F, FAUC, FMB, HUA, HERZ, JAUM, JBGP, K, LOJA, LP, LPB, MA, MEDEL, MER, MERC, MERF, MY, NY, QCA, QCNE, QAP, QPLS, P, PORT, PR, PRC, PSO, R, RB, TOLI, TULV, U, UIS, UPTC, US, UTMC, VALLE, VEN, and W (abbreviations according to Holmgren et al. 1998 onwards). The type specimens of all recognized species and nearly all types of their synonyms were examined.

The taxonomic analysis is based on extensive morphological and anatomical comparisons. Twenty-six morphological characters were selected as useful for the descriptions and differentiation among the species. The selected characters were: height of plants, formation of shoot innovations, number and position of the nodes, presence/absence of auricles, length and diameter of the leaf blades,

shape and length of ligule, color and structure of veins, vestiture of culms, length of panicle, length of spikelets (measured total length of spikelet) and number of florets, length, shape and vestiture of glumes, lemma and palea, length of anthers, and length of hilum. After preliminary observations (Stančík 1999), five anatomical characters of the leaf cross sections (number of vascular bundles, number of ribs, distribution of the sclerenchyma, relative density, and length of trichomes) were also included in the study. Anatomical sections were prepared from dry herbarium specimens after hydratation in a soap solution and observed under microscope at 100× magnification.

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TAXONOMIC TREATMENT

Festuca L., Sp. Pl. 1: 73. 1753. Type: *F. ovina* L., Sp. Pl. 1: 73−74. 1753. (lectotype: designated by Nash, Ill. Fl. U.S. Canad., ed. 2, 1:269. 1913; also Jarvis et al., Watsonia 16: 300. 1987).

Perennial herbs, densely or loosely caespitose (forming often large tussocks) or rhizomatous, commonly monoecious, exceptionally dioecious (not in South America). Culms unbranched 0.1–2 m high, below panicle glabrous or finely scabrous, with 1 or more (2–6) glabrous nodes. Innovations extravaginal, intravaginal or mixed. Sheaths with free or partially united margins, non-auriculate (except in *Festuca* subg. *Schedonorus*); basal sheaths occasionally thickened into a bulb; ligules membranous; normally less than 1 mm, rarely to 10 mm long; leaf blades flat but often conduplicate or setaceous and then basal, without cross nerves, 0.2–15 mm wide, basal cataphyls rarely present. Inflorescences an open or contracted panicle. Spikelets usually with 2 or several bisexual or unisexual florets and an apical rudiment, chasmogamous, some species cleistogamous or viviparous i.e., vegetative proliferation of the spikelets, laterally compressed, disarticulating above the glumes and below the florets; glumes lanceolate to ovate, pointed, carinate or non-carinate, shorter than adjacent lemma; lower glume shorter, 1(rarely 3)-nerved; upper glume 3(rarely 5)-nerved; lemmas commonly membranous (rarely coriaceous), rounded (exceptionally carinate), 5-nerved, entire (rarely bidentate), acute, shortly mucronate or awned; awn continuous with midnerve, terminal, rarely subterminal, up to 15 mm long; paleas membranous, two-carinate, two-dentate, as long as the lemma or a little shorter, scabrous at keels, awnless; lodicules two, small, about 1 mm long, two-dentate, hyaline.; stamens 3, anthers 0.4–6 mm long; ovaries glabrous, rarely hairy at apex, styles terminal without an apical appendage; stigmas 2, white. Fruit a caryopsis, free or with lemma adherent, with a linear or sometimes oblong hilum.

Leaf blade anatomy.—Cross sections with five or more vascular bundles, with or without adaxial ribs over the vascular bundles; bulliform cells present or absent; sclerenchyma under abaxial epidermis continuous or discontinuous, adaxial sclerenchyma fascicles present or absent; sclerenchyma sometimes extending to the vascular bundles abaxially and also sometimes adaxially forming girders; hairs on adaxial epidermis dense or scattered, 20–200 μm long, prickles on abaxial epidermis present or absent.

KEY TO THE SPECIES OF *FESTUCA* IN BRAZIL, COLOMBIA, ECUADOR, AND VENEZUELA

1a. Plants rhizomatous; culms solitary 30–100 cm tall or loosely caespitose herbs with culms 80–250 cm tall; plants often in mountain forests 2
1b. Plants densely caespitose, without rhizomes (only several species exceptionally forming short rhizomes inside the tussocks); culms short 8–50(–60) cm tall or culms tall 60–170 cm tall; plants often in mountain grasslands 24

2a. Cataphylls (basal shoots coriaceous or with coriaceous-membranous scales) present 3
2b. Cataphylls absent 6

3a. Panicle branches densely hairy; ligules 1–1.5(–2) mm long ..... **27. F. laegaardii**
3b. Panicle branches glabrous or scabrous; ligules less than 1 mm long 4

4a. Spikelets with 4–6 florets; lower glumes 2–3 mm long; upper glumes 3–4 mm long; lemmas 4–5 mm long, awned; paleas as long as adjacent lemma ..... **30. F. toca**
4b. Spikelets with 2–4 florets; lower glumes more than 3 mm long; upper glumes more than 4 mm long; lemmas more than 5 mm long, short-awned; paleas shorter than adjacent lemma 5

5a. Panicles nutant and nodding, 9–12 cm wide; lower glumes 4–5 mm long; upper glumes 5.5–6.5 mm long; lemmas 6–7 mm long; anthers 1–1.6 mm long ..... **23. F. chitagana**
5b. Panicles erect, 0.5–1 cm wide; lower glumes 3–3.6 mm long; upper glumes 4.5–5 mm long; lemmas 6–6.5 mm long; anthers 3.5 mm long ..... **26. F. hatico**

6a. Auricles large, more than 1 mm long, falcate 7
6b. Auricles absent or small, less than 1 mm long and inconspicuous, not falcate 8

7a. Margins of auricles hairy; upper glumes 4.5–6.5 mm long ..... **12. F. arundinacea**
7b. Margins of auricles without hairs; upper glumes 3.5–4 mm long ..... **13. F. pratensis**

8a. Apex of lodicules hairy ..... **18. F. fimbriata**
8b. Apex of lodicules glabrous 9

9a. Lower glumes 0.8–2.5 mm long 10
9b. Lower glumes longer than 2.5 mm long 15

10a. Lemma awns more than 4 mm long 11
10b. Lemma awns less than 4 mm long 12

11a. Ligules 3–3.5 mm long; lemma awns 9–12 mm long ..... **4. F. flacca**
11b. Ligules 1–2 mm long; lemma awns 5–7 mm long ..... **7. F. tovariensis**

12a. Spikelets 10–13 mm long; lemmas 7–8.5 mm long; anthers 3–3.5 mm long ..... **10. F. reclinata**
12b. Spikelets 7–10 mm long; lemmas 4.5–6.5 mm long; anthers 0.8–1.5 mm long 13

13a. Leaf blades flat; panicles nutant; lemmas awnless ..... **6. F. sodiroana**
13b. Leaf blades conduplicate or involute, sometimes flat; panicles erect; lemmas with awns 0.5–1.5 mm 14

14a. Culms solitary with long rhizomes; glumes and lemmas purple; panicles 0.5–1 cm wide ..... **19. F. andicola**
14b. Culms loosely tufted; glumes and lemmas green; panicles 1–2 cm wide ..... **3. F. elviae**

15a. Ligules 2.5–13 mm long 16
15b. Ligules 0.5–1.5(–2) mm long 19

16a. Ligules 7–13 mm long; spikelets 11–14 mm long; lemmas awnless 17
16b. Ligules 2.5–5 mm long; spikelets 14–17 mm long; lemma awns 1–8 mm long 18

17a. Lower glumes (3.5–)4–5 mm long; upper glumes 5–6.5 mm long; margins of lemmas erose, toothed ..... **15. F. quadridentata**
17b. Lower glumes 5–7.5 mm long; upper glumes 7–8 mm long; margins of lemma entire ..... **14. F. dichoclada**

18a. Upper glumes 4.5–6.5 mm long; lemmas 10–14 mm long; anthers 3.5–4.5 mm long ..... **9. F. caldasii**

18b. Upper glumes 7–9 mm long; lemmas 10–11 mm long; anthers 3–3.5 mm long ..... **16. F. venezuelana**

19a. Lower glumes 2.5–3.5(–4) mm long 20
19b. Lower glumes 4.5–6 mm long 21

20a. Leaf blades 3–5 mm wide; upper glumes 4.5–6 mm long; lemmas awnless or with awns 0.5 mm long, straight ..... **2. F. coromotensis**
20b. Leaf blades 5–11 mm wide; upper glumes 3.5–4.5 mm long; lemma awns 7–15 mm long, flexuous ..... **8. F. ulochaeta**

21a. Upper glumes 5–5.5 mm long; lemmas 6.5–7 mm long; awns 2.5–3.5 mm long..... **20. F. rubra**
21b. Upper glumes 6–8 mm long; lemmas 8–10 mm long; lemma awns 0–1 mm long..... 22

22a. Leaf blades conduplicate or involute, 0.6–0.7 mm in diameter; ligules 1–1.5 mm long; lemmas 9.5–10 mm long ..... **5. F. guaramaca**
22b. Leaf blades flat, 3–12 mm wide; ligules 0.5–1 mm long; lemmas 8–9 mm long 23

23a. Caespitose plants with rhizomes, 120–180 cm tall; lemma awnless; anthers 3 mm..... **1. F. amplissima**
23b. Culms solitary, rhizomatous, 70–90 cm tall; lemma short-awned, the awns 0.5–1 mm long; anthers 3.5–4 mm long ..... **11. F. woodii**

24a. Cataphylls (basal shoots coriaceous or with coriaceous-membranous scales) present 25
24b. Cataphylls absent 30

25a. Lemmas with a dense covering of long hairs ..... **25. F. dasyantha**
25b. Lemmas glabrous or scabrous 26

26a. Leaf blades 0.8–1.6 mm in diameter; abaxial schlerenchyma continuous 27
26b. Leaf blades 0.4–0.7 mm in diameter; abaxial schlerenchyma discontinuous 29

27a. Cataphylls 2–5 cm long; ligules 0.1–0.3 mm long; lemmas 4.5–6 mm long..... **28. F. pilar-franceii**
27b. Cataphylls 0.5–1.5 cm long; ligules more than 0.3 mm long; lemmas 6–8 mm long..... 28

28a. Culms 70–80 cm tall; panicles contracted, 1–6 cm wide; spikelets 9–10 mm long..... **22. F. azucarica**
28b. Culms 80–170 cm tall; panicles lax, 15–25 cm wide; spikelets 11–15 mm long ..... **29. F. procera**

29a. Lower glumes 5.5–6.5 mm long; upper glumes 7–8.5 mm long; anthers 0.8–1.1 mm long..... **35. F. chita**
29b. Lower glumes 3–4.5 mm long; upper glumes 4.5–6.5 mm long; anthers 2–3.5 mm long..... **24. F. colombiana**

30a. Plants growing in large tussocks, culms (30–)50–100 cm tall and 0.3–1 m in diameter near base 31
30b. Plants growing in small tussocks, culms 15–60(–80) cm tall and 0.05–0.2 m in diameter near base 43

31a. Leaf blades scabrous 32
31b. Leaf blades glabrous 36

32a. Leaf blades 0.5–0.7 mm in diameter; ligules predominantly acute 33
32b. Leaf blades 0.8–1.5 mm in diameter; ligules truncate 35

33a. Some spikelets transformed into vegetative shoots (viviparous plants), sexual organs in such spikelets absent ..... **52. F. subulifolia**
33b. Spikelets perfect, well developed, no spikelets vegetatively prolifering 34

34a. Spikelets 8–14 mm long; lower glumes 6–8.5 mm long; upper glumes 6.5–9.5 mm long; lemmas 6–10 mm long ..... **54. F. tolucensis**
34b. Spikelets 6.5–9 mm long; lower glumes 3.5–5.5 mm long; upper glumes 4–6 mm long; lemmas 5–6.5(–8) mm long ..... **52. F. subulifolia**

35a. Spikelets perfect, not vegetatively prolifering, 8–10 mm long, with 3–4 florets; lemmas 6.5–8.5 mm long, with awns 0.7–1 mm long ..... **37. F. densipaniculata**
35b. All spikelets with vegetative proliferation; lemmas transformed into vegetative shoots, sexual organs absent ..... **29. F. asplundii**

36a. Leaf blades flat or conduplicate, 2–5 mm in diameter; spikelets 12–15 mm long ..... **42. F. glyceriantha**
36b. Leaf blades involute, less than 2 mm in diameter; spikelets shorter than 12 mm long 37

37a. Anthers 1–1.5 mm long 38
37b. Anthers 2–3 mm long 39

38a. Culms about 50 cm tall; leaf blades 0.6–0.8 mm in diameter; spikelets with 3–4 florets; lower glumes 4 mm long; upper glumes 5 mm long ..... **46. F. monguensis**
38b. Culms 80–100 cm tall; leaf blades 1.2–1.5 mm in diameter; spikelets with 5 florets; lower glumes 6–6.5 mm long; upper glumes 7–8 mm long ..... **47. F. nereidaensis**

39a. Leaf blades 1.1–1.8(–4) mm in diameter; lower glumes 2.4–2.6 mm long; upper glumes 3.6–3.9 mm long ..... **48. F. oroana**
39b. Leaf blades 0.4–1 mm in diameter; lower glumes 3–7 mm long; upper glumes 4–8 mm long 40

40a. Ligules longer than 1 mm; panicles open 41
40b. Ligules shorter than 1 mm; panicles contracted 42

41a. Ligules (1.5–)2–3.5 mm long; lower glumes 3–4 mm long; upper glumes 4–5.5 mm long ..... **55. F. turimiquensis**
41b. Ligules (0.5–)1–2(–2.5) mm long; lower glumes (3.5–)4–6(–6.5) mm long; upper glumes (5.5–)6–7.5(–8) mm long ..... **36. F. cleefiana**

42a. Leaf blades 0.4–0.6 mm in diameter; ligules 0.5–1 mm long; spikelets with 3–4 florets; lemmatal awns 1.5–4 mm long ..... **40. F. dinirica**
42b. Leaf blades 0.7–0.1 mm in diameter; ligules 0.1–0.3 mm long; spikelets with 5–7(–8) florets; lemmatal awns 0–1 mm ..... **38. F. cundinamarcae**

43a. Spikelets about 3 cm long, with 5–7 florets; lemmas 17–20 mm long ..... **17. F. fragilis**
43b. Spikelets less than 2 cm long, lemmas less than 15 mm long 44

44a. Lower glumes 1.2–2 mm long; upper glumes 2–2.7 mm long; lemmas 4.5–5.5 mm long ..... **21. F. soukupii**

44b. Lower glumes longer than 2 mm; upper glumes longer than 2mm; lemmas longer than 15 mm..... 45

45a. Leaf blades glabrous..... 46
45b. Leaf blades scabrous 52

46a. Lemma with awns longer than 1 mm 47
46b. Lemma awnless or awns shorter than 1 mm 48

47a. Culms 8–15(–30) cm tall; lower glumes 2.5–3.5 mm long; upper glumes 3.5–5 mm long; lemma with awns 1–2 mm ..... **34. F. chimborazensis**
47b. Culms 15–55 cm tall; lower glumes 4–4.5 mm long; upper glumes 5.5–6.5 mm long; lemma with awns 4–6 mm ..... **44. F. huamachucensis**

48a. Leaf blades less than 0.8 mm in diameter; lower glumes 2.5–4.5 mm long; upper glumes 4–6.5 mm long; lemmas shorter than 7.5 mm 49
48b. Leaf blades (0.5–)0.8–3.5 mm in diameter; lower glumes 6.5–10 mm long; upper glumes 6.5–10.5 mm long; lemmas 7.5–10 mm..... 50

49a. Ligules 0.5–0.7 mm long; upper glumes 4–4.2 mm long; lemmas 5.5–6(–7) mm long..... **45. F. imbaburensis**
49b. Ligules 1.2–1.5 mm long; upper glumes 5–5.5 mm long; lemmas 7–7.5 mm long..... **50. F. renvoizii**

50a. Leaf blades involute, 0.5–0.8 mm in diameter; panicles about 0.5 cm wide; spikelets 8–9.5 mm long; lemmas 7.5–8.5 mm long..... **56. F. vaginalis**
50b. Leaf blades conduplicate, up to 3.5 mm wide; panicles 0.8–2 cm wide; spikelets 10–13 mm; lemmas 8.5–10 mm..... 51

51a. Culms 20–50 cm tall; leaf blades 0.8–2 mm in diameter; ligules 0.6–1 mm long; panicles 0.8–1.5 cm wide; lower glumes 7.5–8 mm long..... **37. F. cocuyana**
51b. Culms 60–80 cm tall; leaf blades 2–3.5 mm wide; ligules 1–1.6 mm long; panicles 1.5–2 cm wide; lower glumes 8.5–9.5 mm long..... **51. F. sanctae-martae**

52a. Ligules 0.3–0.5 mm long;callus and rachilla glabrous..... 53
52b. Ligules 0.5–1.2 mm long; callus and rachilla scabrous or sparsely hairy..... 54

53a. Culms 15–20 cm tall; spikelets 9.5–11 mm long; lower glumes 4–5 mm long; upper glumes 5.5–6 mm long; paleas as long as adjacent lemma; anthers 0.6–0.8 mm long..... **53. F. sumapana**
53b. Culms 30–60 cm tall; spikelets 8–9.5 mm long; lower glumes 3–3.7 mm long; upper glumes 4–5 mm long; paleas shorter than adjacent lemma; anthers 0.9–1.2 mm long..... **32. F. boyacensis**

54a. Leaf blades 0.4–0.7 mm in diameter with 5 vascular bundles; paleas as long as adjacent lemma ... 55
54b. Leaf blades 0.8–1.4 mm in diameter, with 7 vascular bundles; paleas shorter than adjacent lemma 56

55a. Leaf blades glaucous; spikelets 8.5–9 mm long; lower glumes 3–3.5 mm long; upper glumes 4–5 mm long..... **49. F. parciflora**
55b. Leaf blades green; spikelets 9–10.5 mm long; lower glumes 3.5–4.5 mm long; upper glumes 5–6.5 mm long..... **33. F. carchiense**

56a. Culms 50–60 cm tall; ligules 0.6–0.8 mm long; lower glumes 4 mm long; upper glumes 5.5 mm long; anthers 1.3 mm long..... **43. F. holubii**

56b. Culms 15–55 cm tall; ligules 0.8–1.2 mm long; lower glumes 4.5–6 mm long; upper glumes 6–6.5 mm long; anthers 0.8–0.9 mm long..... **41. F. glumosa**

SURVEY OF THE SPECIES AND SUBGENERIC TAXA OF *FESTUCA* IN SOUTH AMERICAN PARAMOS

1. Subg. *Drymanthele* V.I. Krecz. & Bobrov, Fl. URSS 2: 532. 1934. Type: *F. drymeja* Mert. & W.D.J. Koch

1.1. Sect. *Ruprechtia* E.B. Alexeev, Novosti Sist. Vyss. Rast. 17: 42. 1980. Type: *F. amplissima* Rupr.

1. *Festuca amplissima*

2. Subg. *Subulatae* (Tzvelev) E.B. Alexeev, Bjull. Moskovsk. Obšč. Isp. Prir., Otd. Biol. 82(3): 96. 1977. Type: *F. subulata* Trin.

2.1. Sect. *Subulatae* Tzvelev, Bot. Zhurn. 56(9): 1253. 1971. Type: *F. subulata* Trin.

2. *Festuca coromotensis*
3. *Festuca elviae*
4. *Festuca flacca*
5. *Festuca guaramaca*
6. *Festuca sodiroana*
7. *Festuca tovariensis*
8. *Festuca ulochaeta*

2.2. Sect. *Glabricarpae* E.B. Alexeev, Bot. Zhurn. 67(9): 1291. 1982. Type: *F. breviglumis* Swallen

9. *Festuca caldasii*
10. *Festuca reclinata*
11 *Festuca woodii*

3. Subg. *Schedonorus* (P. Beauv.) Peterm., Deutschl. Fl. 643. 1849. Type: *F. arundinaceae* Schreb.

3.1. Sect. *Schedonorus* (P. Beauv.) Koch, Syn. Fl. Germ. Helv. 810. 1837. Type: *F. arundinaceae* Schreb.

12. *Festuca arundinacea*
13. *Festuca pratensis*

4. Subg. *Erosiflorae* E.B. Alexeev**,** Novosti Sist. Vyssh. Rast. 23: 11. 1986. Type: *F. quadridentata* Kunth

14. *Festuca dichoclada*
15. *Festuca quadridentata*
16. *Festuca venezuelana*

5. Subg. *Helleria* E.B. Alexeev, Novosti Syst. Vyssh. Rast. 17: 42. 1980. Type: *F. livida* (Kunth) Willd. ex Spreng.

17. *Festuca fragilis*

6. Subg. *Mallopetalon* (Döll) E.B. Alexeev, Bot. Zhurn. 69(3): 346. 1984. Type: *F. fimbriata* Nees.

18. *Festuca fimbriata*

7. Subg. *Festuca*

7.1. Sect. *Aulaxyper* Dumort, Observ. Gramin. Belg.: 104. 1824. Type: *F. rubra* L.

19. *Festuca andicola*
20. *Festuca rubra*
21. *Festuca soukupii*

7.2. Sect. *Cataphyllophorae* E.B. Alexeev, Bot. Zhurn. 69(11): 1546. 1984. Type: *F. procera* Kunth

22. *Festuca azucarica*
23. *Festuca chitagana*
24. *Festuca colombiana*
25. *Festuca dasyantha*
26. *Festuca hatico*

27. *Festuca laegaardii*
28. *Festuca pilar-franceii*
29. *Festuca procera*
30. *Festuca toca*

7.3. Sect. *Festuca*

31. *Festuca asplundii*
32. *Festuca boyacensis*
33. *Festuca carchiense*
34. *Festuca chimborazensis*
35. *Festuca chita*
36. *Festuca cleefiana*
37. *Festuca cocuyana*
38. *Festuca cundinamarcae*
39. *Festuca densipaniculata*
40. *Festuca dinirica*
41. *Festuca glumosa*
42. *Festuca glyceriantha*
43. *Festuca holubii*
44. *Festuca huamachucensis*
45. *Festuca imbaburensis*
46. *Festuca monguensis*
47. *Festuca nereidaensis*
48. *Festuca oroana*
49. *Festuca parciflora*
50. *Festuca renvoizei*
51. *Festuca sanctae-martae*
52. *Festuca subulifolia*
53. *Festuca sumapana*
54. *Festuca tolucensis*
55. *Festuca turimiquirensis*
56. *Festuca vaginalis*

DESCRIPTIONS OF SPECIES OF *FESTUCA* FROM SOUTH AMERICAN PARAMOS

1. Festuca amplissima Rupr. subsp. **amplissima**, Bull. Acad. Roy. Sci. Bruxelles 9(2): 236. 1842. (**Figs. 2, 72A–D**). Type: Mexico. Veracruz, Pic d'Orizaba, 10,000 ft, Jun–Oct 1840, *H. Galeotti 5766* (lectotype: BR; isotype: W!).

Festuca fratercula Rupr. ex E. Fourn. Mexic. Pl. 2:124. 1886. Type: Mexico. Veracruz, Cordillera, Pico de Orizaba, 12,000 ft, Jun–Oct 1840, *H. Galeotti 5778* (lectotype: LE!, designated here).

Uniola effusa E. Fourn., Mexic. Pl. 2: 122. 1886. Type: Mexico. San Nicolás, *E. Bourgeau 1032* (holotype: P; isotype: US-865711 fragm. ex P!).

Uniola muelleri E. Fourn., Mexic. Pl. 2: 122. 1886. Type: Mexico. Veracruz, Orizaba, *Mueller 2115* (holotype: LE; isotype: US-091892 fragm. ex LE!).

Rhizomatous perennials, innovations extravaginal. Culms 120–180 cm tall, erect, scabrous; nodes 3–6. Leaf sheaths coriaceous, scabrous, brown, striate, older basal sheaths disintegrating into fibres; auricles absent; ligules 0.5–1 mm long, coriaceous, apex truncate; blades 35–70 × 0.4–1.2 cm, flat to involute at tip, green, abaxially scabrous, with prickles on adaxial and abaxial surfaces. Panicles 30–40 cm long, 25–40 cm wide, lax, pyramidal, branched; branches scabrous. Spikelets 12–15 mm long, lanceolate, florets 4 or 5; rachilla densely hairy; glumes 4.5–8 mm long, membranous, narrowly lanceolate, green, scabrous; lower glumes 4.5–6 mm long, 1-nerved; upper glumes 6–8 mm long, 3-nerved; lemmas 8–9 mm long, 5-nerved, membranous to coriaceous, lanceolate, green, scabrous and densely hairy, apex entire, awnless; callus

sparsely hairy; paleas as long as adjacent lemma, membranous, papillose, keels scabrous; anthers about 2.9 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 4/5 as long as the grain.

Leaf blade anatomy.—Cross sections with many vascular bundles; adaxial ribs small; sclerenchyma under both abaxial and adaxial epidermis, discontinuous, extending to the vascular bundles forming girders; adaxial epidermis with bulliform cells and without hairs.

Observations.—*Festuca amplissima* is the only species represented in *Festuca* sect. *Ruprechtia*. It differs from other species of *F.* subg. *Montanae* by lacking cataphylls and by having glabrous ovaries.

Distribution and habitat.—This species was confirmed in Mexico, Guatemala, Costa Rica, and Panamá. Davidse et al. (1994) also mentioned this species from Venezuela. In Central America and Mexico this species is known from forests (*Pinus* spp. and *Quercus* spp.) and forest clearings.

Additional specimens examined. **COSTA RICA. Cartago:** Cantón de Turrialba, Parque Nacional Chirripo, Cuenca del Matina, estacion Crestones, sendero a Ventisqueros, 09°29′52″N, 83°29′20″W, 3400–3500 m, 11 May 1996, *Gambo et al. 819* (MO). **San José:** Trail to the Valle de los Leones, lower part of Valle de los conejos, along the upper river Talari paramo formation with *Chusquea* sp. and areas of short burned forest, 83°31′W, 09°27′N, 3250–3450 m, 21–23 Aug 1971, *Burger & Gomez 8246* (NY); Cantón de Pérez Zeledón, Parque Nacional Chirripo, cuenca Terraba - Sierpe Chirripo, base Crestones páramo, 8°27′25″N, 83°30′38″W, 3460 m, 12 Jul 1996, *Alfaro 1027* (MO); Along the trail from Canaan to Chirripo via Los Angeles above N the Río Talari, elfin forest of dead oak trees, 09°30′N, 83°31′W, 3200–3400 m, 19−22 Jan 1970, *Burger et al. 7428* (F). **GUATEMALA. Chimaltenango:** Volcán de Agua, 10000 ft, 22 Jul 1937, *JRJ 895* (F); Volcán de Acatenango, above Las Calderas, 2700–2900 m, 1 Mar 1939, *Standley 61885* (F); above Las Calderas, 2700−2900 m, 1 Mar 1939, *Standley 61899* (F). **Sacatepequez:** Volcán de Agua, above Santa María de Jesus, 2250–3000 m, 2 Nov 1939, *Standley 65227* (F). **MEXICO. Distrito Federal:** Ajusco, Rancho Vieja Cuilotepec Tlalpan, 2730 m, 19 Sep 1985, *E. Manriqu et al. 1147* (MO); Valle de Mexico, 2500 m, 1 Jan 1952, *Matuda 25909* (MO). **Chiapas:** Mun. San Cristóbal las Casas, at Piedracitas, 7 km E of San Cristóbal along road to Zontehuitz, slopes with *Quercus* and *Pinus*, 7800 ft, 20 Jul 1965, *D. Breedlove 11151* (F); Mun. Tenejapa, Paraje Matsab, 9000 ft, 5 Dec 1966, *Alush Shilom Ton 957* (F). **Guerrero:** Mun. Heliodoro Castillo, ladera E del Cerro Teotepec, 68 km de Filo de Caballo por terraceria a El Paraíso, Bosque de *Abies, Quercus, Pinus, Alnus* y *Clethra*, 2730 m, 23 Nov 1991, *González-Ledesma et al. 484* (F); Mun. de Chilpancingo, Parque Omiltemi a 35 km W of Chilpancingo bosque mesofilo, 2450 m, 21 Nov 1991, *González-Ledesma et al. 478* (MO). **Jalisco:** 14–18 km SW of Tequila on Volcán de Tequila *Quercus*, *Arbutus* forest, 2400–2600 m, 11 Jul 1974, *D. Breedlove 39265* (MO). **Michoacán:** Mountain near Patzcuaro, 8500 ft, 23 Nov 1891, *C.G. Pringle 3945* (NY); Mt. Tancitaro, rocky ledge, 10300 ft, 25 Jul 1941, *Leavenworth et al. 1213* (F, MO, NY). **Oaxaca:** Distr. De Ixtlán, Mun. De Ixtlán, Rancho Teja, 0.25 km N of the upper casita, 2250 m, 4 Aug 1981, *Martin 630* (US). **Puebla:** Mun. San Nicolás de los Ranchos 6 km al SE de Paso de Cortez, brecha a Xalitzintla, 20º18′N, 98º44′W, 3400 m, 14 Sep 1988, *Tenorio 15093* (US). **Veracruz:** Pico de Orizaba, 2500 m, *Liebmann 6109, 6110* (C); Sep 1841, *Liebmann 12904* (C). **PANAMA. Chiriquí:** Volcán Baru, in and near Potrero Muleto, abundant floor of crater 9400–10000 ft, 17 Nov 1978, *B. Hammel 5619* (MO); Volcán Chiriquí, Boquete Distr., 10400 ft, 18 Jul 1938, *Davidson 1043* (F, MO); W slope of Volcán Chiriquí, 11 km directly WNW of Boquete, ridge looking down on Potrero Muleto, elfin forest dominated by Ericaceae, 3000 m, 20 Nov 1975, *G. Davidse & D'Arcy 10244* (NY).

1b. Festuca amplissima subsp. **sierrae** Stančík, Preslia, Prague, 75: 341. 2003. (**Fig. 1**). Type: Colombia. Magdalena, Sierra Nevada de Santa Marta, Hoya del Río Donachuí, Cancurúa, SE slopes, 2400–2650 m, 10 Oct 1959, *J. Cuatrecasas & Castaneda 24736* (holotype: COL!; isotype: US!).

This subspecies differs from typical form by having a larger, denser, and widely spreading panicles.

Observations.—The outstanding character of larger panicles and the isolated geographical position in the northern Andes (Sierra Nevada de Santa Marta, Serranna de Perijá), were the primary reasons for recognizing this subspecies.

Distribution and habitat.—In Colombia and Venezuela *Festuca amplissima* subsp. *sierrae*

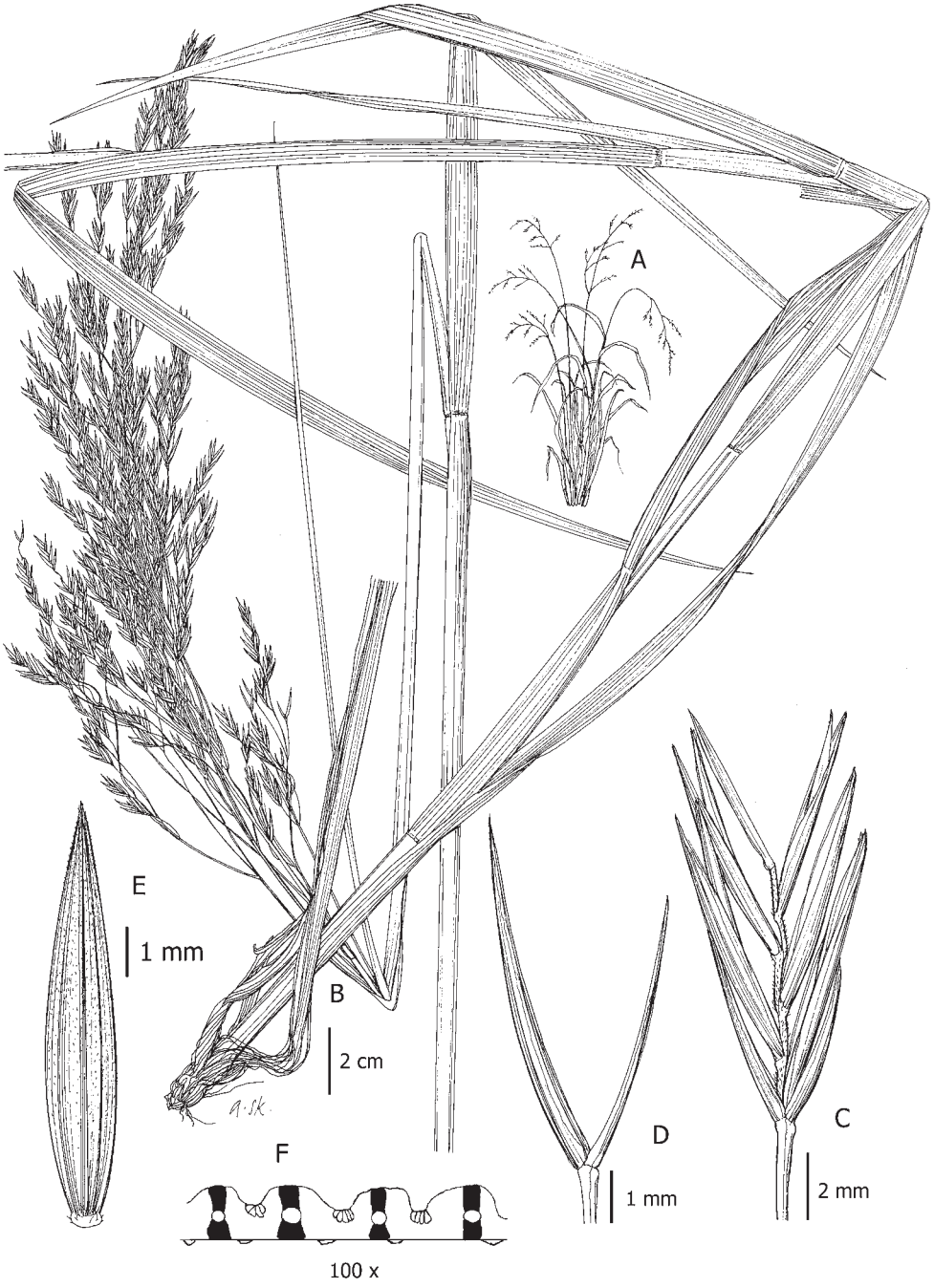


Figure 1. *Festuca amplissima* subsp. *sierrae.* **A.** Stylized growth form. **B.** Habit. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Leaf blade cross-section. A–E, *Cuatrecasas & Castañeda 24736* (COL). F, *Barclay & Juajibioy 7033* (COL).

occurs in matorral and shrub lands and the grass transitional zone of the paramo at an altitude of 2200–3400 m.

Additional specimens examined. **COLOMBIA. Magdalena:** Sierra Nevada de Santa Marta, alrededores de cabeceras de Río Ancho, páramo de Macotama, 3490 m, 16 Feb 1959, *Barclay & Juajíbioy 7033* (COL, MO, US); Páramo de Macotama, NW side of valley, grassy slope, 3490 m, 13–18 Dec 1959, *Barclay & Juajíbioy 7017* (MO);

Mun. Ciénaga, Cabeceras del Río Sevilla, 3500 m, *Carbonó 2474* (UTMC); transecto del Buritaca-filo La Cumbre, 3020 m, 15 Aug 1977, *Rangel et al. 945* (COL); about 30 mi inland from Dibulla, 3850 m, Jul 1923, *Seifriz 489* (US). **VENEZUELA. Zulia:** Serranía de Perijá, Serranía de los Motilones, Distr. Perijá, headwaters of Río Negro, 3000 m, 27 Jun 1974, *Tillet & Honig 746–765* (MO).

2. Festuca coromotensis B. Briceño, Ernstia 4 (3–4): 76. 1994. (**Figs. 2, 3, 72E−F, 73A & B**). TYPE: Venezuela. Mérida, Dept. Libertador, Parque Nacional Sierra Nevada, Laguna La Coromoto, 3300 m, 3 Jul 1987, *B. Briceño & G. Adamo 2003* (holotype: MERF!; isotype: MERC!).

Loosely tufted, rhizomatous perennials with extravaginal innovations. Culms 100–120 cm tall, erect, scabrous; nodes 4 or 5 on lower 1/2. Leaf sheaths membranous, glabrous, striate, brown; auricles absent; ligules 0.5–0.7 mm long, membranous to coriaceous, apex truncate, ciliate; blades 15–25 cm long, 3–5 mm wide, flat, green, abaxially scabrous. Panicles 20–25 cm long, 2–5 cm wide, flexuous, pendant; branches scabrous. Spikelets 9–11 mm long, florets 3 or 4; rachilla ca. 1.2 mm long, pilose; glumes 2.5–6 mm long, narrowly lanceolate, coriaceous, purplish, pilose, apex acute; lower glumes 2.5–3.5 mm long, 1-nerved; upper glumes 4.5–6 mm long, 3-nerved; lemmas 7.5–8.5 mm long, 5-nerved, lanceolate, membranous to coriaceous, margins short pilose, apex entire, awned or awnless, pilose, the awn 0–0.5 mm long; paleas as long as the lemma, pilose; lodicules ca. 0.8 mm long, oblong; anthers 2–2.5 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 4/5 of the total length.

Leaf blade anatomy.—Cross-sections with numerous vascular bundles; adaxial ribs small,

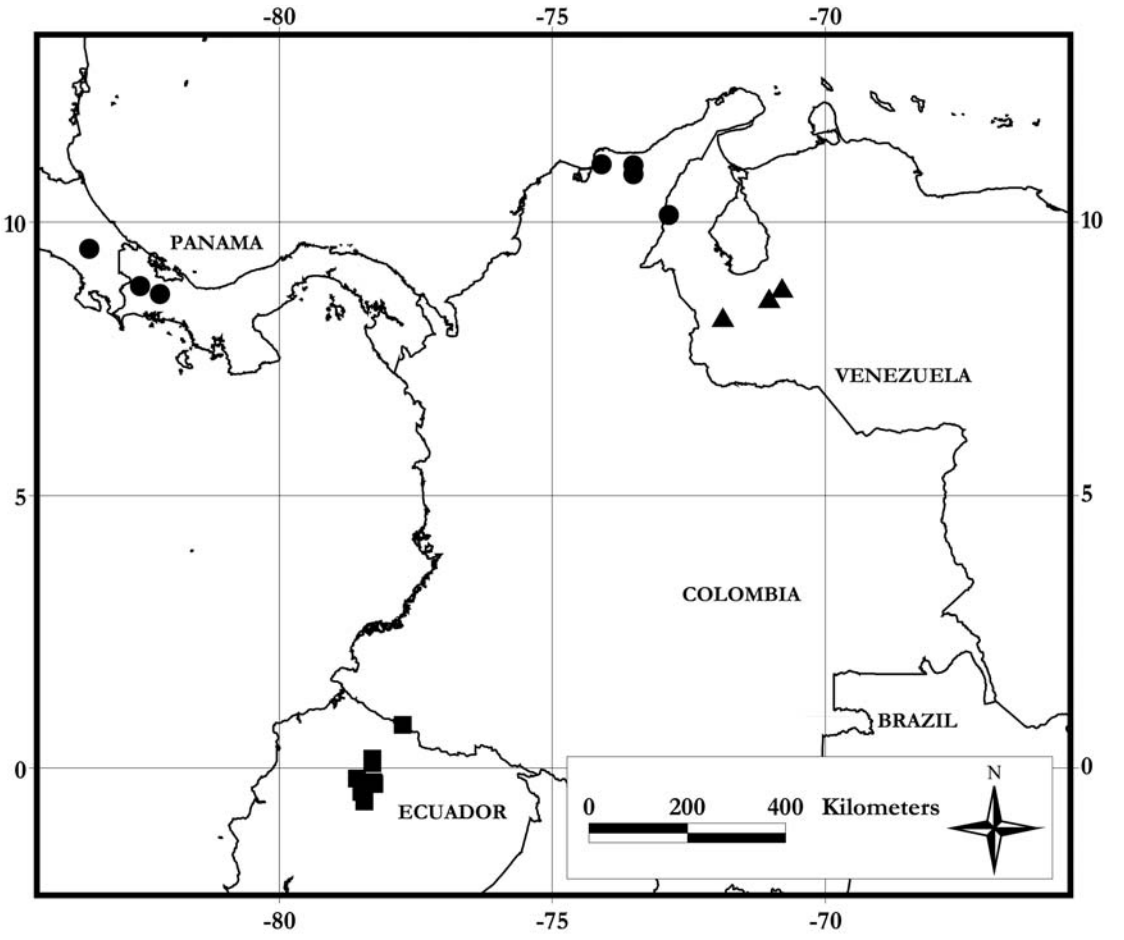


Figure 2. Distribution of *Festuca amplissima* (●), *F. coromotensis* (▲), and *F. flacca* (■).

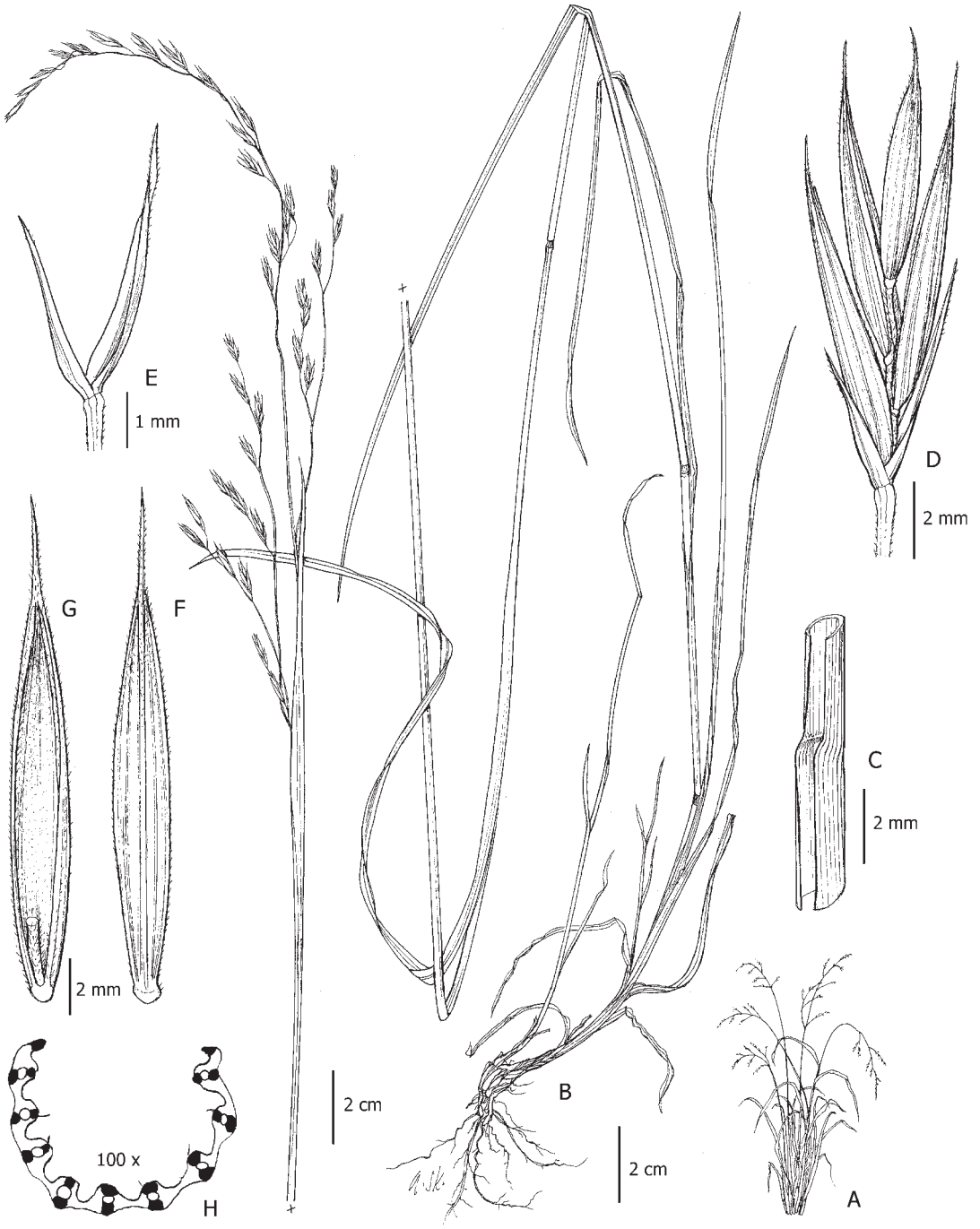


Figure 3. *Festuca coromotensis*. **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 4173* (PRC).

inconspicuous; sclerenchyma below abaxial and adaxial epidermis, discontinuous, forming girders; bulliform cells absent; abaxial epidermis with scattered prickles; adaxial epidermis with sparse hairs, the hairs ca. 0.1 mm long.

Observations.—The habit of *F. coromotensis* is very similar to *F. sodiroana*. However, the spikelets of *F. sodiroana* have shorter glumes (lower glumes 1.3–1.8 mm, upper glumes 2.2–3.5 mm), shorter lemmas (5–6.5 mm), and shorter anthers (0.8–1.2 mm).

Distribution and habitat.—This species is endemic to Venezuela, known only from the Andean states of Mérida and Táchira. *Festuca coromotensis* occurs in the Andean forest and matorral communities between 3000–3500 m.

Additional specimens examined. **VENEZUELA. Mérida:** Entre Los Arbolitos y Los Nevados, Paramo El Toro, 3100 m, 12 Oct 1988, *B. Briceño et al. 2328* (Herbarium Briceño); Mun. Santo Domingo, Laguna Negra, patches of *Polylepis*, 08°47′13.4″N, 70°48′26.1″W, 3500 m, 6 Nov 2000, *D. Stančík 4173* (CAR, COL, PRC); Mun. Santo Domingo, Laguna Mucubaji, schrubby patches, 08°47′19.5″N, 70°48′36.1″W, 3470 m, 6 Nov 2000, *D. Stančík 4174* (AAU, CAR, COL, PRC); Mun. Tabay, Laguna Coromoto, mountain forest, 08°35′41.7″N, 71°01′26.9″W, 3100–3200 m, 7 Nov 2000, *D. Stančík 4180* (AAU, CAR, COL, US, VEN, W); Mun. Tabay, Laguna Coromoto, mountain forest, 3000–3100 m, 7 Nov 2000, *D. Stančík 4177B* (PRC). **Táchira:** Páramo entre Enconejada para Pogonero, 3000 m, Sep 1955, *Baldillo 3496* (VEN); Mun. La Grita, Par. La Negra, 8°15′11.2″N, 71°52′41.5″W, 3200 m, 10 Nov 2000, *D. Stančík 4281* (AAU, CAR, COL, VEN); 8°15′26.4″N, 71°52′16.5″W, 3100 m, *D. Stančík 4282* (CAR, COL, PRC).

3. Festuca elviae B. Briceño, Ernstia 4 (3–4): 77, f. 2–4. 1994. (**Figs. 4, 6, 73C–F**). Type: Venezuela. Mérida, Libertador: Páramo La Culata, camino hacia Laguna Tapada, 3300 m, 19 Oct 1984, *B. Briceño & G. Adamo 1114* (holotype: MERF!).

Loosely tufted, rhizomatous, perennials with extravaginal innovations. Culms 40–80(–100) cm tall, erect, glabrous, nodes 2 or 3 in basal half. Leaf sheaths membranous, brown, glabrous; auricles absent; ligules 0.7–1.5 mm long, membranous, apex truncate, ciliate or dentate; blades 15–20 cm long, 1–6 mm wide, flat, sometimes involute, green, abaxially scabrous. Panicles 10–17 × 1–2 cm, contracted, erect; branches scabrous. Spikelets 7–9 mm long, florets 3–5; rachillas 1–1.4 mm long, glabrous; glumes 0.8–3 mm long, narrowly lanceolate, membranous, green, glabrous, apex acute; lower glumes 0.8–1.5 mm long, 1-nerved; upper glumes 2–3 mm long, 3-nerved; lemmas 4.5–5.5(–6) mm long, 5-nerved, lanceolate, membranaceous-coriaceous, green, apex glabrous or scabrous, entire, sometimes shortly awned, the awn 0.5–1(–2) mm long; paleas almost as long as the lemma, apex scabrous; anthers 0.9–1.2 mm long; ovary apex glabrous. Caryopses oblong; hilum nearly the entire length.

Leaf blade anatomy.—Cross sections with numerous vascular bundles and ribs on abaxial surface; sclerenchyma under both abaxial and adaxial epidermis discontinuous and extending to the vascular bundles; bulliform cells absent; abaxial epidermis with scattered prickles.

Observations.—Spikelets with short glumes and short-awned lemmas suggest affinity with the Colombian and Ecuadorian species, *F. andicola* and *F. sodiroana*. However, *Festuca andicola* and *F. sodiroana* have slightly longer lower glumes (1.3–1.8 mm), nodding culms, and narrower panicles (0.4–1 cm).

Distribution and habitat.—This species is endemic to Venezuela, known only from the state of Mérida. It occurs in the humid or swampy margins of the Andean forest, along streams, in clearings, and in pastures, between 3000–3700 m.

Additional specimens examined. **VENEZUELA. Mérida:** Dept. Rangel, SE de la entrada a la Lag. Mucubaji, 3550 m, 28 Aug 1980, *B. Briceño & Adamo 191, 196* (MERF, MO); 3550 m, 2 Oct 1996, *B. Briceño et al. 3390* (Herbarium Breceño); Dept. Rangel, SE del Hotel Los Frailes, 3100 m, 22 May 1981, *B. Briceño & Adamo 274* (MERF, MO); Dept. Rangel, camino hacia Laguna Las Canoas, 3100 m, 10 Jul 1981, *B. Briceño & Adamo 306* (MERF); Páramo Los Granates, 3420 m, 30 Aug 1985, *B. Briceño & Adamo 1320* (MERF); Páramo Misinta, 3100 m, 3 Dec 1986, *B. Briceño & Adamo 1705* (MERF); Mun. Santo Domingo, Laguna Mucubaji, swamps around the lagoon, 08°47′33″N, 70°48′56″W, 3600 m, 6 Nov 2000, *D. Stančík 4171* (AAU, CAR, COL, PRC); Laguna Mucubají, shrubby patches, 3470 m, 8°47′20″N, 70°48′36″W, *D. Stančík 4175* (AAU, CAR, COL, PRC). Mun. Mucuchies, Paramo de Piedras Blancas, 8°48′31″N, 70°55′08″W, 3700 m, 4 Nov 2000, *D. Stančík 4215* (AAU, CAR, COL, PRC); Mun. La Culata, Páramo La Culata, 8°45′N, 71°33′W, 3300 m, 12 Nov 2000, *D. Stančík 4250* (CAR, COL, PRC); 3100 m, *D. Stančík 4257* (CAR, COL, PRC); 8°45′N, 71°03′W, 3100 m, 12 Nov 2000, *D. Stančík 4256* (CAR, COL, PRC, US); Dept. Libertador, NE con respecto al Valle de la Culata., Dept. Libertador, paramo La Culata, Laguna Tapada, 3300 m, 7 Jun 1984, *B. Briceño & Adamo 948* (Herbarium Briceño), 28 Sep 1984, *B. Briceño & Adamo 1086* (MERF); Pass on the Mérida-Barinas Hwy, paramo

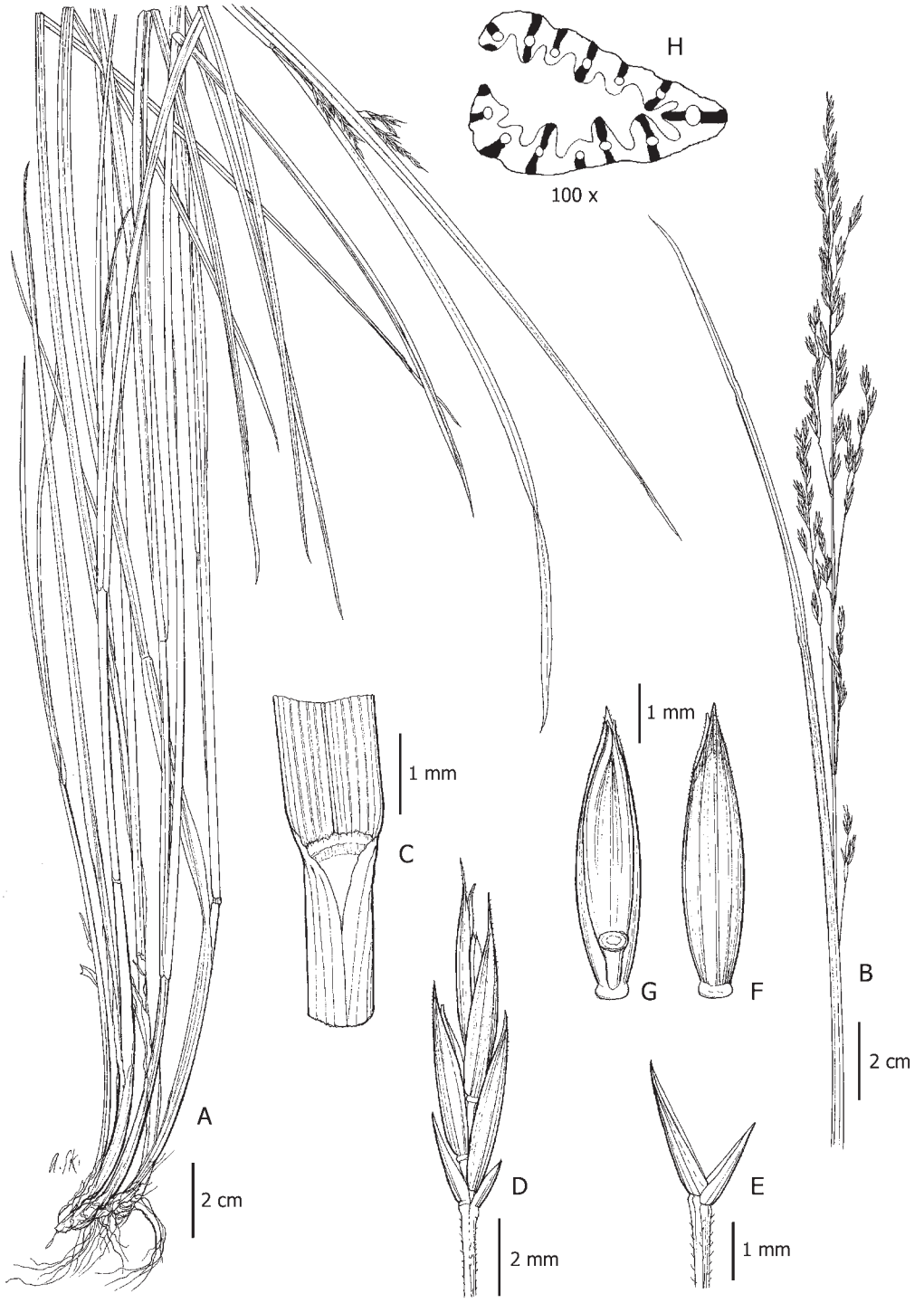


Figure 4. *Festuca elviae.* **A.** Habit. **B.** Inflorescence (detail). **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Briceño & Adamo 948* (PRC).

above Laguna Grande et Universidad de los Andes, 3500 m, 19 Nov 1971, *G. Davidse et al. 3223* (MO); Valle de los Calderones y Páramo de los Pozones, 3400 m, 19 Oct 1995, *B. Briceño et al. 3345* (herbarium Briceño); Laguna Coromoto, mountain forest, 8°35′41″N, 71°01′27″W, 3000–3100 m, 7 Nov 2000, *D. Stančík 4178* (AAU, CAR, COL, PRC, US, W); Entre La Mucuy e Laguna Coromoto, 3000 m, 27 Mar 1994, *B. Briceño et al. 2601* (herbarium Briceño).

4. Festuca flacca Hack. ex E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 1543. 1984. (**Figs. 2, 5, 74A–D**). Type: Ecuador. Pichincha, in silv. super. pr. Tablahungi, 1887, *Sodiro 36/11* (holotype: W!; isotypes: QPLS!, W!, US!).

Festuca subulata var. *fraseriana* St.-Yves, Candollea 3: 451. 1928. Type: Amerique du Sud, Equateur, *sin. loc.*, 1860, *Fraser s.n.* (holotype: G!).

Loosely tufted perennials with extravaginal innovations. Culms 70–120(–150) cm tall, erect, glabrous; nodes 3–7 nodes in distal half. Leaf sheaths membranous, brown, striate, scabrous, occassionally hairy, margins free; auricles absent; ligules 3–3.5 mm long, membranous, apex acute; blades 25–30 × 0.3–1.1 cm, flat, green, abaxially scabrous. Panicles 20–35 × 5–15 cm, lax, few-flowered, linear-oblong to ovate; branches scabrous. Spikelets 7–8 mm long, florets 2–4 with a rudiment; rachilla pilose; glumes 1.2–3.5 mm long, green, glabrous, narrowly lanceolate, apex acuminate; lower glumes 1.2–2.4 mm long, 1-nerved; upper glumes 2.5–3.5 mm long, 3-nerved, sometimes scabrous on dorsally; lemmas 6.5–7 mm long, 5-nerved, membranous to coriaceous, lanceolate, green, occasionally purplish-green, papillose, apex scabrous, awned, the awn 9–12 mm long, scabrous, fine and straight; paleas almost as long as the lemma, glabrous and inconspicuously scabrous on margins and keels, apex hairy; lodicules lanceolate, acuminate; anthers 1.1–1.4 mm long; ovary apex sparsely hairy. Caryopses lanceolate; hilum 4/5 the length.

Leaf blade anatomy.—Cross sections with numerous vascular bundles and without ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous, extending to the vascular bundles forming girders; bulliform cells present; abaxial epidermis (or both sides) with scattered prickles.

Observations.—Alexeev (1984) incorrectly cited the page of the original publication of Sodiro (1889), where this taxon is mentioned for the first time then later described by Alexeev as *F. flacca*. *Festuca flacca* is morphologically similar to other long-awned species that have short glumes, such as: *F. ulochaeta* from Brazil, Colombia, and Venezuela; *F. cochabambana* from Bolivia; and, *F. tovariensis* from Bolivia and Peru. However, *Festuca ulochaeta* has flexuous lemma awns, *F. tovariensis* has truncate ligules, and *F. cochabambana* has pubescent leaf sheaths.

Distribution and habitat.—*Festuca flacca* is endemic to Ecuador, known from the central and northern Andean departments (Carchi, Cotopaxi, Imbabura and Pichincha). It occurs in mountain Andean forests between 2900–3500 m.

Additional specimens examined. **ECUADOR. Carchi:** Hacienda San Rafael, faldas occidentales de la Cordillera Oriental, 2900–3000 m, *Acosta-Solís 21026* (US); wooded hills about 5 mi S of Tulcán, 2500 m, *A.S. Hitchcock 21042* (US). **Cotopaxi:** Parque Nacional Cotopaxi, pine plantation, 00°37′S, 78°27′W, 3400 m, *S. Laegaard 54540A* (AAU, QCA), *S. Laegaard 54540B* (AAU, QCA). Cotopaxi, 3550 m, *E. Asplund 6359* (NY, S, US). **Imbabura:** Lake Cuicocha - Islote Chica, 3150 m, *E. Asplund 7156* (NY, S, US); Laguna Mojanda, 10 km SSW of Otavalo, 00°10′N, 78°18′W, 2900–3150 m, *Sparre 13562* (S). **Pichincha:** Road Pifo–Papallacta, km 15, *Polylepis incana* forest, 00°16′S, 78°17′W, 3530 m, 16 Apr 1992, *S. Laegaard 102316* (AAU, QCA, QCNE); Pifo, 3000 m, *Mille s.n.* (QPLS); Volcán Pasachoa, above house of Fundación Natura, 00°27′S, 78°30′W, 2900–3300 m, 16 Sep 1985, *S. Laegaard 55260* (AAU, QCA, QCNE); 3200 m, 27 Apr 1985, *S. Laegaard 54164* (AAU, QCA, QCNE); 19 Sep 1985, *S. Laegaard 55281* (AAU, QCA, QCNE); Mt. Pichincha – St. Gertriadis, *Sodiro s.n.* (QPLS); Mt. Pichincha – Tablahuras, *Sodiro s.n.* (QPLS); Mt. Pichincha, *Sodiro s.n.* (US); Slope of Pichincha above Lloa, 3200 m, *E. Asplund 7535* (AAU); *E. Asplund 7559* (K, P, S,US); 2900–3100 m, *Acosta-Solís 20054* (US); Concepcion, near Hda. Monjas, 10200 ft, *Bell 17* (S); Mun. Amaguaña, Volcán Pasochoa, bosque andino, 3400 m, 14 Sep 2000, *D. Stančík 3668* (PRC, QCA, US); Mun. Otavalo, road from Laguna Mojanda to Cochasquí, shrubby margin of the road, 00°04′55.1″N, 78°17′49.8″W, 3450 m, 19 Oct 2000, *D. Stančík 4104* (PRC, QCA).

Figure 5. *Festuca flacca.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 3668* (PRC).

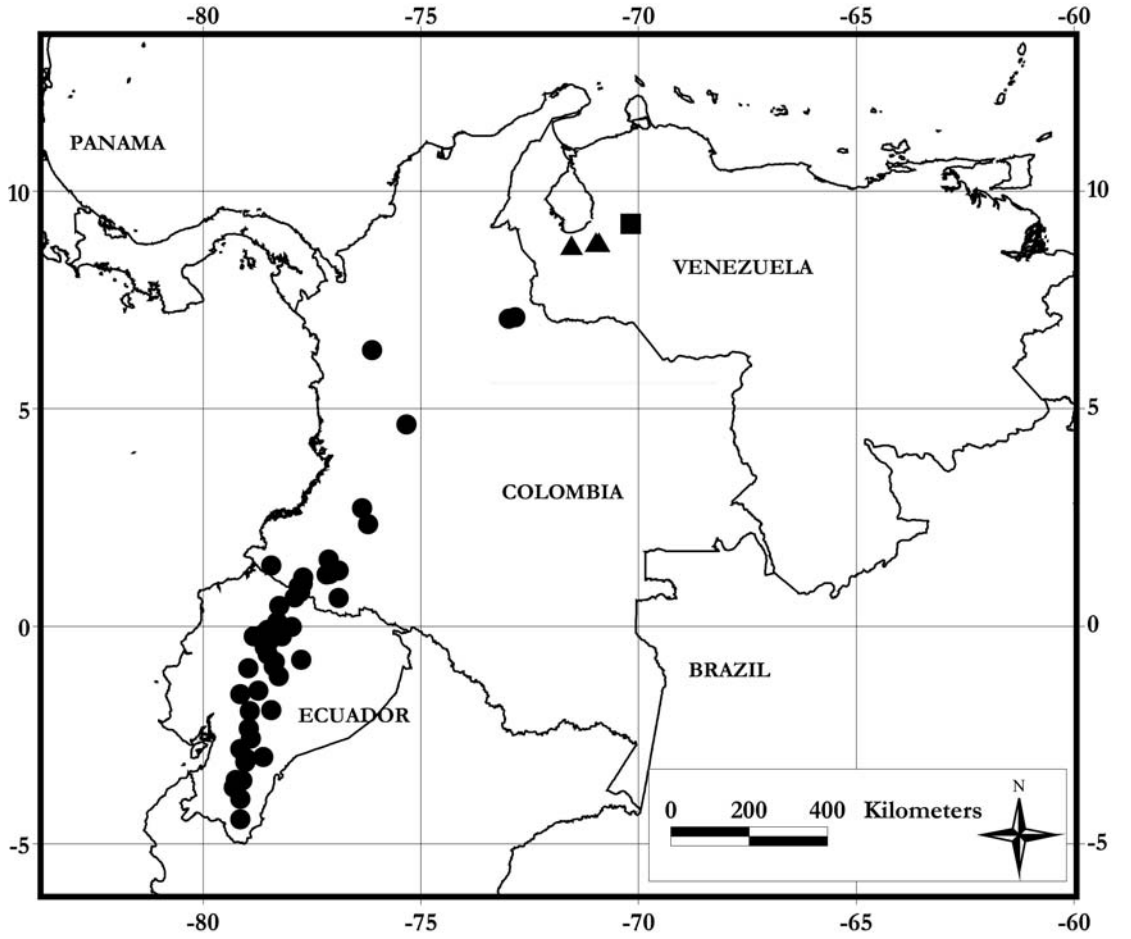


Figure 6. Distribution of *Festuca sodiroana* (●), *F. elviae* (▲), and *F. guaramacalana* (■).

5. Festuca guaramacalana Stančík, Novon 14(3): 343. 2004. (**Figs. 6, 7, 74E–F, 75A & B**). Type: Venezuela. Trujillo, Mun. Bocono, Parque Nacional Guaramacal, 09°14′15″N, 70°11′14″W, Andean mountain forest, margin of the brook with *Neurolepis* sp., *Cortaderia* sp., 2880 m, 29 Nov 2000, *D. Stančík 4286* (holotype: PRC!; isotypes: CAR!, COL!).

Rhizomatous perennial, forming small tussocks with extravaginal innovations. Culms 100–130 cm tall, erect, glabrous; nodes 3 or 4 nodes in distal half. Leaf sheaths membranous-coriaceous, purplish-brown, striate, fibrous at base, margins free; auricles absent; ligules 1–1.5 mm long, membranous, sometimes coriaceous, apex acute; blades 30–40 × 0.6–0.7 cm, conduplicate to involute, green, sometimes olive-green, abaxially glabrous. Panicles 15–20 × 2–5 cm, flexuous, pendant, elongate, branched; branches finely scabrous. Spikelets 13–15 mm long, narrowly lanceolate, florets 5–7; rachilla pilose; glumes 3.7–7 mm long, narrowly lanceolate, purplish, membranous to coriaceous, sparsely scabrous, apex acute; lower glumes 3.7–4.7 mm long, 1-nerved; upper glumes 5–7 mm long, 3-nerved; lemmas 9.5–10 mm long, membranous to coriaceous, lanceolate, 5-nerved, purplish, papillose, apex entire, mucronate or shortly awned, the awn 0.5–1 mm long; callus sparsely pilose; paleas finely pilose, almost as long as the lemma; lodicules ovate, two-dentate; anthers 2.5–2.8 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 4/5 as long as the grain.

Leaf blade anatomy.—Cross-sections with about 11 vascular bundles and 5 ribs above; sclerenchyma under both abaxial and adaxial epidermis discontinuous and extending to some vascular bundles forming girders; bulliform cells absent;

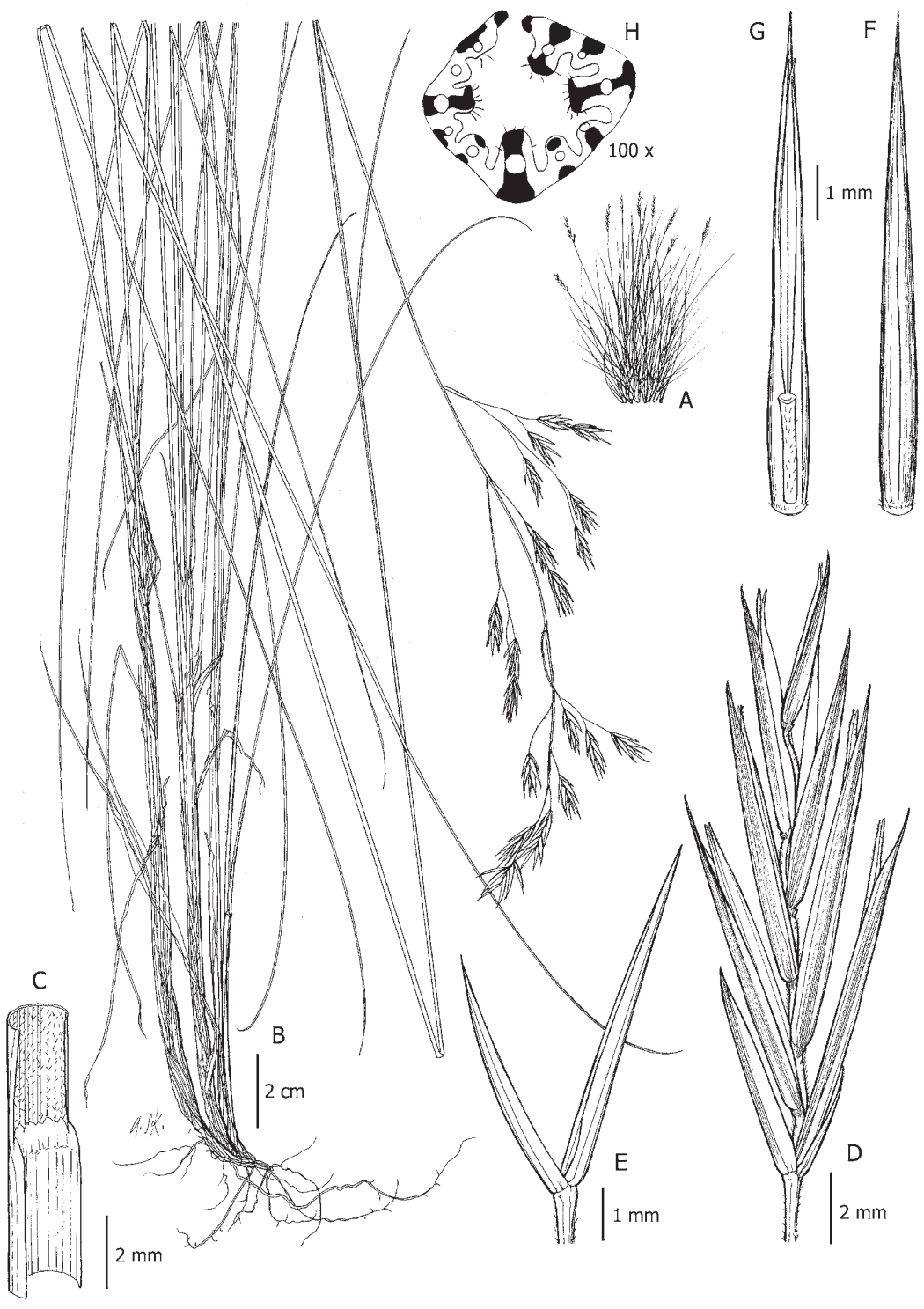


Figure 7. *Festuca guaramacalana.* **A.** Growing form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 4286* (PRC).

adaxial epidermis with scattered microhairs, ca. 0.09 mm long.

Observations.—Festuca guaramacalana belongs to *Festuca* sect. *Subulatae* and among the South American members of this section, *F. guaramacalana* has the largest spikelets and longest glumes (Stančík & Peterson 2002). The lemmatal awns of *F. guaramacalana* are short (0.5–1 mm) and this is in contrast with most other members of sect. *Subulatae*, although *F. sodiroana* typically has acute lemmas. Morphologically, *F. coromotensis* appears to be most similar to *F. guaramacalana* but the former has shorter ligules (0.5–0.7 mm long), ligules with truncate apices, shorter spikelets (9–11 mm long) with 3 to 4 florets, and shorter lemmas (7.5–8.5 mm long).

Distribution and habitat.—Festuca guaramacalana is endemic to Venezuela and is known only from Parque Nacional Guaramacal where it occurs near small brooks with *Neurolepis* sp. and *Cortaderia* sp. between 2600–2880 m. This species is a narrow endemic and is vulnerable to extinction due to loss of habitat.

Additional specimens examined. **VENEZUELA. Trujillo:** Mun. Boconó. Parque Nacional Guaramacal. Páramo El Pumar. 2870 m, 2004, *M. Ramirez & N. Cuello 3523, 3524, 3528* (PORT).

6. Festuca sodiroana Hack. ex E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 1545. 1984. (**Figs. 6, 8, 75C−F**). Type: Ecuador. Pichincha, silv. super. et pasq., 1884, *Sodiro 36/6* (holotype: W!; isotypes: MO-923640!, PRC ex QPLS!, QPLS!, US!).

Rhizomatous perennials with extravaginal innovations. Culms (40–)50–120(–150) cm tall, erect, glabrous; nodes 2 or 3(–4) in distal half. Leaf sheaths membranous, brown, striate, pilose at base, margins free; auricles absent; ligules 0.2–1.1 mm long membranous to coriaceous, apex truncate, ciliate; blades 15–25 × 0.4–0.7 cm, flat, green, abaxially glabrous. Panicles 15–20 × 1–2 cm, lax, contracted and something nutant, branched; branches scabrous. Spikelets 7.5–9(–10) mm long, florets 4 or 5(–6); rachilla pilose; glumes 1.3–2.9(–3.5) mm long, lanceolate, green, membranous to coriaceous, glabrous, apex acute; lower glumes 1.3–1.8 mm long, 1-nerved; upper glumes 2.2–2.9(–3.5) mm long, 3-nerved; lemmas 5–6(–6.5) mm long, 5-nerved, membranous to coriaceous, lanceolate, green, awnless, apex acute, entire, muticous, scabrous; paleas almost as long as the lemma, glabrous or inconspicuously scabrous, apex hairy; lodicules lanceolate, acuminate; anthers 0.8–1.2 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 4/5 of total length.

Leaf blade anatomy.—Cross-sections with numerous vascular bundles, without ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous, extending to the vascular bundles; bulliform cells present; abaxial epidermis with scattered prickles, adaxial epidermis without hairs or with scattered hairs.

Observations.—Specimens that belong to this species were originally determined by Hackel and Sodiro as either *F. sodiroana* or *F. pichinchae*, but these names were not validly published. Alexeev recognized that these specimens belonged to the same species and validated the name *F. sodiroana*. *Festuca sodiroana* differs from others in sect. *Subulatae* by having muticous lemmas.

Distribution and habitat.—Known from southern Ecuador to northern Colombia where it is found in all three cordilleras. It occurs in forest clearings, margins of brooks in Andean mountain forests, roads banks, and trails at an altitude of 2600–3800 m. *Festuca sodiroana* is known to occur in vegetation communities: *Neurolepido aristatae–Oreopanacion nitidii* (Cleef et al. 1983) and *Chusquea scandentis–Weinmannion rollottii* (Cleef et al. 1983).

Additional specimens examined. **COLOMBIA. Antioquia:** Mun. Urrao, Páramo Frontino, Llano Grande, 3520 m, 10 Sep 1986, *Roldán et al. 360* (HUA); Campanas, La Laguna, 3500–3800 m, 3 Mar 1989, *MacDougal et al. 4504* (HUA, MO). **Cauca:** Macizo Colombiano, Páramo de Las Papas, entre Boqueron y La Hoya, 2910 m, 11 Sep 1958, *Idrobo et al. 3026* (COL); Parque Nacional Puracé, termales de San Juan, 3100–3300 m, 6 Apr 1985, *Wood 4792* (COL, K); Páramo de Moras, between Mosoco y Pitayo, 3000–3500 m, Feb 1906, *Pittier 1511* (US). Mt. Puracé, 3100–3300 m, 16 Jun 1922, *Killip 6709* (US). **Cundinamarca:** Páramo de Tablazo, 3200 m, 8 Apr 1984, *Wood 4347* (COL, FMB, K). **Nariño:** El Encano, road from Pasto to Vírgen, vereda Caltapamba, 3100 m, 23 Mar 1999, *D. Stančík 2992* (COL, PRC, PSO, US); *D. Stančík 2991* (COL, PRC, PSO); El Encano, road to village Colon, km 4, 2650 m, 13 Mar 1999, *D. Stančík 2866* (COL, PRC, PSO); km 6, 2900 m, 13 Mar 1999, *D. Stančík 2858* (COL, PRC, PSO); Mun.

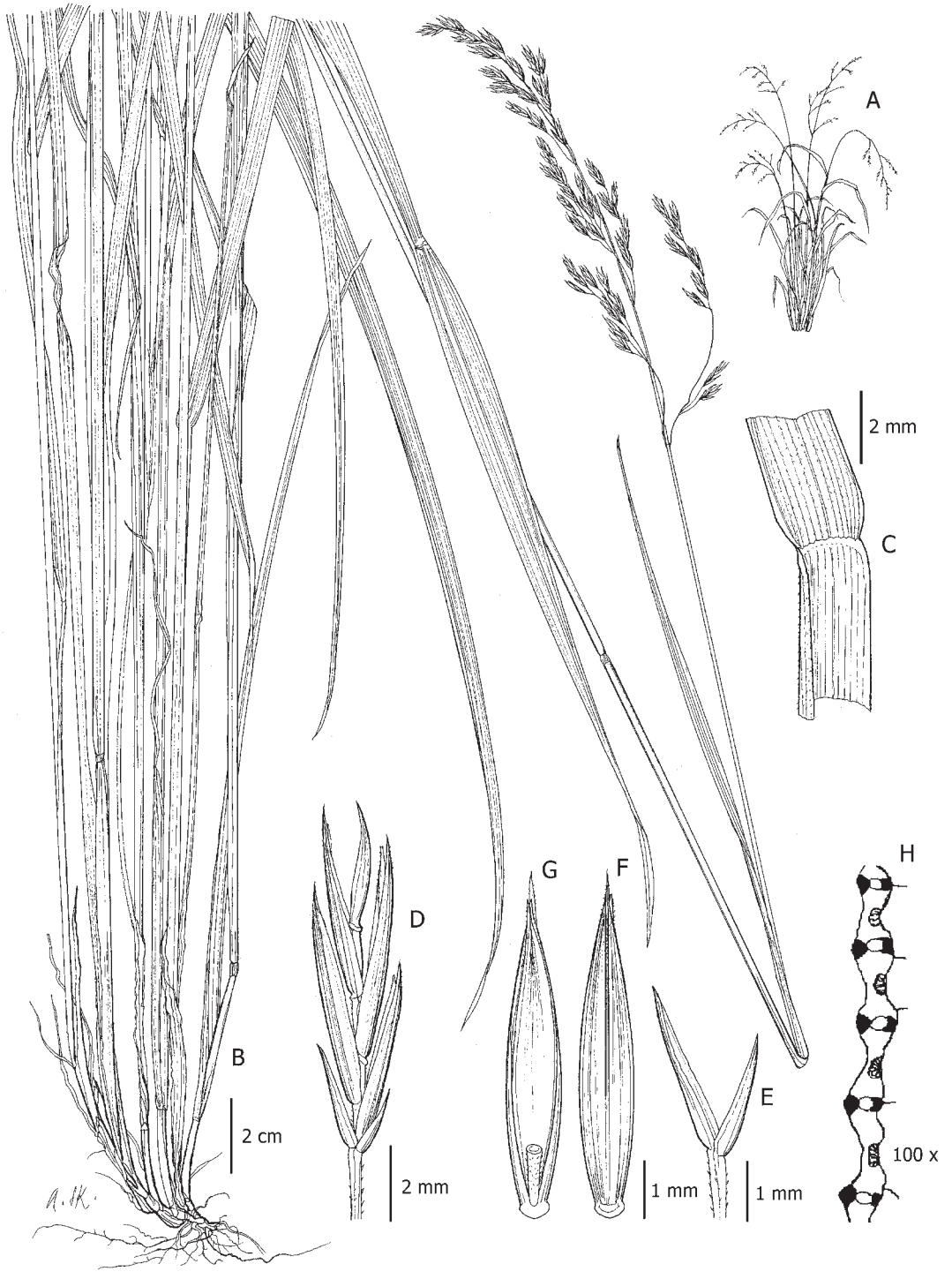


Figure 8. *Festuca sodiroana.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 2992* (PRC).

Cumbal, vereda Las Huertas, 3600 m, 9 Mar 1999, *D. Stančík 2754* (COL, PRC, PSO); Cumbal, lakeshore, 4000 m, 24 Mar 1941, *Sneider 430* (NY); Mun. Pasto, paramo Puerto Frío, between villages Las Almas and Alisales, 2900 m,14 Mar 1999, *D. Stančík 2870* (COL, PRC, PSO); Mun. Tuquerres, Volcán Azufral, road from vereda San Roque Alto, 3500 m, 9 Mar 1999, *D. Stančík 2772* (COL, PRC, PSO); 2650 m, 9 Mar 1999, *D. Stančík 2776* (COL, PRC, PSO); Vereda El Carmelo and La Florida, Volcán Doña Juana, 2900 m, 18 Mar 1999, *D. Stančík 2902* (COL, PRC, PSO); Páramo de Bordoncillo, Mun. Santiago, vereda San Antonio de Bellavista, 1°11´N, 77°06´W, 3200−3400 m, 18 Mar 1964, *Alberto et al. 144* (COL); Mun. Guachucal, páramo de Infernillo, 3200 m, 5 Mar 1999, *D. Stančík 2632* (COL, PRC). **Norte de Santander:** between Pamplona and Mutiscua, 2700 m, 1 Apr 1984, *Wood 4326* (COL, FMB, K). **Putumayo:** Páramo de Tabano, 15 May 1935, *Archer 3402* (US). **Santander:** Valle California, 2800 m, 14 Sep 1985, *Wood 5066* (FMB, K). **Tolima:** Mun. Ibague, Nevado del Tolima, 04°37.4´N, 75°19.8´W, 3400 m, 8 Jun 2000, *D. Stančík 3595* (COL, PRC, PSO); 3400 m, 16 Dec 1984, *Wood 4648* (COL, FMB, K); W slope of Paramo Rico, 3200 m, 15−19 Jan 1927, *Killip & Smith 17861* (NY). sin. loc.: Cerro Nevada, Bos. La Peña, 2900 m, *Lindig 1116* (K, P); *Lindig 1117* (P); *Mutis 5544* (US). **ECUADOR. Azuay:** Road Cuenca – Saraguro, km 6, S of Cumbe, 03°04´S, 79°00´W, 3150 m, *S. Laegaard 105132* (AAU); Parque Nacional Cajas–Laguna Llaviuco, 3150 m, 22 Apr 1990, *P.M. Peterson 8872, C.R. Annable & M.E. Poston* (K, MO, QCA, QCNE, US); Ganadel, 3250 m, *E. Asplund 17846* (S); between Cuenca and Hiugra, 2700–3000 m, *A.S. Hitchcock* 21682 (US); road Sigsig–Guadaquiza, 02°09´S, 78°43´W, 3300 m, 29 May 1992, *S. Laegaard et al. 103032* (AAU, QCA, QCNE); Mun. Cuenca, Parque Nacional Cajas, Laguna Llaviucu, 02°50´30˝S, 79°08´45˝W, 3100–3150 m, 3 Aug 1999, *Palice 1* (PRC); *Palice 3* (PRC); *Palice 4* (PRC). **Bolívar:** Road Guaranda–Pueblo Viejo, km 21.6, 01°35´S, 79°09´W, 2500 m, 6 Mar 1988, *S. Laegaard & S.A. Renvoize 70580* (AAU); km 20.1, 01°35´S, 79°05´W, 2700 m, *S. Laegaard & S.A. Renvoize 70577* (AAU, K, QCA, QCNE). **Cañar:** Road Cañar–Biblian, Fuganillas, 02°36´S, 78°54´W, *S. Laegaard 52754* (AAU, QCA, QCNE); Tipococha–Hacienda Shical, 3000 m, *Acosta-Solís 16963* (US); *Acosta-Solís 16974* (US). **Carchi:** El Angel, Hacienda la Esperanza, 00°39´N, 77°54´W, 3300 m, *S. Laegaard 53118* (AAU, QCA); El Voladero, 00°38´N, 67°53´W, 3400–3800 m, *Davalos 22* (US); wooded hills about 5 mi S of Tulcán, 2500 m, *A.S. Hitchcock 21094* (US); Road Las Juntas–El Angel, 00°46´N, 77°46´W, 3180 m, 11 Mar 1992, *S. Laegaard 101711* (AAU, QCA, QCNE); La Rinconada, 3200 m, *E. Asplund 7195* (F, S); 3000 m, *A.S. Hitchcock 20798* (NY, US). **Cotopaxi:** Road Pilalo–Zumbagua, 15 km above Pilalo, 00°59´S, 78°58´W, 3350 m, *Holm-Nielsen 24604* (AAU); km 9, 0°59´S, 78°57´W, 3150 m, 7 Apr 1992, *S. Laegaard 102227* (AAU, QCA, QCNE); Road Pilalo–Latacunga, 00°57´S, 78°58´W, 3400 m, *Holm-Nielsen 1482* (AAU, MO, S); Road Quevedo–Latacunga, 3600 m, *Harling et al. 8904* (GB); Río Chalupas, 00°50´S, 78°21´W, 3700 m, *S. Laegaard 101781* (AAU, QCA, QCNE); Mun. Lasso, Volcán Cotopaxi, margin of the forest at the road to National Park entrance, 00°39´6˝S, 78°30´55˝W, 3530 m, 28 Sep 2000, *D. Stančík 3885, 3886* (PRC, QCA). **Chimborazo:** Road Chunchi–Zhub, km 22, 02°22´S, 78°57´W, 2780 m, 27 May 1992, *S. Laegaard et al. 103010* (AAU, QCA); Urbina towards Mt. Chimborazo, 3750 m, *E. Asplund 7878* (S); Pallatanga–comunidad Jesus del Gran Poder, 01°58´S, 78°56´W, 2800–3200 m, *Clark et al. 1372* (QCNE). **Imbabura:** Road Otavalo–Selva Alegre, km 25.2, 00°16´S, 78°24´W, 3300 m, *S. Laegaard et al. 70813* (AAU, K, QCA); Paramo de Angochagua, 2900–3600 m, *Acosta-Solís 18839* (US); Cayambe–Laguna San Marcos, 11200 ft, *Cazalet & Pennington 5417* (K, NY, US); Mun. Urcuquí, road to Cerro Yanaurcu, 00°26´28˝N, 78°15´24˝W, 4100 m, 15 Oct 2000, *D. Stančík 4095* (PRC, QCA); Mun. Otavalo, road from Laguna Mojanda to Cochasquí, 00°04´55˝N, 78°17´50˝W, 3450 m, 19 Oct 2000, *D. Stančík 4105* (PRC, QCA); *D. Stančík 4113* (PRC, QCA). **Loja:** Road to Fierra Urcu, 03°33´S, 79´15´W, 3100 m, *S. Laegaard et al. 18855* (AAU, LOJA, QCA, QCNE); Road Saraguro–Yacuambi, 03°34´S, 79°06´W, 3050 m, *S. Laegaard 20688* (AAU, LOJA); between San Lucas and Oña, 2200–3100 m, *A.S. Hitchcock 21512* (US); Udo de Sabanilla, 04°27´S, 79°09´W, 2700 m, 1 Sep 1998, *S. Laegaard et al. 19095* (LOJA); Mun. Saraguro, road to Fierra Urcu, 03°42´40˝S, 79°18´12˝W, 3400–3450 m, 24 Aug 2000, *D. Stančík 3771, 3781* (PRC, QCA); 3000–3100 m, *D. Stančík 3792* (PRC, QCA). **Morona-Santiago:** road Gualaceo-Limon, km 12 of pass, 03°01´S, 78°37´W, 2590 m, *S. Laegaard et al. 103079* (AAU); Mun. Alao, way from Alao to

Parque Nacional Sangay, 3500–3700 m, 23 Jul 1999, *D. Stančík 3292* (PRC, QCA, W); Parque Nacional Sangay, patches of the forest above the Quebrada Tablamitza, 3600 m, 22 Jul 1999, *D. Stančík 3352* (PRC, QCA). **Napo:** km 45 on road Salcedo–Napo, 6 km NE, 00º56´S, 78º23´W, 3600 m, *S. Laegaard 53372* (AAU, QCA, QCNE). **Pichincha:** Near Quito, Jun 1922, *Harteman 39* (US); Paramo Guamani, 00º15´S, 78º12´W, 3700 m, *S. Laegaard 105069* (AAU); 3530 m, *S. Laegaard 102318* (AAU, QCA, QCNE); Volcán Pichincha, 3250 m, *Asplund 6155* (AAU, MO); above Lloa, 3200 m, *E. Asplund 7537* (F, S); 3250 m, *E. Asplund 6155* (F, MO, S, US); Mt. Pichincha, *Sodiro s.n.* (NY, MO); 3400 m, *Sodiro s.n.* (US); *Milles et al. 281* (US); *Sodiro s.n.* (US); 3600 m, *Sodiro 282* (US); 3300 m, *E. Asplund 16163* (S); At base of Mt. Pichincha–La Carolina, *Sodiro s.n.* (S); road Chillogallo–Chiriboga, km 3 E of San Juan, 3100 m, *Sparre 16950* (S); *Sparre 16920* (S); San Juan towards Quito, 3400 m, *E. Asplund 16094* (S); Tambillo, 2700 m, *E. Asplund 6215* (AAU, F, MO, S, US); road Pifo–Pintag, 00º19´S, 78º17´W, 3100 m, *S. Laegaard 102293* (AAU, QCA, QCNE); road Santo Domingo–Quito, between Saloya and Chiriboga, 2800 m, *Harling et al. 10415* (GB); Volcán Corazón, 11000 ft, *Prescott 913* (NY); road km 13.5 ESE of Machachi, and 10 km NE towards Sangolqui, 3350 m, 25 May 1990, *P.M. Peterson 9313 & E.J. Judziewicz* (K, MO, QCA, QCNE, US); road Quito–Nono, 00º06´S, 78º31´W, 3300 m, 17 Jun 1984, *S. Laegaard 52285* (AAU, QCA, QCNE); Nono, 2600 m, *E. Asplund 7462* (S); Volcán Pasochoa, 00º21´S, 78º29´W, 3100–3400 m, 23 Feb 1992, *S. Laegaard 101406* (AAU, QCA); 00º27´S, 78º30´W, 3200 m, *S. Laegaard 55282* (AAU, QCA, QCNE); *Sodiro s.n.* (QPLS); Highway Aloag–St. Domingo, 2900 m, *Sparre 15076* (S); Mun. Pifo, Páramo Guamaní, *Polylepis* forest, 00°19´S, 78°15´W, 3700 m, 19 Jun 1999, *D. Stančík 3010* (PRC, QCA); Mun. Amaguaña, volcán Pasachoa, 3400 m, 14 Sep 2000, *D. Stančík 3667* (PRC, QCA); Mun. San Antonio, Res. Geobotanica Pululahua, 00°02´20˝N, 78°29´33˝W, bottom of the crater, 2700 m, 13 Sep 2000, *D. Stančík 3656* (PRC, QCA). **Tungurahua:** sin loc., *Spruce 5938* (K, W). Mun. Baños, Volcán Tungurahua, on way to refugium, E side of the volcán, 3300 m, 29 Jul 1999, *Palice 9* (PRC); Mun. Pillaro, Las Llanganatis, 01º 09´43˝S, 78°15´9˝W, 3600 m, 28 Sep 2000, *D. Stančík 3985* (PRC, QCA). **Zamora–Chinchipe:** road Loja–Zamora, ca. 2–6 km E of pass, 03º59´S, 79º09´W, 2750 m, *S. Laegaard 18748* (AAU, LOJA); 2600 m, *S. Laegaard 18727* (AAU, LOJA); Road Loja–Zamora, 1 km E of pass, 04º00´S, 79º09´W, 2700 m, *S. Laegaard 18483* (AAU, LOJA, QCA, QCNE).

7. Festuca tovariensis Stančík & P.M. Peterson, Sida 20(1): 24. 2002. (**Figs. 9, 11**). TYPE: Peru. Huancavelica, Prov. Tayacaja, Chuspi−Hda. Tocas, entre Colchabamba y Paucarbamba, monte bajo, 2800 m, 22 Apr 1954, *O. Tovar Serpa 2057* (holotype: US-2181286!; isotype: USM!).

Loosely tufted perennials with extravaginal innovations. Culms 70–90 cm tall, erect, glabrous; nodes 2–4 nodes in basal half. Leaf sheaths membranous, brown, margins free; auricles absent; ligules 1–2 mm long, membranous, margins ciliate, apex truncate; blades 8–15 cm long, 1.5–4.5 mm wide, flat, green, abaxially scabrous with ribs on abaxial surface. Panicles 15–20 × 7–10 cm, open, pendant; branches scabrous. Spikelets 7.5–9.5 mm long, florets 3; rachillas 1.1–1.4 mm long, densely pilose; glumes 1.5–4.5(–5) mm long, narrowly lanceolate, coriaceous, purplish, glabrous, apex acute sometimes scabrous; lower glumes 1.5–1.8 mm long, 1-nerved; upper glumes 3.5–4.5(–5) mm long, 1–3-nerved; lemmas 5.5–6.5 mm long, lanceolate, coriaceous to membranous, inconspicuously 5-nerved, purplish-green, scabrous, apex entire, awned, the awn 5–7 mm long, terminal, scabrous, straight; paleas as long as the lemma, keels scabrous, apex hairy; lodicules ca. 0.8 mm long, lanceolate, acuminate; anthers 1.5–1.6 mm long; ovary apex sparsely hairy. Caryopses lanceolate; hilum 2/5–1/2 of total length.

Observations.— Festuca tovariensis is morphologically similar to other long-awned species that have short glumes, such as: *F. ulochaeta* from Brazil, Colombia, and Venezuela; *F. cochabambana* from Bolivia; and *F. flacca* from Ecuador.

Distribution and habitat.—This species is known only from the Andean forest zone of northern and central Peru between 2500–3850 m.

Additional specimens examined. **PERU. Ancash:** Prov. Yungay, Parque Nacional Huascarán, Llanganuco sector, María Josefa trail between Chinancocha and Pucayacu, 09°05´S, 77°39´W, 3700–3850 m, 5 Jul 1985, *Smith 10561* (MO). **Ayacucho:** Prov. Huanta/La Mar, Tambo, Wolken-Nebel-Buschwald, 37 km to Ayna, 3250 m, 23 Mar 1977, *Ellenberg 7024* (USM). **Cajamarca.** Prov.

Figure 9. *Festuca tovariensis.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Caryopsis. A–H, *Vega et al. 1544* (F).

Cajamarca, Yumagual, entre San Juan y El Gavilán-Gavilán, ladera con arbustos, 2500 m, 6 Oct 1975, *Vega et al. 1544* (F); Prov. Contumaza, alrededores de Guzmango, ladera, 2600 m, 25 Jul 1992, *Sagásteguii 14785* (F); Carretera a Yumagual, 2500 m, 26 Jun 1966, *Vega 249* (USM).

8. Festuca ulochaeta Nees ex Steud., Syn. Pl. Glumac. 1:305. 1854. (**Figs. 10, 11, 76A–D**). Type: Brazil. *Sellow s.n.* (isotypes: B!, K!)

Festuca leptothrix Trin. ex Döll, Fl. Bras. 2(3): 115. 1878. Type: Brazil. São Paulo, *G.H. von Langsdorff s.n.* (holotype: LE-TRIN-2818.01!; isotypes: K!, US-91399 fragm!).

Vulpia ulochaeta Nees ex Döll, Fl. Bras. 2(3): 115. 1878, *nom. inval.* Type: Brazil. *Sellow s.n.* (holotype: B!, BAA-3489 fragm ex B).

Loosely tufted perennials with extravaginal innovations. Culms 60–120 cm tall, erect, glabrous; nodes 2–4 nodes. Leaf sheaths membranous, brown, striate, glabrous; auricles absent; ligules 0.5–1(–2) mm long, membranous, apex truncate; blades 15–30 × 0.5–1.1 cm, flats, green, abaxially scabrous. Panicles 15–25(–35) × 15–25 cm, flexuous, pendant, ovate; branches scabrous. Spikelets 9–12 mm long, florets 3–5; rachilla shortly hairy; glumes 2.5–4.5(–6) mm long, membranous to coriaceous, narrowly lanceolate, green, apex acute, upper third scabrous; lower glumes 2.5–3.5(–4) mm long, 1-nerved; upper glumes 3.5–4.5(–6) mm long, 3-nerved; lemmas 6–8(–9) mm long, 5-nerved, membranous to coriaceous, lanceolate, green, papillose, apex scabrous, awned, the awn 7–15 mm long, scabrous, flexuous; paleas almost as long as the lemma, glabrous, margins and upper third scabrous; lodicules lanceolate; anthers 1.1–1.5(–2) mm long, ovary apex sparsely hairy. Caryopses lanceolate; hilum 3/4 of total length.

Leaf blade anatomy.—Cross-sections with numerous vascular bundles, without ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous and extending to thevascular bundles; bulliform cells absent; abaxial epidermis with scattered prickles.

Observations.—Festuca ulochaeta has spikelets with short glumes and long-awned lemmas, characteristics shared with *F. flacca*, *F. cuzcoensis,* and *F. cochabambana*. *Festuca ulochaeta* differs from these other species by having lemmas with extremely long (7–15 mm) and distinctly flexuous (versus straight) awns.

Distribution and habitat.—Festuca ulochaeta is known from the humid forests of SE Brazil and NE Argentina between 700–2200 m. In Colombia and Venezuela this species occurs in clearings, margins of the streams, and roadsides in Andean forests (Cordillera Oriental and Aragua, Mérida) between 2600–3100 m. *Festuca ulochaeta* is reported from Costa Rica for the first time here.

Additional specimens examined. **ARGENTINA. Misiones:** Dpto. Gral. Manuel Belgrano, Santo Andresito, 26°12´S, 53°40´W, 720 m, 15 Feb 1996, *O. Morrone & A.M. Cialdella 854* (CTES, MO). **Salta:** Dpto. Santa Victoria, camino de Toldos a Lipeo, a 15 km de Toldos, 1650 m, 11 Nov 1974, *A.M. Türpe 2932* (W); Arroyo Latas, 20 Feb 1924, *L. Parodi 5673* (US). **BRAZIL. Minas Gerais:** Xanxere, Pinheiral, 9 km E of Xanxere, 600–800 m, 26 Feb 1957, *Smith & Klein 11836* (B, R, US); Serra de Caparão, 2100–2220 m, 4 May 1925, *A. Chase 9659* (W); 2100 m, 4 May 1925, *A. Chase 9672* (US); 2100–2200 m, *A. Chase 9673* (US); Monte Verde, Sep 1997, *Wagner 5010* (ICN); Vila Monteverde, Pico da Pedra Salada, *Burman 880* (SP). **Paraná:** ca. 85 km of Guarapuava, 800–1050 m, 6 Mar 1967, *Linderman et al. 4658* (K, W, US); Ypiranga, 9 Feb 1904, *Dusen 3624* (R); *Dusen 3515* (R); Piraquara–Estrada a Monte Algre, Apr 1950, *G. Hatschbach 1912* (BAA); Tres Barras, 27 Jan 1916, *Dusen 17561* (BAA); Iraty, in silvula subuliginosa, 26 Feb 1909, *Dusen 7808* (US); Curitiba, woods along stream, Estacão Experimental, 13 Feb 1946, *J.R. Swallen 8540* (US); Curitiba, colonia Muricy–S. José dos Pinhais, na beira da Estrada, 1 Mar 1965, *Scito & Kuniyoshi 1315* (K); Curitiba, Orla do brejo, 15 Jan 1975, *Maguire 3487* (K); Orla Guarapuava, fazenda Capão Redondo, 20–23 Mar 1946, *J.R. Swallen 8859* (US); Mun. Palmas, 1100 m, 16 Feb 1958, *G. Hatschbach 4715* (US); Curitiba, Parque Barigui, area degradada, proxima a orla da foresta con *Araucaria*, 25°22´S, 49°13´W, 2 Apr 1997, *Kozera & Izernhagen 476* (NY); Piraguara, ad marginam, 1 Jul 1909, *Dusen 7783* (K, NY); Mun. Río Branco do Sul, *Dombrowski 2432* (ICN, K); São Mateus do Sul, Río Potinga, 760 m, do interior da mata, 9 Feb 1966, *G. Hatschbach 13820* (K). **Río de Janeiro:** Serra de Itatiaia, 1960 m, 16 Jan 1925, *A. Chase 8276* (RB, US); Parque Nacional de Itatiaia, entre Agulhas Negras e Abrigo Massena, campo alto 11–12 Feb 1985, *Burman 905* (SP). Río **Grande do Sul:** Highway BR-116 to Lajes, 1000 m, 10 Mar 1976, *G. Davidse et al. 11074* (K, SP, VEN); Entre J. Kroeff et Roncinka, 18 Mar 1964,

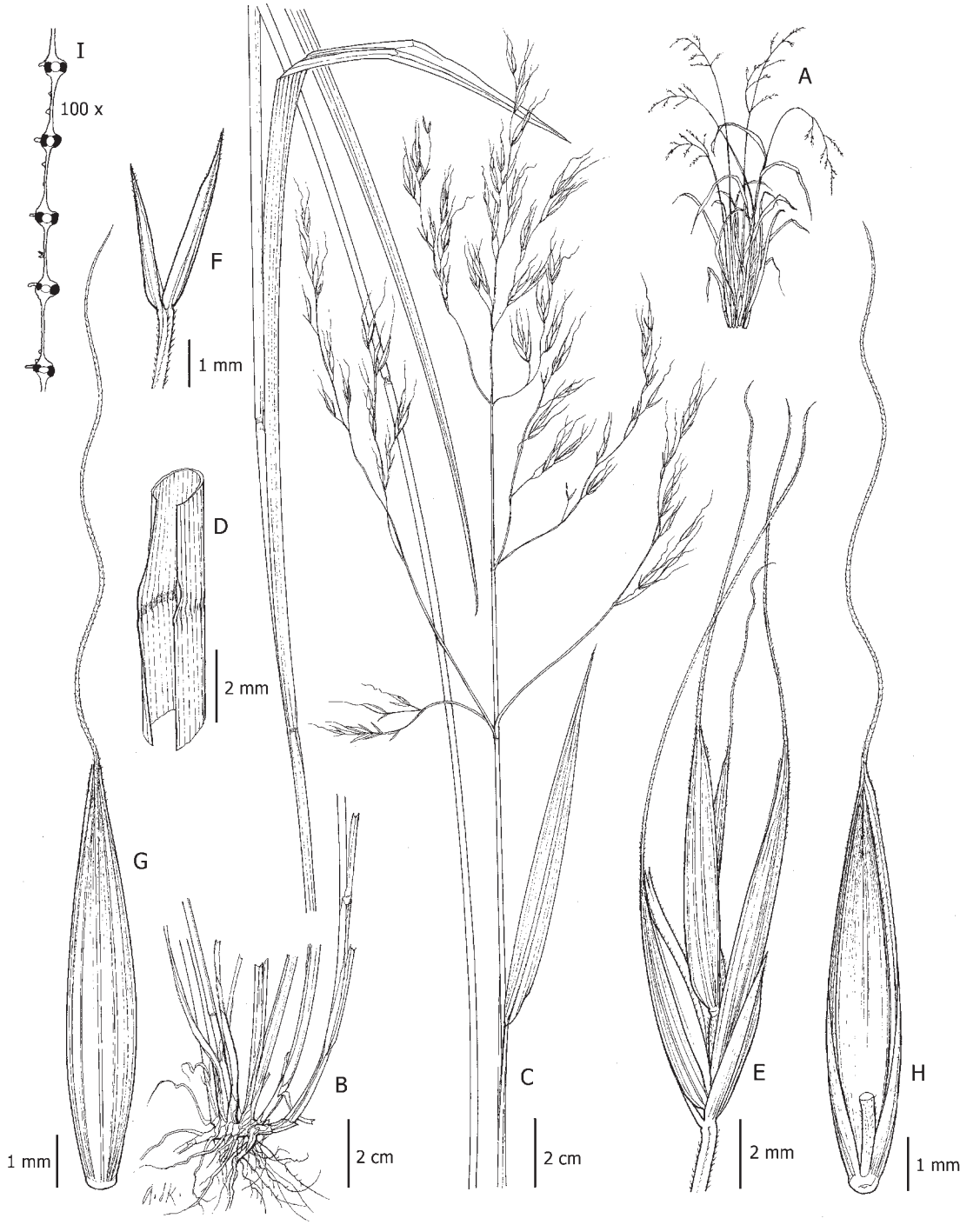


Figure 10. *Festuca ulochaeta.* **A.** Stylized growth form. **B.** Habit. **C.** Inflorescence. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 4179* (COL).

Brescia & Marches 4212 (K, P); Farroupilha, in araucarieto, 700 m, 15 Feb 1957, *Camargo 59992* (B); Vila Oliva, Caxias do Sul, 24 Feb 1954, *Rambo 54999* (B, BAA); *Rambo 54989* (B, US); Mun. Cruz Alta, campos de Cruz Alta, 500 m, Feb 1906, *Jurgens 6258* (W, US); Serra de Caparas, Espirito Santo, 27 Nov 1929, *A. Chase 10101* (W, US); São Leopoldo–Boni Jesus, *Dutra 331* (ICN, R); *Dutra 402* (R, US); Taimbe, São Francisco de Paula, 18 Dec 1950, *Rambo 49315* (BAA); São Francisco de Paula–Tainhas, Dec 1953, *Barreto 1871* (BAA); Mun. de Caxias do Sul, Ana Rech, 780 m, 18 Mar 2000, *Scur 656* (US); Taimbesinho, in araucarieto aperto, 20 Feb 1953, *Rambo 54011* (US); Esmeralda, estacçao ecologica De Aracuri, 2 Dec 1979, *Winge et al. 1362* (ICN); *Winge 1272* (ICN); km 60 W of Passo Fundo along highway BR 285 to Vacaria, intersection with Río Igeiro, 11 Mar 1976, *G. Davidse & D'Arcy 11166* (SP); São Francisco da Paula to Eletra, *Araucaria* woodland 31 Jan 1965, *Clayton 4491* (K, SP); Cambara do Sul, 29°00´S, 50°00´W, 27 Jan 1948, *Rambo 36446* (K); Cambara do Sul, Itaimbezinho, Bela Vista, 1 Dec 1981, *Wagner 944* (ICN); Itaimbezinho, Bela Vista, *Valls 2386* (ICN); *Wagner et al. 298* (ICN); 1 Dec 1981, *Wagner 946* (ICN); *Wagner 947* (ICN); *Valls 56* (ICN); Lagoa dos Patos, Saco de Tapes, Dec 1980, *Goergem & Wagner 50197* (ICN); Mun. de Caxias do Sol–Ana Rech 780 m, 18 Mar 2000, *Scur 656* (MO). **Santa Catârina:** Campo Ere, 29 Feb 1964, *Castellaños 24729* (COL, K); Caçador-Curitibaños, 33 km SE of Caçador on the road to Lebon Regis (47 km), 700–900 m, 16 Mar 1957, *Smith & Klein 12188* (R, US); Serra de Boa Vista, São José, 3 Mar 1961, *Reitz & Klein 10832* (B, US); 10 Nov 1960, *Reitz & Klein 10399* (B, US); Palmares, Campos Novos, 900 m, 11 Apr 1963, *Reitz & Klein 14611* (B, US); Mun. Caçador, km W of Caçador, ruderal, 900–1000 m, 6 Feb 1957, *Smith & Klein 10887* (R); Bog. 8 km N of Caçador, 950–1100 m, 7 Feb 1957, *Smith*

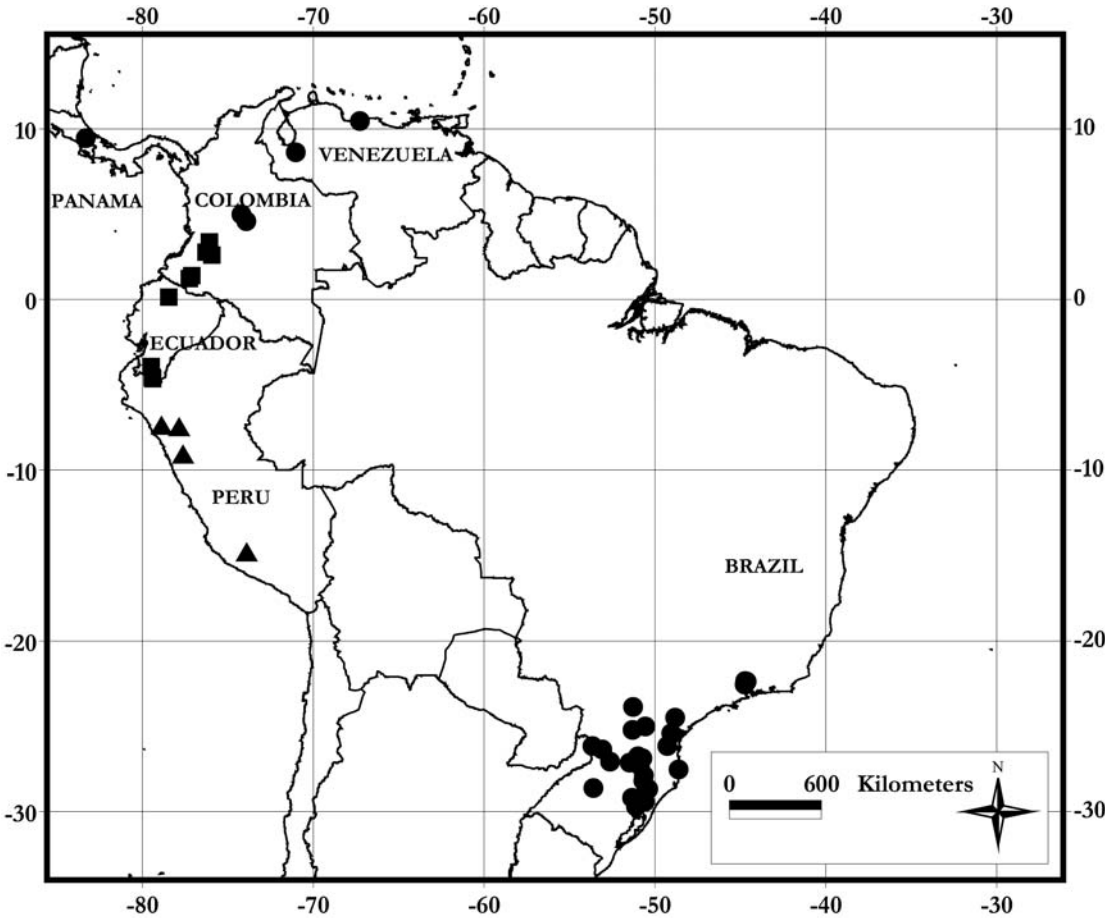


Figure 11. Distribution of *Festuca ulochaeta* (●), *F. tovariensis* (▲), and *F. caldasii* (■).

& Klein 10956 (R, US); Mun. Joacaba, campos of palmas, 55 km W of Caçador, 1000–1200 m, 18 Feb 1957, *Smith & Klein 11384* (R, US); Mun. Chapeco, Fazenda Campo São Vicente, 24 km W of Campo Ere, 900–1000 m, 20 Feb 1957, *Smith & Klein 11611* (R, US); Mun. Lajes, E of Capao Alto, 900–1000 m, 12 Feb 1957, *Smith & Klein 11335* (R, US); Mun. Campo Alegre, lower fazenda of ernesto Scheide, 900 m, 10 Mar 1957, *Smith & Klein 12024* (R, US); Morro Juco Prudente, steep slopes of wooded arroyo, 1 Jan 1946, *J.R. Swallen 8033* (US); Coxilha Rica, open woods, 6 Jan 1946, *J.R. Swallen 8168* (US); Picadas, km 181 da ERF, Papanduva, 1000 m, 26 Feb 1962, *Reitz & Klein 12509* (US); São Joaquim, Urupema, matinha, 1200 m, 24 Dec 1962, *Reitz & Klein 14585* (US); Río Caçador, 21 Jan 1946, *J.R. Swallen 8231* (MO, NY, US); km 21, NE of Santa Cecilia, along Highway BR-116 to Curitiba, open grassland with rocks outcrops, marshy area and patches of trees, 1250 m, 3 Oct 1976, *G. Davidse et al. 11082* (NY, SP); km 18, NE of Santa Cecilia, along Highway BR-116 to Curitiba, grassy roadside, 1200 m, 3 Oct 1976, *G. Davidse et al. 11087* (NY, SP); Campo Dos Padres, Bom Retiro, 1900 m, 20 Dec 1953, *Reitz 2611* (NY). **São Paulo:** 1816–1821, *Saint-Hilaire 312* (P*); Saint-Hilaire 304* (P); São Paulo prope Apiahy, *Puiggari s.n.* (W); Serra de Bocaina, Apr 1951, *Segadas 2827* (R); Campos do Jordao, subida para o pico do Itapeva, *Kuhlmann 2242* (SP). **COLOMBIA. Cundinamarca:** Paramo del Tablazo, W of Subachoque, 3100 m*, Wood 3842* (COL, FMB, K); between La Calera – Choachí, ca. 1 km above Mundo Nuevo, 2600 m, 1983, *Wood 5104* (COL, K). sin. loc., *Lindig 1862* (P). **COSTA RICA. Limon:** Cantón de Talamanca, Sabanas de Durika, 1 km aguas abajo de la confluencia de los Río Uk y Río Kuk, 83°19′30″W, 09°25′20″N, 2250 m, 20 Oct 1989, *Herrera 3730* (K, MO). **VENEZUELA. Aragua:** Colonia Tovar, trayecto El Lagunazo - Colonia Tovar, 2100 m, Feb 1953, *Aristeguieta 763* (VEN). **Mérida:** Mun. Tabay, Laguna Coromoto, mountain forest, 3000–3100 m, 7 Nov 2000, *D. Stančík 4177* (AAU, CAR, COL, PRC, W); 2800–3000 m, *D. Stančík 4179* (CAR, COL, PRC, US); Laguna La Coromoto, 3200–3300 m, 3 Jul 1987, *B. Briceño & Adamo 2011* (Herbarium Briceño).

9. Festuca caldasii (Kunth) Kunth, Revis. Gramin. 1: 132. 1835. (**Figs. 11, 12, 76E & F, 77A & B**). *Bromus caldasii* Kunth Nov. Gen. Sp. (quarto ed.) 1: 151. 1816. *Schedonorus caldasii* (Kunth) Roem. & Schult., Syst. Veg. 2: 709. 1819. *Festuca quadridentata* var. *caldasii* (Kunth) St.-Yves, Candollea 3: 266. 1927. *Festuca quitensis* Willd. ex Kunth, Enum. Pl. 1: 407. 1833, *nom. inval.* Type: Ecuador. crescit locis altis regni Quitensis, prope Chillo, *Humboldt & Bonpland s.n.* (lectotype: P!, designated here; isolectotypes: B!, US-865519 fragm. ex P!).

Bromus procerus Kunth, Nov. Gen. Sp. (quarto ed.) 1: 150. 1816. *Schedonorus procerus* (Kunth) Roem. & Schult., Syst. Veg. 2:708. 1819. *Bromus procerus* Humb. ex Spreng., Syst. Veg. 1:357. 1825. *nom. illegit.*

Festuca quadridentata subsp. *eminens* (Kunth) St.-Yves, Candollea 3: 266. 1927. *Festuca eminens* Kunth, Révis. Gramin. 1: 132. 1829. Type: Ecuador. Pichincha, 2410 m, Feb, *Humboldt & Bonpland 2296* (holotype: P!; isotypes: B!, BAA-1206 fragm. ex B, P!, US-2875405 fragm. ex P!).

Rhizomatous perennials with extravaginal innovations. Culms 70–150 cm tall, erect, scabrous; nodes 3 or 4 in distal half. Leaf sheaths coriaceous, scabrous, chestnut-brown to brown, striate, fibrous near base, margins free; ligules 2.5–3 mm long, membranous, abaxially hairy, apex acute, lacerate; blades 20–35 × 0.3–0.9 cm, flat, green, scabrous, with prickles on both abaxial and adaxial epidermis. Panicles 13–17 × 5–8 cm, ovate; branches erect or sometimes spreading, scabrous. Spikelets 15–17 mm long, oval, florets 5–7(–8); rachilla pilose; glumes 3.5–6.5 mm long, membranous, lanceolate, green with transparent membranous margins; lower glumes 3.5–4(–5) mm long, 1-nerved; upper glumes 4.5–6.5 mm long, 3-nerved; lemmas 10–14 mm long, lanceolate, membranous to coriaceous, 5-nerved, green, scabrous or shortly densely hairy, apex entire, awned, the awn 1–3 mm long; callus glabrous; paleas 4/5 as long as the lemma, membranous, scabrous; lodicules 0.8–1 mm long, oblong-lanceolate; anthers (2.8–)3.5–4.5 mm long; ovary apex glabrous. Caryopses not seen.

Leaf blade anatomy.—Cross-sections with many vascular bundles, with just small ribs; sclerenchyma under both abaxial and adaxial epidermis, discontinuous; bulliform cells present, few; epidermis without hairs.

Observations.—Festuca caldasii is morphologically similar to *F. woodii*, a species that occurs in northern Colombia. However, *F. woodii* has

Figure 12. *Festuca caldasii.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Laegaard 20405* (F).

smaller spikelets (12–14 versus 15–17 mm long), shorter lemmas (8.5–9 versus 10–14 mm long), and shorter lemma awns (1 versus 1–3 mm long). In Costa Rica and Panama there are two other species in sect. *Glabricarpae*: *F. breviglumis* Swallen and *F. chiriquensis* Swallen. However, both of these species have shorter (0.5–1 mm long) and acute ligules.

Distribution and habitat.—Festuca caldasii occurs sporadically from southern Colombia (Cauca, Nariño) to southern Ecuador (Cañar, Chimborazo, Loja, Pichincha). This species is known from the margins of Andean forests and matorral vegetation between 1900–3000 m.

Additional specimens examined. **COLOMBIA. Cauca:** Tierra Dentro, below Pitaio, 2400 m, Feb 1906, *Pittier 437* (US); Río Paez Valley, between Huila and Bitonco, 1900–2300 m, Feb 1906, *Pittier 1320* (US); near Jambalo, 2200 m, Feb 1906, *Pittier 1444* (US). **Nariño:** Mun. Buesaco, a 2 km de la poblacion, 2000 m, *Ramírez 1404* (COL); Mun. Pasto, Morasurco hill, 2550 m, 24 Feb 1986, *Wood 5309* (COL, FMB, K). **ECUADOR. Cañar:** El Tambo–Carshao road, km 1.5–3, 02°28´S, 78°59´W, 3100 m, 10 Jun 1999, *S. Laegaard & Sklenář 20302* (LOJA); **Chimborazo:** Canyon of Río Chanohan, about 5 km N of Hiugra, 5000–6500 ft, CAMP (F, K, NY, US); road Sipambe–Hiugra, km 10, 02°15´S, 78°57´W, 2050 m, *S. Laegaard 20405* (AAU, PRC); Huigra, 1200 m, *A.S. Hitchcock 20746* (US); km 6 NE of Pallatanga and 5.4 km W on road to Chillanes, 1950 m, *P.M. Peterson & E.J. Judziewicz 9259* (QCA, US). Cañon of the Río Chanchan, about 5 km N of Huigra, moist forested valleys in the afternoon fog belt, 5000–6500 ft, 19–28 May 1945, *Camp 3327* (K). **Loja:** Road Catacocha-La Toma, km 28, 03°58´S, 79°31´W, 2200–2250 m, *S. Laegaard 102535* (AAU, QCA); Zumba road, km 6 above Jimbura, 04°40´, 79°26´W, 2400–2450 m, *S. Laegaard 105256* (AAU); road Amalusa–Jimbura, km 7–9, 04°36´S, 79°28´W, 1900 m, *S. Laegaard 105235* (AAU, QCA). **Pichincha:** Cotocollao, *Sodiro s.n.* (QPLS, US); *Sodiro s.n.* (W).

10. Festuca reclinata Swallen, Contr. U.S. Natl. Herb. 29(6): 254. 1949. (**Figs. 13, 14, 77C−F**). Type: Colombia. Santander: Paramo de Almorzadero, Cordillera Oriental, 3500–3700 m, 20 Jun 1940, *J. Cuatrecasas & H.G. Barriga 9970* (holotype: US-1798714!; isotype: COL!).

Rhizomatous perennials forming small tussocks with extravaginal innovations. Culms 30–40 cm tall, decumbens to erect, glabrous; nodes 2 or 3 in distal half; leaf sheaths membranous, greenish-white, scabrous, upper sheaths closed for 1/2 the length; auricles absent; ligules 1–2.5 mm long, membranous, apex acute, ephemeral; blades 5–15 × 0.3–0.5 cm, flat, green, abaxially scabrous. Panicles 9–10 cm × 2–3 cm, flexuous, ovate, branched; branches glabrous. Spikelets 10–13 mm long, obovate, florets 4; rachilla papillose; glumes 1.3–3.5 mm long, membranous, lanceolate, green, glabrous, upper margins hairy; lower glumes 1.3–2 mm long, 1-nerved; upper glumes 3–3.5 mm long, 3-nerved; lemmas 7–8.5 mm long, 5-nerved, lanceolate, membranous, green, scabrous, apex two-dentate, awned between the teeth, the awn 1–2 mm long; callus glabrous; paleas 4/5 as long as the lemma, membranous, keels scabrous; lodicules lanceolate; anthers 3–3.5 mm long; ovary apex glabrous. Caryopses not seen.

Leaf blade anatomy.—Cross-sections with many vascular bundles, with small ribs; sclerenchyma under both abaxial and adaxial epidermis, discontinuous, small, extending to the vascular bundles forming girders; bulliform cells absent; epidermis sparsely hairy.

Observations.—Festuca reclinata superficially resembles *Aphanelytrum procumbens* Hack. The spikelets and panicles of *F. reclinata* are similar to *Aphanelytrum*, but the glumes in the former are clearly nerved (versus unnerved), which is the difference between the two genera. Alexeev (1986) placed *F. reclinata* in sect. *Glabricarpae* and we consider the Alexeev's decision to be only provisional.

Distribution and habitat.—Festuca reclinata is known only from the type locality in the Colombian Cordillera Oriental, Dept. Santander were it was found in a paramo.

11. Festuca woodii Stančík**,** Darwiniana 41(1–4): 107. 2003. (**Figs. 14, 15, 78A−D**). Type: Colombia. Boyacá, Sierra Nevada del Cocuy, Hda. La Esperanza, 3700 m, in crevices of limestone pavement on a steep, open dip slope. Vigorously tufted perennial more than 1 m, inflorescence purple brown, 29 Oct 1985, *J.R.I. Wood 5254* (holotype: COL!, isotypes: FMB!, K!).

Rhizomatous perennials with extravaginal innovations. Culm 70–90 cm tall, erect, scabrous;

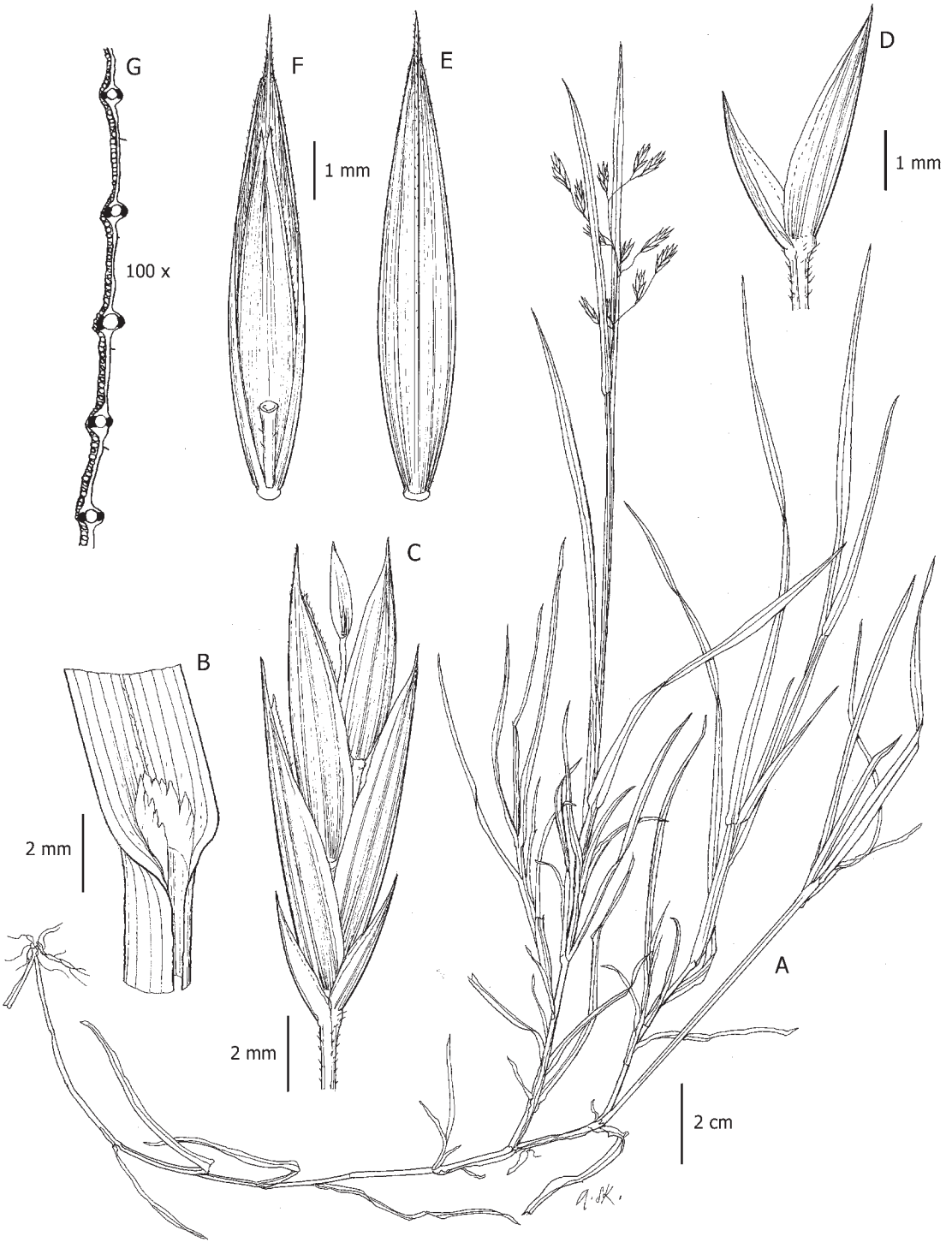


Figure 13. *Festuca reclinata.* **A.** Growing form. **B.** Ligule. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Lemma with palea and rachilla. **G.** Leaf blade cross-section. A–G, *Cuatrecasas & Barriga 9970* (COL).

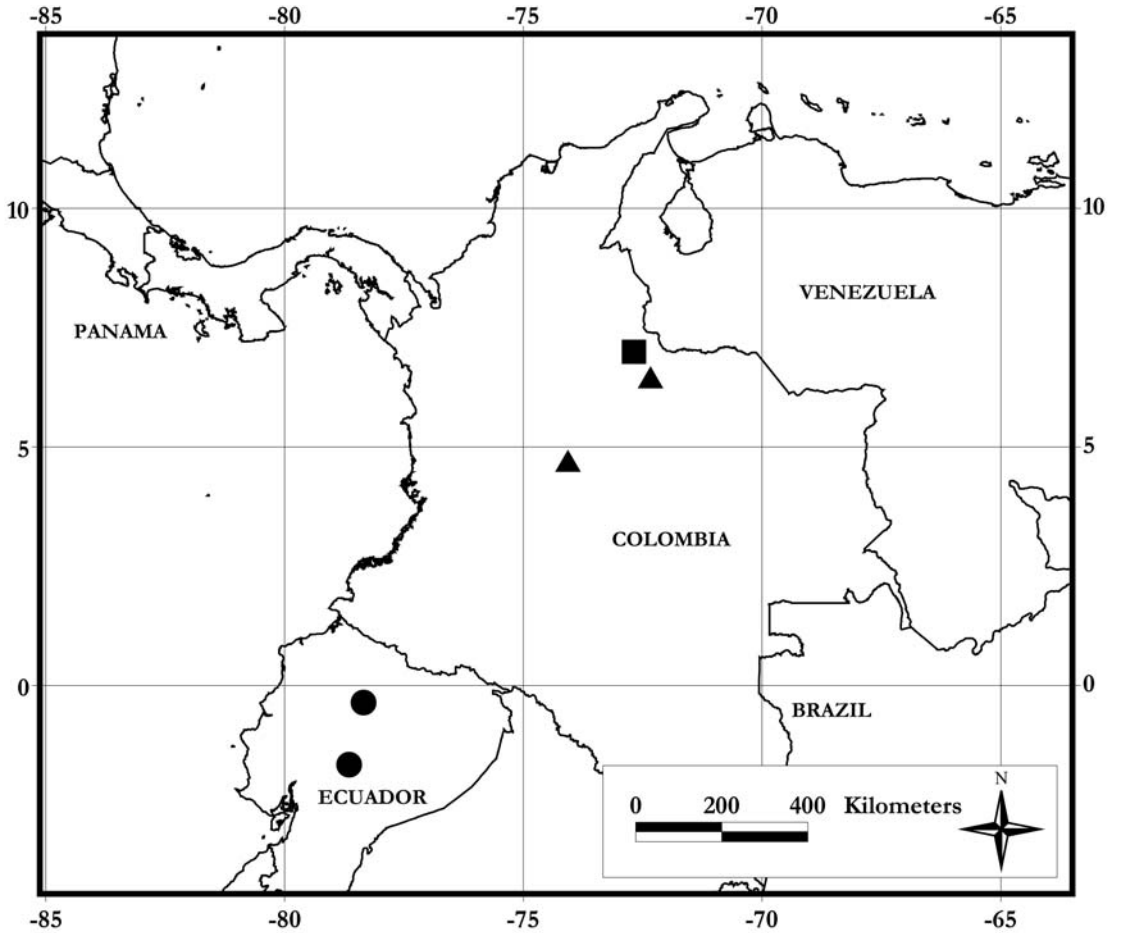


Figure 14. Distribution of *Festuca pratensis* (●), *F. woodii* (▲), and *F. reclinata* (■).

nodes 2 or 3; leaf sheaths membranous, glabrous, grayish, fibrous and ephemeral at base, margins free; auricles absent; ligules ca. 0.5 mm long, membranous, apex truncate; blades 50–60 × 0.25–0.5 cm, flat, conduplicate near apex, green, scabrous, with prickles on both abaxial and adaxial surface. Panicles ca. 20 cm long and 15 cm wide, flexuous, ovate, branched; branches scabrous. Spikelets 12–14 mm long, ovate, florets 4 or 5; rachilla densely hairy; glumes 4.5–7.5 mm long, membranous, narrowly lanceolate, green, sparsely scabrous; lower glumes 4.5–5.5 mm long, 1-nerved; upper glumes 6–7.5 mm long, 3-nerved; lemmas 8.5–9 mm long, 5-nerved, membranous to coriaceous, lanceolate, green, scabrous and short-hairy, apex two-dentate, awned, the awn 0.5–1 mm long; callus glabrous; paleas as long as the lemma, membranous, papillose; anthers 3.5–4 mm long; ovary apex sparsely short-hairy. Caryopses not seen.

Leaf blade anatomy.—Cross-sections with many vascular bundles and small ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous, extending to the vascular bundles forming girders; bulliform cells present; epidermis without hairs.

Observations.—Festuca woodii is morphologically similar to *F. caldasii* known from southern Colombia and Ecuador. However, *F. woodii* has shorter ligules (0.5 versus 2.5–3 mm long), truncate (versus acute) ligules, smaller spikelets (12–14 versus 15–17 mm long), and longer glumes.

Distribution and habitat.—Festuca woodii is endemic to the Colombian Cordillera Oriental (Boyacá, Cundinamarca) occuring in matorral and grass paramo vegetation types on rocky slopes and calcareous outcrops between 2700–3700 m.

Additional specimens examined. **COLOMBIA. Cundinamarca:** Bogotá, 2730 m, 16 Sep 1915,

Figure 15. *Festuca woodii.* **A.** Stylized growth form. **B.** Habit. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Leaf blade cross-section. A–F, *Wood 5254* (COL).

Apollinaire & Arthur 18 (US). **Boyacá:** Sierra Nevada del Cocuy, Hda. La Esperanza, 3700 m, 29 Dec 1985, *Wood 5354* (FMB).

12. Festuca arundinacea Schreb., Spic. Fl. Lips. 57. 1771. (**Figs. 16, 17, 78E & F, 79A & B**). *Bromus arundinaceus* (Schreb.) Roth, Tent. Fl. Germ. 2: 141. 1789. *Schedonorus arundinaceus* (Schreb.) Dumort., Observ. Gramin. Belg. 106. 1824, *nom. conserv*. *Festuca elatior* var. *arundinacea* (Schreb.) Wimm., Fl. Schles. 3: 59. 1857. *Festuca elatior* subsp. *arundinacea* (Schreb.) Čelak., Prodr. Fl. Böhmen 1: 51. 1867. *Festuca elatior* subsp. *arundinacea* (Schreb.) Hack., Monogr. Festuc. Eur. 152. 1882. *Lolium arundinaceum* (Schreb.) Darbysh., Novon 3(3): 241. 1993. Type: Scheuzer, Agrostographia, tab. 5, fig. 18. 1719. (lectotype: designated by Reveal, Terrell, Wiersema & Scholz, Taxon 40: 136. 1991).

Festuca elatior L., Sp. Pl. 1: 75. 1753, *nom. rej. Poa elatior* (L.) Moench, Enum. Pl. Hess. 37. 1777. *Avena secunda* Salisb., Prodr. Stirp. 22. 1796. *Bromus elatior* (L.) Koeler, Descr. Gram. 214. 1802. *Schedonorus elatior* (L.) P. Beauv., Ess. Agrost. 99, 156, 162, 177. 1812. *Festuca pratensis* var. *elatior* (L.) Gaudin, Fl. Helv. 1: 293. 1828. *Bucetum elatius* (L.) Parnell, Grasses Scotl. 107, pl. 46. 1842. *Tragus elatior* (L.) Panz. ex B.D. Jacks., Ind. Kew. 2: 1098. 1895. *Gnomonia elatior* (L.) Lunell, Amer. Midl. Nat. 4: 224. 1915. (lectotype: LINN-92.17, designated by Terrell, Brittonia 19: 131. 1967; again by Linder, Bothalia 16: 59. 1986).

Poa phoenix Scop., Fl. Carniol., ed. 2, 1: 74. 1771. *Schedonorus phoenix* (Scop.) J. Holub, Preslia 70: 113. 1998.

Bromus littoreus Retz., Fl. Scand. Prodr. 19. 1779. *Schedonorus* littoreus (Retz.) Tzvelev, Nov. Sist. Vyssh. Rast. 31: 258. 1998.

Festuca littoralis Wahlenb., *nom. illeg. hom*., Nova Acta Regiae Soc. Sci. Upsal. 8: 211. 1821.

Festuca pseudosclerophylla Krivot., Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 17: 73. 1955. *Leucopoa pseudosclerophylla* (Krivot.) Bor in K. H. Rech., Fl. Iranica 70: 73. 1970.

Poa hybrida var. *vallesiaca* Bronm., Repert. Spec. Nov. Regni Veg. 16: 301. 1919.

Festuca elatior subsp. *arundinacea* var. *genuina* subvar. *orientalis* Hack., Monogr. Festuc. Europ. 154. 1882. *Festuca orientalis* (Hack.) Krecz. & Bobrov, Fl. URSS 2: 531. 1934. *Festuca arundinacea* subsp. *orientalis* (Hack.) Tzvelev, Fl. URSS 18: 17. 1970.

Festuca regeliana Pavl., Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 41(1): 80. 1938.

Loosely tufted to shortly rhizomatous perennials with extravaginal innovations. Culms (50–) 100–150 cm tall, erect, scabrous; nodes 3. Leaf sheaths coriaceous, striate, glabrous or scabrous; auricles present, falcate, margins ciliate; ligules ca. 0.5 mm long, membranous to coriaceous, apex truncate; blades 25–30 cm long, 5–11 mm wide, flat, green, abaxially scabrous. Panicles 10–17 × 4–6 cm, narrow, with erect branches; branches scabrous. Spikelets 9–12(–15) mm long, florets 6–8(–10); rachilla scabrous; glumes 3.3–6.5(–7) mm long, lanceolate, membranous to coriaceous, green, glabrous, apex acute; lower glumes 3.3–5(–5.5) mm long, 1-nerved; upper glumes 4.5–6.5 mm long, 3-nerved, sometimes scabrous on back; lemmas 6–7.5(–8) mm long, 5-nerved, lanceolate, membranous to coriaceous, green, apex scabrous on midrib, mucronate or short-awned, the awn 0.5–1.5 mm long; paleas almost as long as the lemma, scabrous on margins and keels; lodicules lanceolate, acuminate; anthers 2.7–3.5 mm long; ovary apex glabrous or sparsely hairy.

Leaf blade anatomy.—Cross-sections with numerous vascular bundles, with small ribs above; sclerenchyma discontinuous, extending to the vascular bundles under both abaxial and adaxial epidermis; bulliform cells present.

Observations.—This species is often treated by many authors as a separate genus, *Schedonorus arundinaceus* (Soreng et al. 2003).

Distribution and habitat.—Festuca arundinacea is introduced from Europe and cultivated in pastures, fields and rarely escaping along roadsides between 2300−3600 m.

Additional specimens examined. **COLOMBIA. Cundinamarca:** Mun. de Suba, Hda. Las Mercedes, 16 May 1964, *E. Forero et al. 45* (COL); 8 Oct 1964, *E. Forero et al. 82* (COL); 15 Oct 1964, *E. Forero et al. 92* (COL); between Guasca and La Calera, Vereda Santa Helena, 2950 m, 9 Dec 1984, *Wood 4639* (COL, K). **Nariño:** Mun. Ipiales, "Las Lajas", 2740 m, 8 Aug 1939, *García-Barriga 7838A* (COL). **ECUADOR. Cañar:** S of El Tambo, km 1.5–3 on road to Carshao, 02°28´S, 78°59´W, 3100 m, *S. Laegaard & Sklenář 20301* (AAU); Mun. El Tambo, road from El Tambo to Ingapirca, km 1,

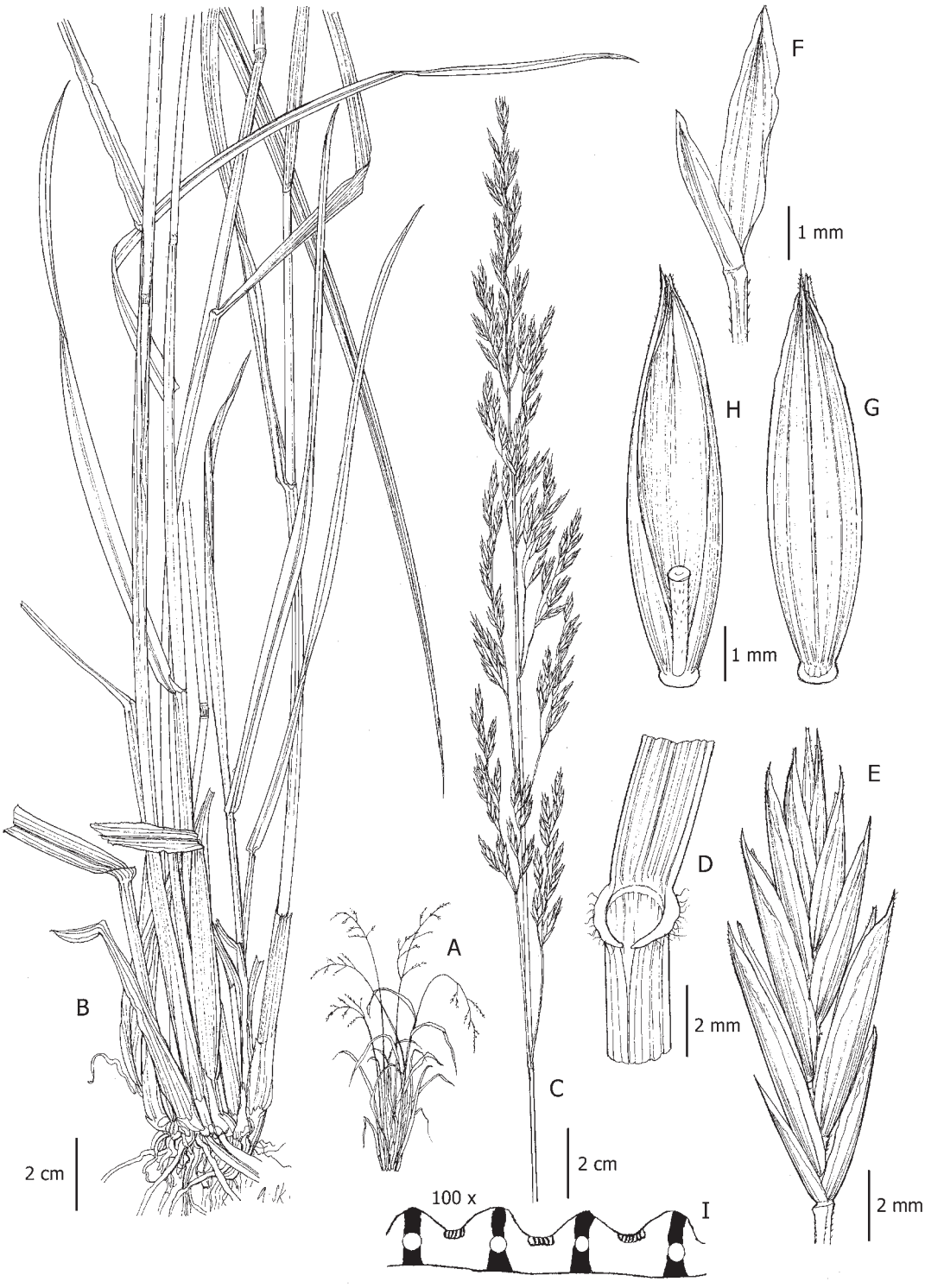


Figure 16. *Festuca arundinacea.* **A.** Stylized growth form. **B.** Habit. **C.** Inflorescence. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 4102* (PRC).

burned matorral and paramo, 3400–3500 m, 29 Aug 2000, *D. Stančík 3798* (PRC, QCA). **Chimborazo:** km 5 N of Tixan, meadows, 02°06′S, 78°46′W, 3280 m, *S. Laegaard 101818* (AAU, QCAQCNE); *S. Laegaard et al.103003* (AAU, QCA, QCNE); km 22 on road Alausi–Riobamba, 02°08′S, 78°46′W, 3250 m, *S. Laegaard 18667* (AAU,LOJA, QCA, QCNE); pasture near Riobamba, *Sodiro s.n.* (QPLS). **Cotopaxi:** Salcedo, 2650 m, *Acosta-Solís 10206* (F, US). **Loja:** La Argelia (Escuela de Agronomia), 04°02′S, 79°12′W, 2100 m, *S. Laegaard 18704* (LOJA). **Morona-Santiago:** Hda. Huargualla–Hda. San Eduardo, 01°57′S, 78°32.2′W, 3600 m, 19 Jul 1999, *D. Stančík 3309* (PRC, QCA); *D. Stančík 3310* (PRC, QCA). **Pichincha:** Quito, 00°10′S, 78°30′W, 2850 m, 30 Mar 1998, *S. Laegaard 18623* (LOJA); Quito–Santa Catalina, 00°22′S, 78°21′W, Feb 1981, *Vivar & Marín 1305* (LOJA); Quito–El Batan, 2850 m, *Acosta-Solís 19821* (US); *Acosta-Solís 19832* (US); *Acosta-Solís 19835* (US); W side of Mt. Pichincha, 3070 m, *Sodiro s.n.* (QPLS); Pichincha, Aug 1888, *Sodiro s.n.* (QPLS); 3000 m, 1904, *Sodiro s.n.* (US); Road Lloa–Guagua Pichincha, km 6, 00°13′S, 78°35′W, 3600 m, *S. Laegaard 102716* (AAU). Mun. Otavalo, Ruchanda–road to Quito, 3100 m, 14 Jul 1999, *D. Stančík 3221* (PRC, QCA); Mun. Otavalo, road from Laguna Mojanda to Cochasquí, 00°04′55″N, 78°17′50″W, 3450 m, 19 Oct 2000, *D. Stančík 4102* (PRC, QCA). **Tungurahua:** Tungurahua, Aug 1901, *Sodiro s.n.* (QPLS, US); Slope of Mt. Tungurahua above Baños, 2300 m, *E. Asplund 8425* (S); Pillaro, 2850 m, *E. Asplund 8150* (NY, QCA, S). **Zamora-Chinchipe:** Old road Loja–Zamora ca. 1 km E of pass, 03°59′S, 79°09′W, 2750 m, 26 Apr 1998, *S. Laegaard 18744* (AAU, LOJA, QCA, QCNE). **VENEZUELA. Barinas:** 74 km NW of Barinas on Hwy 1 and 71 km NE of Mérida, slopes with *Festuca, Espeletia, Loutegia, Stevia*, and *Sporobolus*, 2740 m, 24 Nov 1991, *P.M. Peterson 11181* (US). **Mérida.** Entre Pedregal y Apartaderos, praderas de fuentes del Chama, asociado a *Juncus, Rumex* etc., 3240 m, 23 Aug 1981, *Ponce & Trujuillo 245* (MY); Dept. Rangel, Páramo de Mucubají, Mesa del Caballo, El Pedregal, 3350 m, 12 Jun 1981, *B. Briceño & Adamo 286* (Herbarium Briceño, PRC).

13. Festuca pratensis Huds., Fl. Angl. 37. 1762. (**Fig. 14**). *Festuca fluitans* var. *pratensis* (Huds.) Huds., Fl. Angl. (ed. 2) 47. 1778. *Schedonorus pratensis* (Huds.) Beauv., Ess. Agrostogr. 99, 163, 177. 1812. *Bromus pratensis* (Huds.) Spreng., Syst. Veg. 1: 359. 1825, *nom. illeg. Bucetum pratense* (Huds.) Parnell, Grass. Scotland 105, t. 46. 1842. *Festuca elatior* var. *pratensis* (Huds.) A. Gray, Man. Bot. (ed. 5) 634. 1867. *Festuca elatior* subsp. *pratensis* (Huds.) Hack., Bot. Centralbl. 8: 407. 1881. *Festuca elatior* subsp. *pratensis* (Huds.) Hack., Monogr. Festuc. Eur. 150. 1882, isonym. *Tragus pratensis* (Huds.) Panz. ex B.D. Jacks., Index Kew. 2:1099. 1895. *Lolium pratense* (Huds.) Darbysh., Novon 3(3): 242. 1993. Type: Great Britain (BM-SL), *Buddle s.n.*, (lectotype: BM-SL!, Herb. Sloane. 125.16, designated by Reveal, Terrell, Wiersema & Scholz, Taxon 40:135. 1991).

Festuca poaeoides Michx., Fl. Bor.-Amer. 1: 67. 1803, *nom. illeg. Festuca poaeoides* var. *americana* Pers., Syn. Pl. 1: 94. 1805. *Festuca americana* (Pers.) F. G. Dietr., Nachtr. vollst. Lex. Gärtn. 3: 332.1817. *Schedonorus americanus* (Pers.) Roem. & Schult., Syst. Veg. 2: 706. 1817.

Schedonorus radicans Dumort., Obs. Gramin. belg.: 106. 1824. *Festuca radicans* (Dumort.) Steud., Syn. Pl. Glum. 1: 309. 1854.

Festuca glabra Spreng., Syst. Veg. 1: 353. 1824, *nom. illeg. hom*.

Rhizomatous perennials with extravaginal innovations. Culms 60–120 cm tall, erect, scabrous; nodes 3 in the basal half. Leaf sheaths (lowermost) coriaceous, brown, striate, scabrous, margins free, sometimes fibrous; auricles falcate, without hairs on margins; ligules 0.3–0.5 mm long membranous, sometimes coriaceous, apex truncate; blades 20–25 × 0.4–0.8(–1) cm, flat, green, abaxially scabrous. Panicles 15–20 × 3–5 cm, contracted, narrow; branches scabrous. Spikelets 9–11 mm long, florets 5 or 6; rachilla scabrous; glumes 2.7–4 mm long, lanceolate, membranous, sometimes coriaceous, green, glabrous, apex acuminate; lower glumes 2.7–3 mm long, 1-nerved; upper glumes 3.7–4 mm long, 3-nerved; lemmas 6–6.5 mm long, 5-nerved, membranous to coriaceous, lanceolate, green, apex scabrous, mucronate; paleas almost as long as the lemma, scabrous on margins and keels; lodicules lanceolate, acuminate; anthers 2.7–3.5 mm long; ovary apex glabrous or sparsely hairy.

Leaf blade anatomy.—Cross-sections with numerous vascular bundles, without ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous, extending to the vascular bundles forming girders; bulliform cells present.

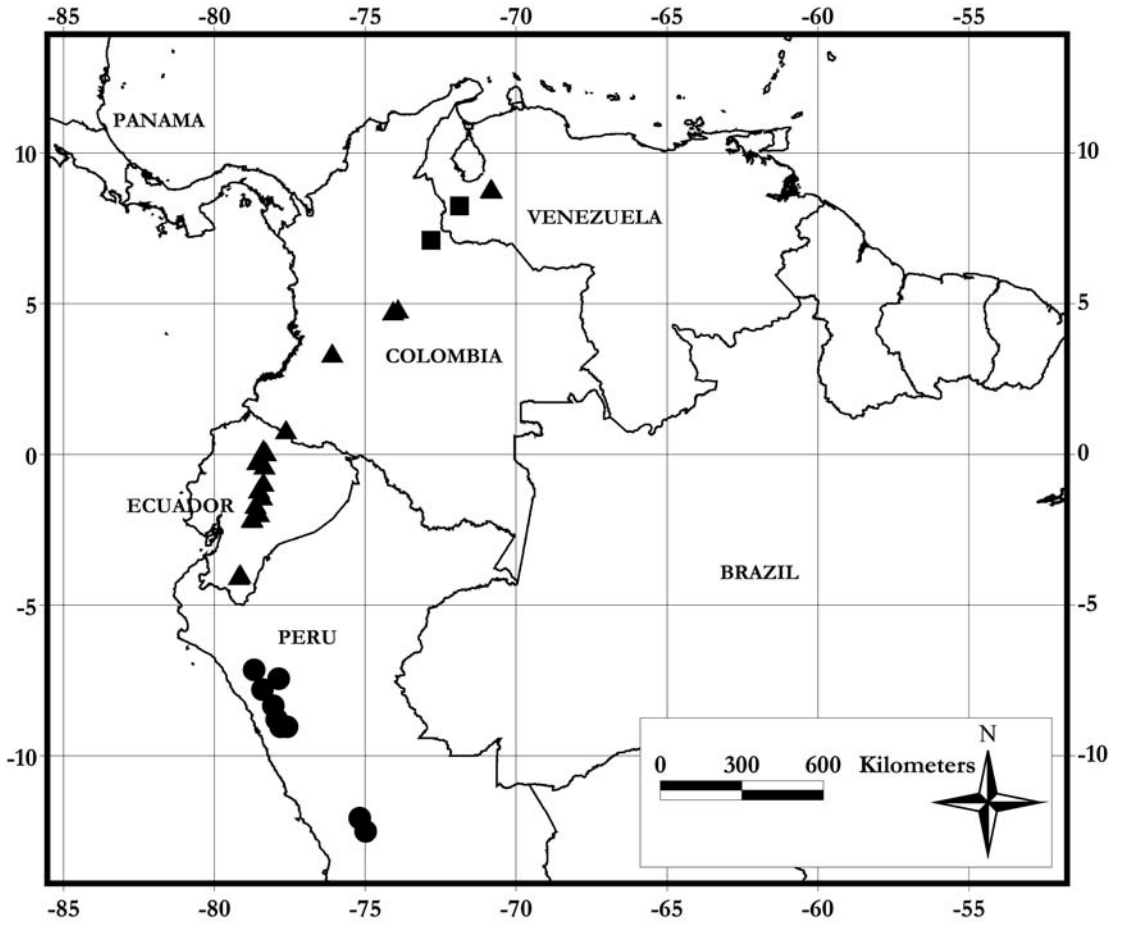


Figure 17. Distribution of *Festuca dichoclada* (●), *F. arundinacea* (▲), and *F. venezuelana* (■).

Observations.—Modern authors generally treat this taxon as a separate genus, *Schedonorus pratensis* (Soreng et al. 2003).

Distribution and habitat.—This species is introduced from the Europe and sporadically cultivated at an altitude around 3000 m.

Additional specimens examined. **ECUADOR. Chimborazo:** Riobamba, *Sodiro s.n.* (US). **Pichincha:** Quito–Santa Catalina, 00°22´S, 78°31´W, *Vivar & Marín 1306* (LOJA); Cantón Tabacundo–Picalquí, 2750 m, *Acosta-Solís 16268* (US).

14. Festuca dichoclada Pilg., Bot. Jahrb. Syst. 37: 514. 1906. (**Fig. 17**). *Festuca quadridentata* var. *dichoclada* (Pilg.) St.-Yves, Candollea 3: 265. 1927. Type: Peru. Ancachs (Ancash), in declivibus montium Cordillera blanca supra Caraz in faucibus umbrosis fruticibus altis obtectis, 3300–3600 m, 9 Jun 1903, *A. Weberbauer 3230* (holotype: B!; isotypes: BAA-1196 fragm. ex B, US-2875396 fragm. ex B!).

Large rhizomatous, loosely caespitose perennials with intravaginal innovations. Culms 150–200 cm tall, erect, scabrous; nodes 3 or 4 in distal half. Leaf sheaths coriaceous, scabrous; auricles absent; ligules 8–12 mm long, membranous, apex acute; blades 40–100 × 0.5–1.4 cm, flat occasionally partially conduplicate, green, abaxially scabrous, with prickles on abaxial and adaxial epidermis. Panicles 20–40 × 20–25 cm, ovate; branches scabrous. Spikelets 11–14 mm long, oblong, florets 3–5; rachilla hairy; glumes 5–9 mm long, lanceolate, greenish-white, smooth to papillose, apex acute; lower glumes 5–7.5 mm long, 1-nerved; upper glumes 6.5–9 mm long, 3-nerved; lemmas 8.5–10 mm long, lanceolate, 5-nerved, membranous to coriaceous, scabrous, apex entire, awnless; callus glabrous; paleas as long as the lemma, smooth to papillose;

lodicules ovate, obtuse; anthers 3.5–4.2(–4.7) mm long; ovary apex glabrous. Caryopses oblong; hilum nearly as long as the caryopsis.

Leaf blade anatomy.—Cross-sections with many vascular bundles and ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous; bulliform cells present; epidermis without hairs.

Distribution and habitat.—Known only from northern and central Peru. It occurs along margins of Andean forests, clearings, rocky slopes, and paramos between 3000–4000 m.

Additional specimens examined. **PERU. Ancash:** Prov. Bolognesi, Jerusalem, cerro al E de Aquia, arcilloso–pedregoso en monte pluvifolio, 3200–3250 m, 18 May 1950, *R. Ferreyra 7526* (US); Casca, abajo de Chiquian, 3100–3200 m, 9 May 1950, *R. Ferreyra 7281* (US); Prov. Yungay, Huascarán Parque Nacional, between Lake Llanganuco and Portachuelo, 77°36′W, 09°03′S, 4200–4329m, 16 Aug 1984, *Smith 8233* (US). Prov. Huaraz, Huascarán Parque Nacional, Quebrada Shallap, 77°24′W, 09°30′S, 3700–4000 m, 22 May 1985, *Smith et al. 10769* (F); Prov. Huaylas, Huascarán Parque Nacional, environs of Auquispuquio, 77°57′W, 08°49′S, 3900–4000 m, 4 Sep 1986, *Smith et al. 12110* (F); Prov. Yungay, Huascarán Parque Nacional, Llanganuco sector, María Josefa trail between Chinancocha and Pucayacu, 77°39′W, 09°05′S, 3700–3850 m, 5 Jul 1985, *Smith 10537* (F); Prov. Carhuaz, Huascarán Parque Nacional, Quebrada Ulta, on road to Ulta Pass, 77°32′W, 09°07′S, 4000–4400 m, 29 Jul 1985, *Smith 11389* (F). **Cajamarca:** Prov. Contumaza, Guzmango, cerro Campanillas, 3050 m, 1 Jun 1959, *SagásteguiiSagásteguii 2991* (US); Prov. Cajamarca, SAIS José Carlos Mariategui, km 20–40 on Sunchubamba–San Juan road, jalca with small patches of ceja de selva in rocky area, 3300–3500 m, 5 Jun 1984, *Smith 7534* (US); Prov. Cajamarca, Distr. San Juan, carretera San Juan–Cajamarca, arriba de San Juan, ladera arcillosa-pedregosa, 2350 m, 6 Dec 1993, *Vega 730* (F); Prov. Cajamarca, Cumbe Mayo, 21 km al W de Cajamarca, ladera con arbustos disersos, 3100 m, 4 Nov 1977, *Vega 1966* (F). **Huancavelica:** Conaica, Carhuay–pampa arriba de Conaica, 3700–3750 m, 18 Mar 1951, *O. Tovar 143* (US). **Junín:** Prov. Huancayo, Hda. Acopalca**,** 4000 m, 20 Jul 1945, *Infantes 435* (US). **La Libertad:** Prov. De Otuzca, cerca a Usquil, falda de cerro, junto con *Chusquea*, *Loasa*, *Cajophora*, 3000–3100 m, 9 Jun 1950, *R. Ferreyra 7642* (K, US); *R. Ferreyra 7664* (K, US); Otuzco, entre piedras, 2600 m, 6 Apr 1990, *Leiva & Leiva 96* (F); Otuzco, cerro de los Enamorados (al norte de Salpo), ladera, 3440 m, 16 Jun 1993, *Leiva 797* (MO); Near Usquil, Utusco, hillside, 3200 m, 9 Jun 1950, *Anderson 1271* (US).

15. Festuca quadridentata Kunth, Nov. Gen. Sp. (quarto ed.) 1: 154. 1816. (**Figs. 18, 21, 79C−F, 80A**). *Festuca flexuosa* Willd. ex Kunth, Enum. Pl. 1: 407. 1833, *nom. inval. pro syn.* Type: Ecuador. Chimborazo, 2860 m, *Humboldt & Bonpland s.n.* (holotype: P!; isotypes: B!, P!).

Large tussocked perennials with intravaginal innovations. Culms 170–200 cm tall, erect, scabrous; nodes 3 or 4 in distal half. Leaf sheaths coriaceous, striate, scabrous; auricles absent; ligules (8–)9–13 mm long, membranous, apex acute; blades 40–150 × 0.7–1.4 cm, flat to conduplicate, green, scabrous with prickles on abaxial and adaxial epidermis. Panicles 20–40 × 15–20 cm, ovate; branches scabrous. Spikelets 11–13(–15) mm long, oblong, florets (3–)4 or 5(–6); rachilla with short, scattered hairs; glumes (3.5–)4–6.5 mm long, lanceolate, greenish-white, smooth sometimes papillose, apex acute; lower glumes (3.5–)4–5 mm long, 1-nerved; upper glumes 5–6.5 mm long, 3-nerved; lemmas 8.5–9.5 mm long, lanceolate, 5-nerved, membranous to coriaceous, scabrous or papillose, apex erose and dentate, awnless or sometimes mucronate; callus glabrous; paleas as long as the lemma or longer, smooth or papillose; lodicules ca. 0.7 mm long, ovate, apex obtuse; anthers 3.5–4.2(–4.7) mm long; ovary apex glabrous. Caryopses oblong; hilum nearly as long as the caryopsis.

Leaf blade anatomy.—Cross-sections with many vascular bundles, corresponding to the number of ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous; bulliform cells present; epidermis without hairs.

Observations.—Festuca quadridentata is morphologically similar to the Peruvian species *F. dichoclada*, however the former differs by having shorter lower glumes (5–7.5 mm long in *F. dichoclada*), shorter upper glumes (3.5–5 mm versus 6.5–9 mm), and dentate lemmas (versus entire).

Distribution and habitat.—This species is endemic to central Ecuador (Cañar, Chimborazo, Morona-Santiago, Pichincha) where is known from

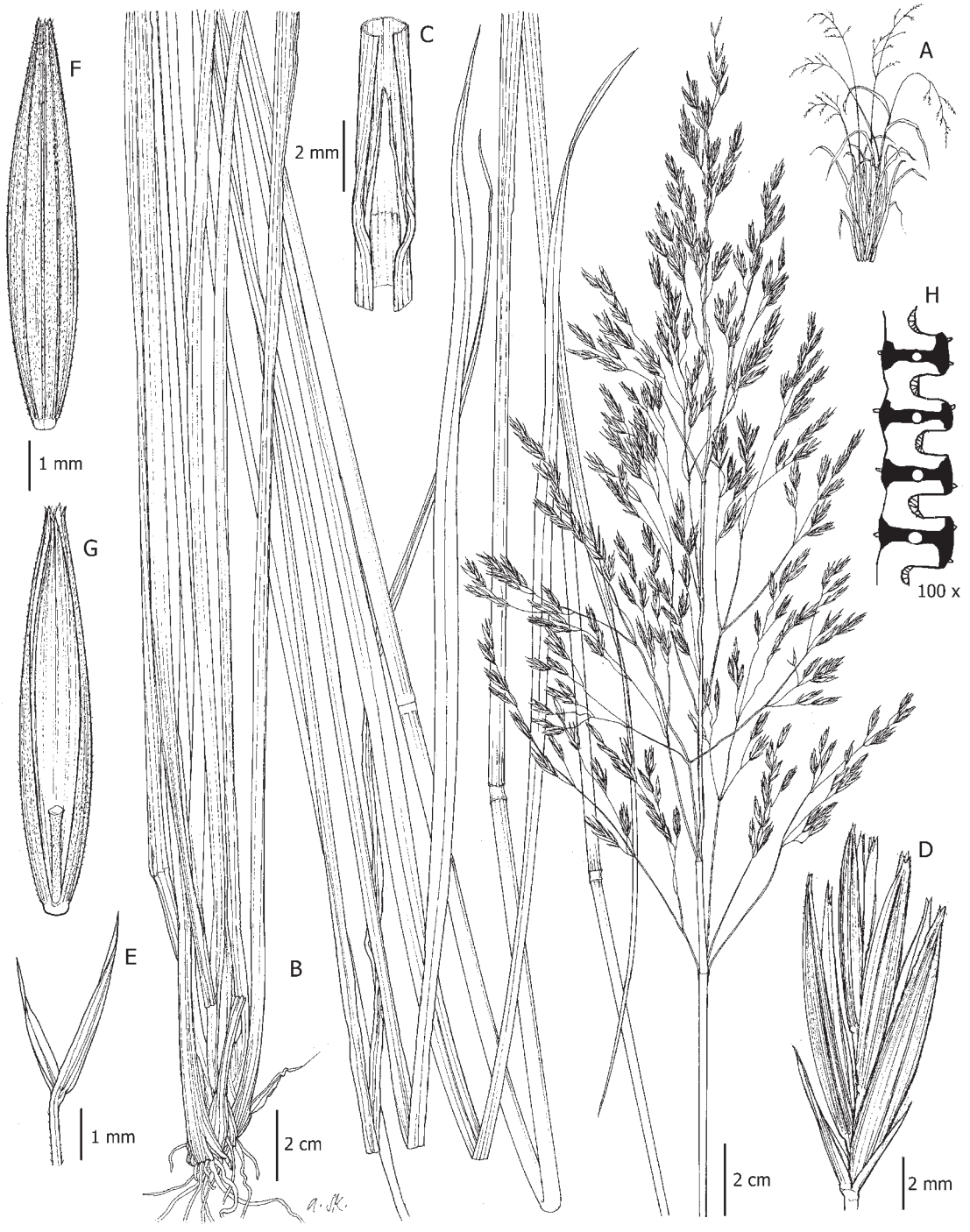


Figure 18. *Festuca quadridentata.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–G, *Laegaard & Sklenář 20308* (PRC); H, *Stančík 3317* (PRC).

Andean mountain forests, between (1500–)3000–3400 m.

Additional specimens examined. **ECUADOR. Cañar:** S of El Tambo, ca. 1.5–3 km road to Carshao, 02°28´S, 78°59´W, 3100 m, 10 Jun 1999, *S. Laegaard & Sklenář 20308* (AAU, LOJA, PRC); 10 Jun 1999, *S. Laegaard & Sklenář 20287* (AAU, LOJA, PRC). **Chimborazo:** near Alao, along Río Alao, 01°52´S, 78°30´W, 3200–3400 m, 22 Sep 1985, *S. Laegaard 55290* (AAU, QCNE); km 10 N of Sipambe, 02°08´S, 78°52´W, 3400 m, 11 Nov 1985, *S. Laegaard 55567* (AAU, QCA); road Alao–Chambo, km 10, 01°50´S, 78°34´W, 3000 m, 11 Oct 1985, *S. Laegaard 55411* (AAU, QCA); in prov. Riobamba, *Sodiro s.n.* (QPLS); Alao, Hab. Llactapamba, 3200 m, *Acosta-Solís 7581* (F, US); eastern Cordillera of Riobamba, 3200 m, *Rimbach 54* (F, US). **Morona-Santiago:** Parque Nacional Sangay, Hda. Huargualla–San Eduardo, 02°00.25´S, 78°27´W, 3700 m, *D. Stančík 3317* (AAU, QCA, PRC, US). **Pichincha:** Gualea, *Sodiro s.n.* (QPLS); 1500 m, *Mille s.n.* (QPLS). Sin. loc. *Sodiro 20/5* (P).

16. Festuca venezuelana Stančík, Darwiniana 41(1–4): 111, f. 15b–l. 2003. (**Figs. 17, 19, 80B–F**). Type: Venezuela. Táchira, Mun. La Grita, Paramo La Negra, cross of the roads to La Grita and Pogonero, 08°13´22˝N, 71°52´51˝W, shrubby margin of the road with *Asteraceae*, *Melastomataceae*, *Cordia* sp., 2800 m, 11 Nov 2000, *D. Stančík 4262* (holotype: PRC!, isotypes: AAU!, CAR!, COL!, W!).

Tussocked perennials with extravaginal innovations. Culms 130–180 cm tall, erect, scabrous; nodes 3. Leaf sheaths coriaceous, fibrous, scabrous, brown; auricles absent; ligules 3–5 mm long, membranous, apex acute; blades 25–40 × 0.5–1.1 cm, flat, green, abaxially scabrous. Panicles 20–25 × 10–15 cm, lax, nutant; branches scabrous. Spikelets 14–16 mm long, oblong-lanceolate, florets 5–7; rachillas 1–1.2 mm long, scabrous; glumes 3–9 mm long, narrowly lanceolate, coriaceous, margins membranous, apex acute; lower glumes 3–4.5 mm, 1-nerved; upper glumes 7–9 mm long, 3-nerved, apex scabrous; lemmas 10–11 mm long, 5-nerved, lanceolate, coriaceous, brownish-green, scabrous, apex two-dentate and awned, the awn 2–8 mm long, some plants awnless; paleas as long as the lemma, scabrous on margins and keels; lodicules lanceolate, acuminate; anthers 3–3.5 mm long; ovary apex glabrous. Caryopses oblong-lanceolate; hilum 3/4 of caryopsis length.

Leaf blade anatomy.—Cross-sections with many vascular bundles, with shallow ribs; sclerenchyma under both abaxial and adaxial epidermis, discontinuous; bulliform cells present; epidermis with prickles on abaxial and adaxial surfaces, macrohairs absent.

Observations.—Festuca venezuelana is morphologically similar to the Bolivian *F. steinbachii*. However, *F. steinbachii* has shorter ligules (ca. 1 mm long), shorter spikelets (11–13 mm long), and shorter awns (0.5–1.3 mm long).

Distribution and habitat.—Festuca venezuelana ranges from Colombian Cordillera Oriental (N de Santander) to the western part of the Venezuelan Andes (Táchira). It occurs in Andean forest clearings between 2800–3400 m.

Additional specimens examined. **COLOMBIA. Norte de Santander:** between Mutiscua and Pamplona, edge of wood, 3400 m, 32 Feb 1927, *Killip 19719* (K, US). **VENEZUELA. Táchira:** Grita, Porqueras-Aldea Agua Díaz, 22 Sep 1942, *Tamayo 2326* (US, VEN).

17. Festuca fragilis (Luces) B. Briceño, Ernstia 4(3–4): 7 8–79. 1994. (**Figs. 20, 21, 81A–F**). *Helleria fragilis* Luces, J. Wash. Acad. Sci. 32(6): 157, f. 1. 1942, *nom. inval. Hellerochloa fragilis* (Luces) Rauschert, Taxon 31(3): 561. 1982. Type: Venezuela. Mérida, Páramo de Tucaní, 4500 m, 17 Dec 1910, *A. Jahn 62* (holotype: VEN!; isotype: US!).

Small tussocked perennials with intravaginal innovations. Culms 20–25 cm tall, erect, finely scabrous; nodes 1, basal. Leaf sheaths membranous to coriaceous, stramineous, glabrous, inconspicuously striate; auricles absent; ligules 4–5 mm long, membranous, apex acute, ciliate; blades 10–15 cm long, 0.6–0.7 mm wide, conduplicate to involute, abaxially scrabrous, olive-green, only 2 or 3 per culm, apex acute. Panicles 5–8 × 1–2 cm, contracted, dense, lanceolate, branches scabrous. Spikelets ca. 3 cm long, obovate, florets 5–7; rachilla densely hairy; glumes 7.5–13 mm long, membranous, lanceolate, margins dentate, apex acute; lower glumes 7.5–9.5 mm long, 1-nerved; upper glumes 10–13 mm long, 3-nerved; lemmas 17–20 mm long, 5-nerved, lanceolate, membranous, upper 1/2 and margins scabrous, apex shortly two-dentate and awned, the awn 5–7 mm long; callus glabrous;

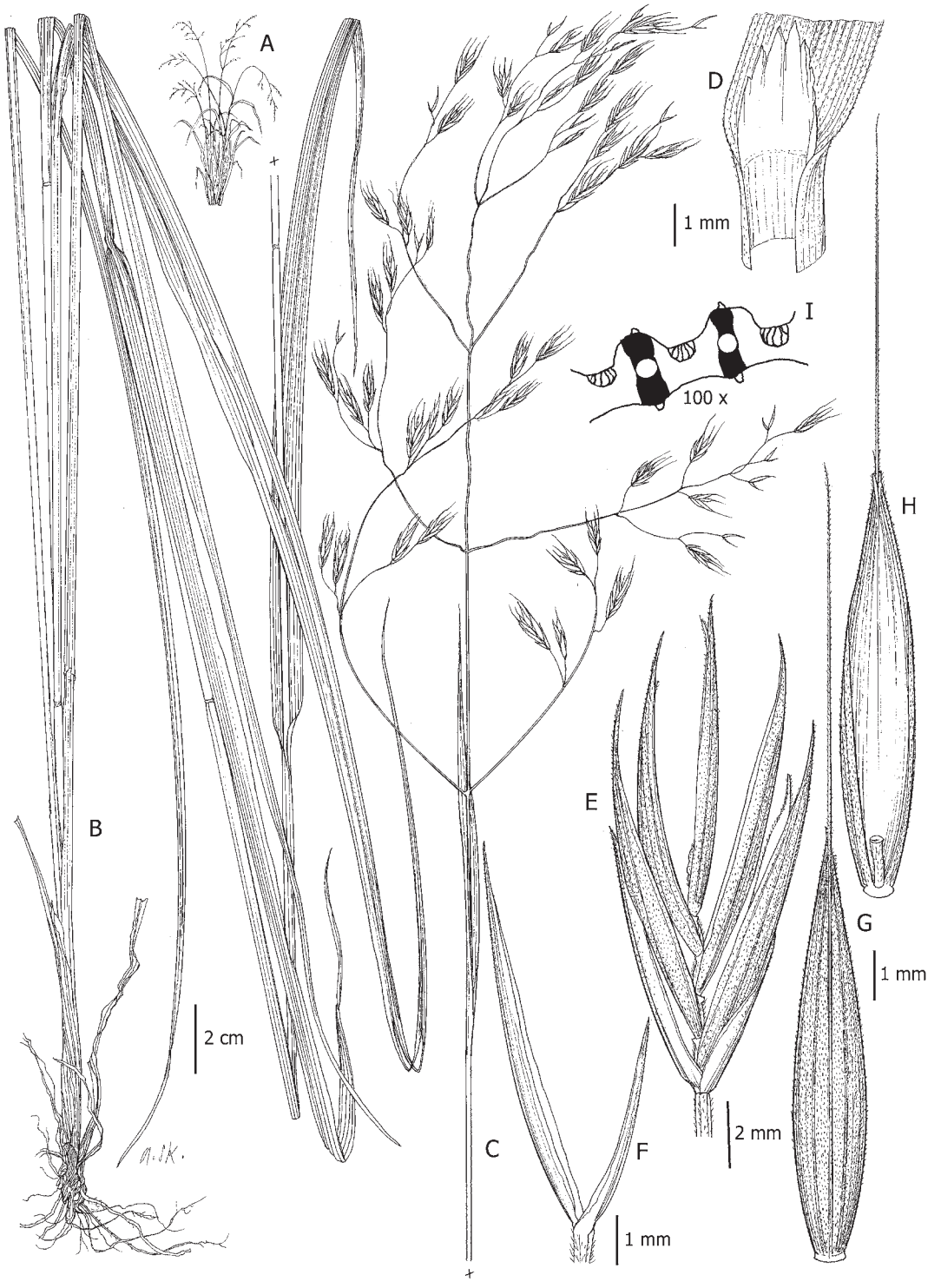


Figure 19. *Festuca venezuelana.* **A.** Stylized growth form. **B.** Habit. **C.** Inflorescence. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 4263* (PRC).

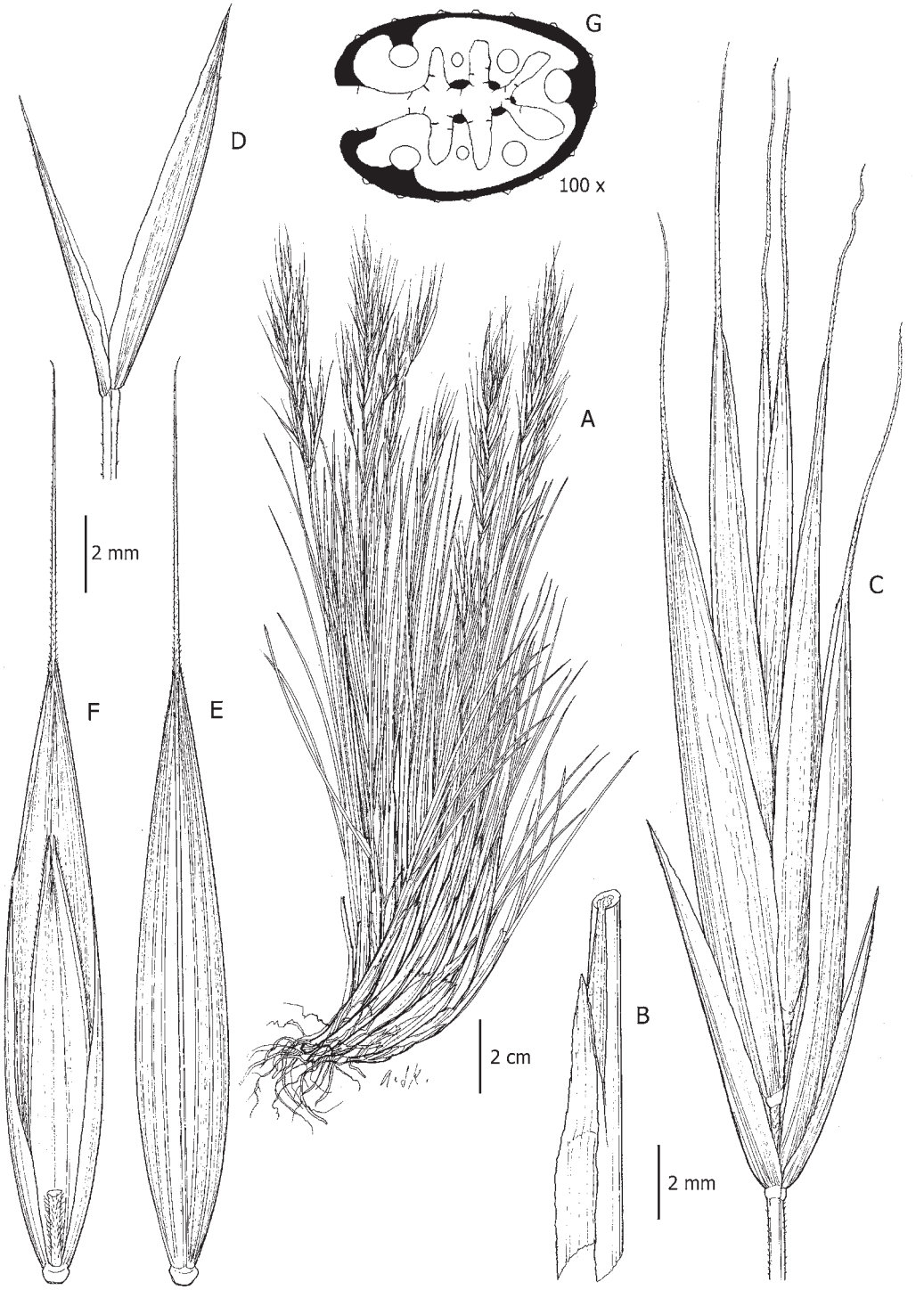


Figure 20. *Festuca fragilis.* **A.** Habit. **B.** Ligule. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Lemma with palea and rachilla. **G.** Leaf blade cross-section. A–G, from *Stančík 4192* (PRC).

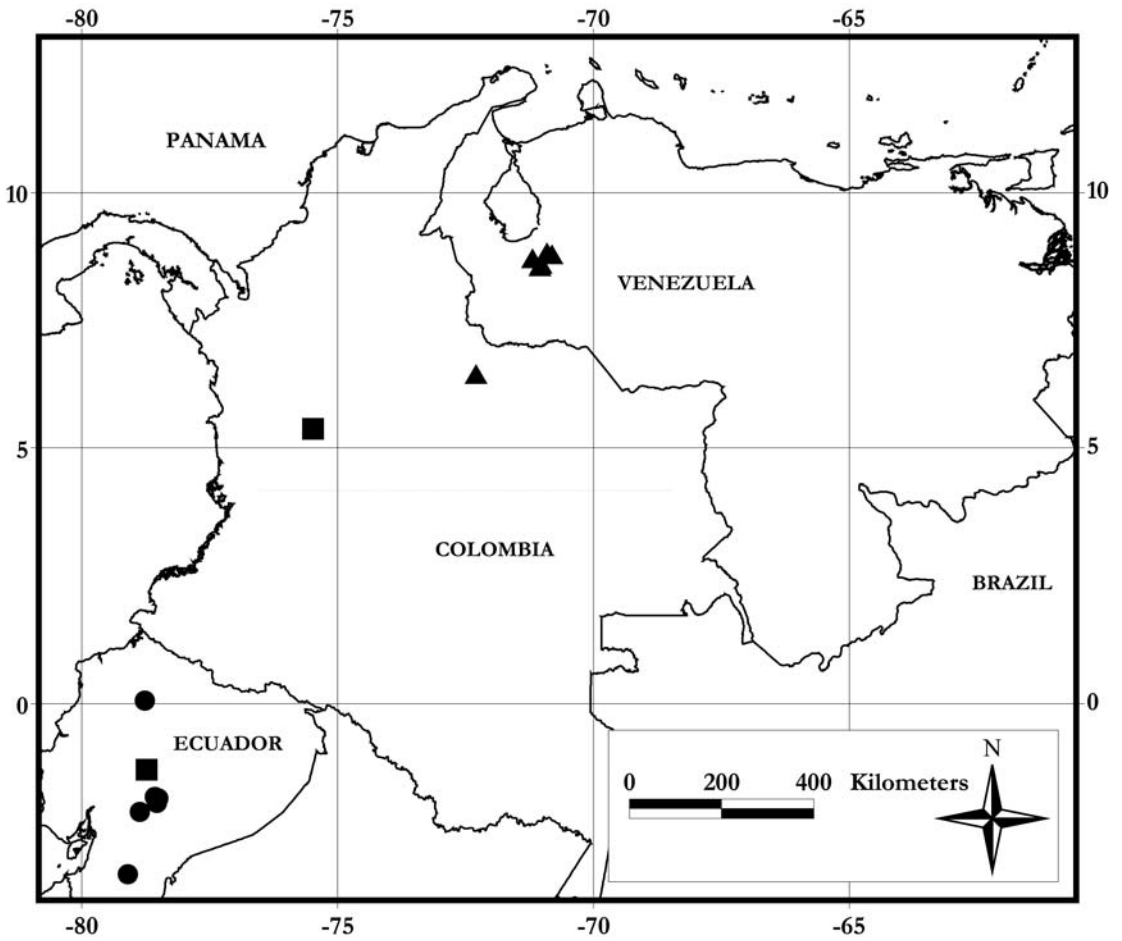


Figure 21. Distribution of *Festuca quadridentata* (●), *F. fragilis* (▲), and *F. rubra* (■).

paleas 3/4 as long as the lemma, membranous, lanceolate, papillose, upper third and along keels scabrous; lodicules lanceolate; anthers 1.5–2.2 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 2/3 of total length.

Leaf blade anatomy.—Cross-sections with 7 vascular bundles and 5 ribs above; sclerenchyma under abaxial and adaxial epidermis, continuous, girders absent; epidermis with hairs on adaxial surface, scattered, the hairs 0.03 mm long.

Observations.—The Mexican species, *F. livida* (*F.* subg. *Helleria*) is morphologically similar to *F. fragilis* but differs from it by having shorter culms (10–15 cm tall), shorter lemmas (8–14 mm long), and shorter lemmatal awns (1–4 mm long).

Distribution and habitat.—Festuca fragilis is known only from the state of Mérida, Venezuela and the Sierra Nevada del Cocuy, Colombia, from dry rocky slopes of super-paramo between 3600–4800 m.

Additional specimens examined. **COLOMBIA. Arauca:** Sierra Nevada del Cocuy, Laguna La Plaza, 4300 m, 31 Dec 1985, *Wood 5259* (COL). **VENEZUELA. Mérida:** Mun. Mucuchies, Paramo de Piedras Blancas, mountain ridge towards Alto Mucunano, 08°49′54″N, 70°57′33″W, 4350 m, 4 Nov 2000, *D. Stančík 4182* (CAR, COL, PRC, US, W); Laguna Negra, 08°49′16″N, 70°57′02″W, 4270 m, *D. Stančík 4192* (AAU, CAR, COL, PRC); Mun. Mérida, Sierra Nevada–Pico Espejo, 8°42′N, 71°12′W, 4 Nov 2000, *D. Stančík 4248* (AAU, CAR, COL, PRC, W); *Barclay & Juajíbioy 10180* (US); Pico de Las Piedras Blancas, 4740 m, 25 May 1952, *Vareschi 1232* (VEN); Camino a Pico Bolívar, 4100–4300 m, 10 Oct 1953, *Little 15717* (MER); páramo Media Luna, pendiente N del Pico

El Toro, 08°32′27″N, 71°04′19″W, super-páramo con *Lachemilla equisetifolia* y *Coespeletia moritziana*, 4350 m, 21 Dec 1994, *Berg 470* (K); Sierra Nevada de Santo Domingo, between Apartaderos and Timotes, E facing rocky slope, 21–26 Nov 1959, *Barclay et al. 9677* (US); Laguna Coromoto, 3600 m, Oct 1956, *Aristeguieta 2596* (VEN); 3400 m, Oct 1956, *Aristeguieta 2603* (VEN); Páramos más altos cerca de El Gavilán, 4200 m, 25 Jan 1929, *Pittier 13276* (VEN, US); Páramo de Piedras Blancas, 4300 m, 25 Sep 1952, *Vareschi et al. 1233* (VEN); 4200 m, 28 Feb 1976, *Baruch 46* (VEN); 4400 m, 8 Dec 1979, *Barreto 656* (MERC); 4000–4600 m, 31 Oct 1981, *B. Briceño et al. 358* (MERC); 4150–4250 m, 13 Nov 1976, *Ricardi & Carrez 5930* (MER); Paramo de Mucuchies, Pico Aguila, Pico de Aguila, 3800–3900 m, 22 Jan 1986, *Bono 5662* (VEN); 4300 m, 17 Oct 1984, *Bono 4328* (VEN); 4700 m, 12 Feb 1976, *Teran 13215* (MERF); 4118m, 6 Dec 1980, *Badillo et al. 7562* (MY); Pico Espejo, 4765m, 17 Dec 1969, *J. Steyermark & Koyama 102389* (VEN); 4680–4780 m, 31 Dec 1961, *Teran & Melchior 833* (MER, HERZ); *Teran & Melchior 848* (MER); 4400 m, 16 Dec 1952, *Bernardi 268* (MER); Loma Redonda–Alto de La Cruz, 4040–4300 m, 11 Nov 1994, *B. Briceño 3074* (Herbarium Briceño); Mun. Rangel, Páramo El Banco, entrada por la Toma baja, 4420 m, 21 Oct 1997, *B. Briceño & Molinillo 3461* (Herbarium Briceño); Páramo Mucubají, camino a Mucunuque, 3600 m, 25 Oct 1980, *B. Briceño & Adamo 244* (Herbarium Briceño, US); 4200–4300 m, 4 Nov 1992, *Meier 3025* (VEN); Distr. Campo Elias, Sierra La Culata, Pico El Campanario, 4325m, 20 Oct 1972, *Teran 7732* (MERF); 3600–4100 m, 26 Oct 1972, *Teran 7909* (MERF);

18. Festuca fimbriata Nees, Fl. Bras. Enum. Pl. 2(1): 472. 1829. (**Figs. 22, 23, 82A–E**). Type: Brasilia meridionales, Montevideo, *F. Sellow s.n.* (holotype: B!; isotypes: K!, LE-TRIN-2806.01!, LE-TRIN-2806.02!, US-557541 ex B!, US-1441522 ex B!, US-1126679 fragm. ex W!, W!).

Festuca ampliflora Döll, Fl. Bras. 2(3): 116, pl. 34. 1878. Type: Brazil. Minas Gerais, Caldas, *Regnell III 1409* (lectotype: S! designated by Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 348. 1984; isolectotypes: P!, US-2875375 fragm. ex M!).

Rhizomatous perennials with extravaginal innovations. Culms (60–)90–150(–250) cm tall, erect, glabrous; nodes 3 or 4 in distal half; cataphylls sometimes present, about 4–6 cm long. Leaf sheaths membranous, brown, striate, glabrous; auricles absent; ligules 0.1–0.5(–1) mm long, coriaceous, apex truncate, ciliate; blades 20–50 × 0.4–1.5 cm, flat, green, abaxially scabrous with prickles on abaxial epidermis. Panicles 20–40 × 10–15 cm, ovate; branches scabrous. Spikelets 11–15(–20) mm long, oblong or ovate, florets (5–)6–7(–9); rachillas 1–1.3 mm long, glabrous; glumes (3.5–)4–8(–9) mm long, lanceolate, scabrous, apex acute; lower glumes (3.5–)4–6(–7) mm long, 1-nerved; upper glumes 5.5–6(–7.5) mm long, 3-nerved; lemmas 6–8 (–9) mm long, membranous to coriaceous, lanceolate, 5-nerved, scabrous, papillose, apex entire, awnless; callus glabrous; paleas as long as the lemma, scabrous; lodicules ca. 1mm long, lanceolate, with scattered hairs at apex; anthers 2.5–3.5(–4) mm long; ovary apex pilose. Caryopses lanceolate; hilum nearly as long as the grain.

Leaf blade anatomy.—Cross-sections with numerous vascular bundles with small ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous and extending to the vascular bundles; bulliform cells present; epidermis with scattered prickles.

Observations.—Festuca fimbriata is characterised by having pilose lodicules. This unusual feature probably represents a plesiomorphy since elsewhere in the genus it is only known to occur in the Australian *F.* subg. *Austrofestuca*.

Distribution and habitat.—Festuca fimbriata is restricted to the area between northern Uruguay, northeastern Argentina, and southeastern Brazil, in forest openings, wet depressions, and swamps between (70–)700–1650(–2400)m.

Additional specimens examined. **ARGENTINA. Corrientes:** Dept. Santo Tomé, Ea. Timbó, costa del Río Uruguay, 26 km SE de Colina Garabí, 16 Sep 1980, *O. Ahumada & A. Schinini 4085* (CTES); Arroyo Chimiray y Ruta 40, 8 Oct 1976, *Quarin 3409* (CTES); Dept. Santo Tomé, Garruchos, 22 Oct 1954, *Burkart 19654* (BAA); Estancia "Garruchos", swamps and wet medows, *T.M. Pedersen 819* (C, MO); Ruta 37, 5 km E de Gdor. Virasoro, 14 Nov 1974, A. *Schinini & Carnevali 10523* (US). **Misiones:** Dept. Capital, Ruta provincial No. 1, 12 km S de Posadas, 16 Nov 1974, A. *Schinini & Carnevali 10687* (CTES). **BRAZIL. Minas Gerais:** Jan 1880, *Regnell s.n.* (W); Caldas, 28 Jan 1846, *Widgren s.n.* (K, US); Monte Verde, Sep 1997, *Longhi & Witten 5011* (ICN). **Paraná:**

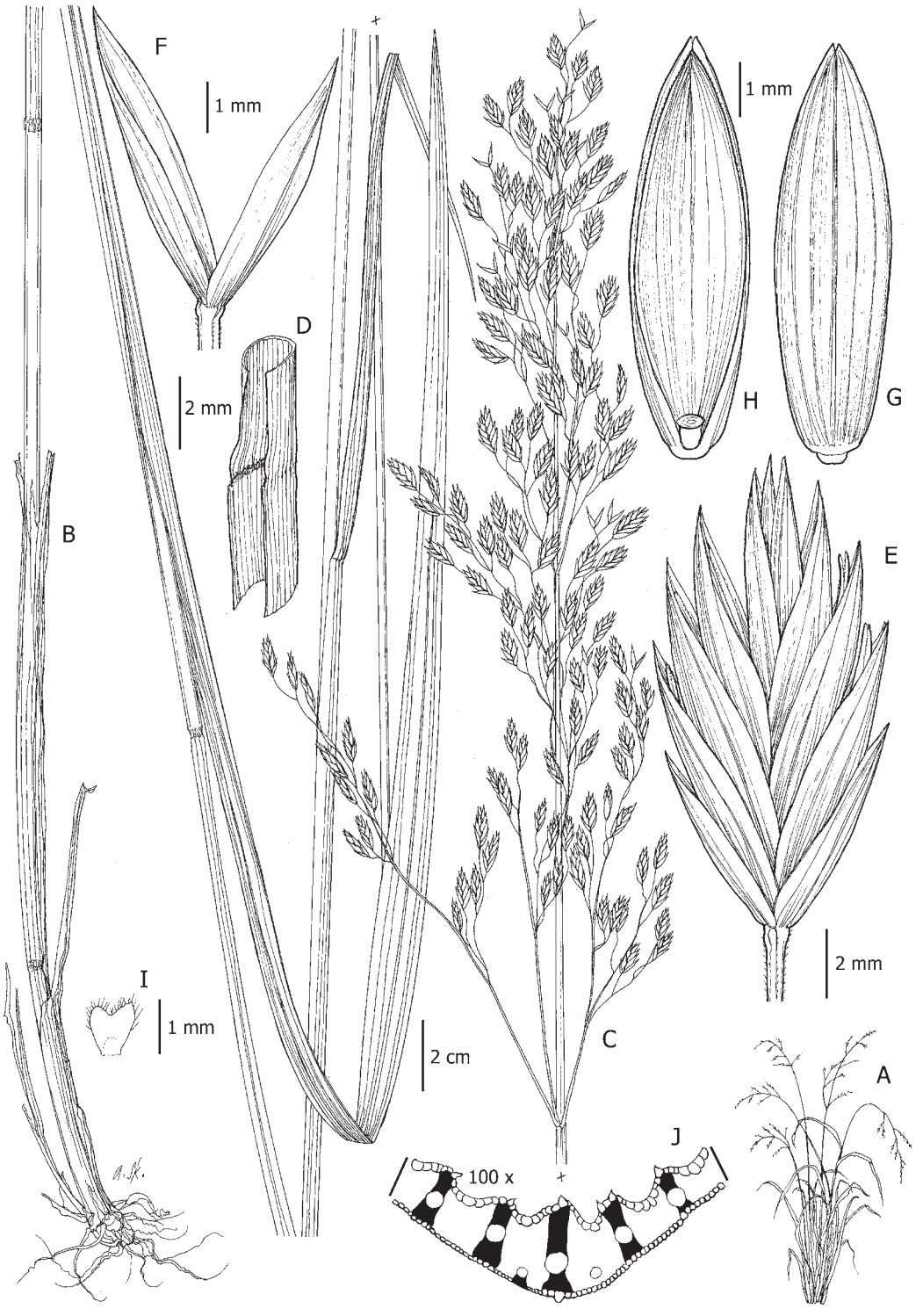


Figure 22. *Festuca fimbriata.* **A.** Stylized growth form. **B.** Habit. **C.** Inflorescence. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Lodicule. **J.** Leaf blade cross-section. A–J, *T.M. Pedersen 11475* (MO).

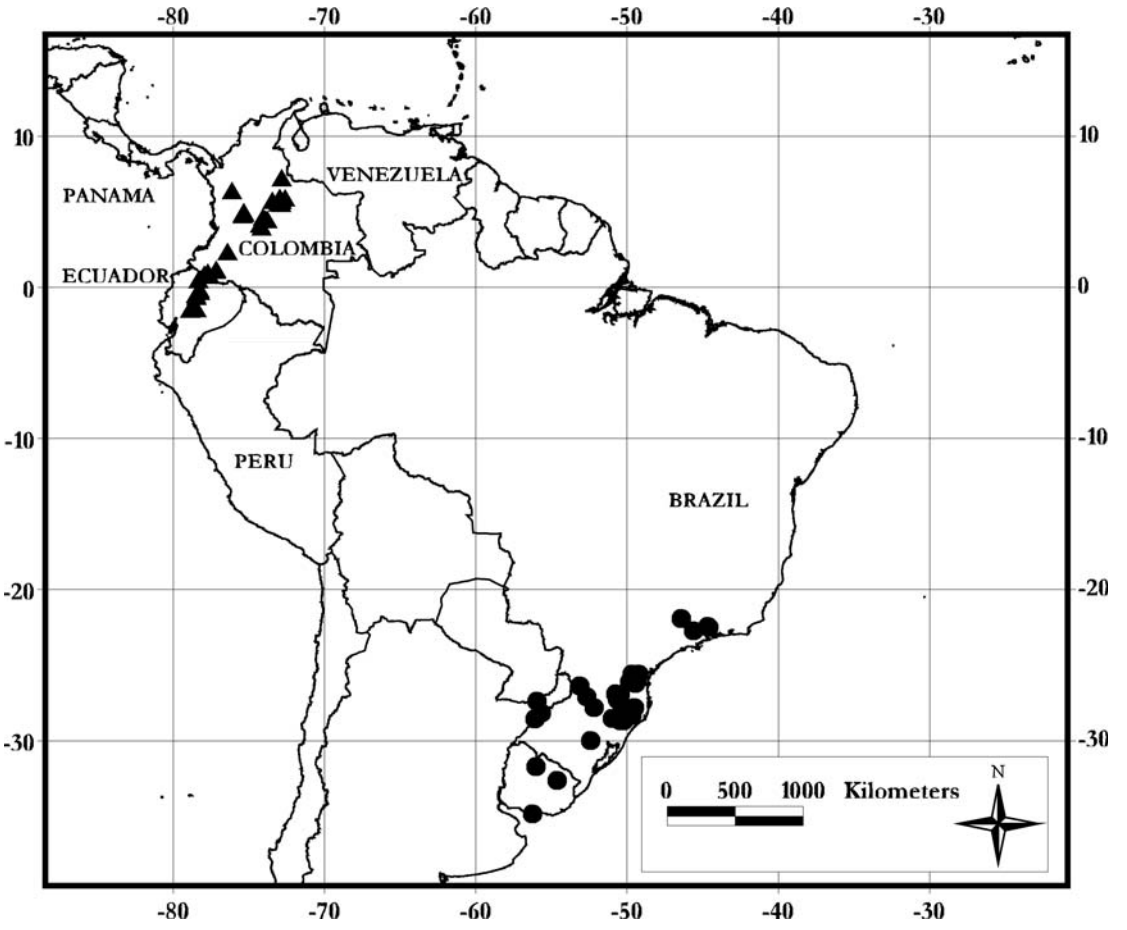


Figure 23. Distribution of *Festuca fimbriata* (●), and *F. andicola* (▲).

Piraquara, Pinhais,, 25 Nov 1968, *G. Hatschbach 20379* (C, K); Mun. Balsa Nova, Bicudo, 6 Dec 1962, *G. Hatschbach 9551* (US); 26 Feb 1909, *Dusen 8972* (K, US); Mun. Curitiba, Atuba, margin of swamp, 23 Jan 1965, *Clayton 4301* (K); Castro, Río Cunhaporanga, várzea, 26 Nov 1968, *G. Hatschbach 20381* (K); Mun. Jaguariaiva, Río Jaguariaiva, campo, 13 Nov 1974, *G. Hatschbach 35575* (K). **Río de Janeiro:** Mun. Itatiaia, Prateleiras, 2300 m, Mar 1937, *Brade & Kuhlman 15631* (B, COL, PRC, RB); Serra de Itatiaia, 1900 m, Mar 1894, *Ule 243* (R); Río de Janeiro, Alto de Itatiaia, 2200–2400 m, 17 Jan 1925, *A. Chase 8302* (US). **Río Grande do Sol:** Aparados da Rocinha, Bom Jesus, 18 Jan 1950, *Rambo 45452* (US); Vacaria, 9 Jan 1946, *J.R. Swallen 8189* (MO, US); Mun. Río Pardo, Fasenda Soledad (Jurgens), 70 m, 1905, *Jurgensen G85* (US); Bom Jesus, entre Ausentes e Poste Fiscal da Serra da Rocinha, 4 Dec 1971, *Valls et al. 1893* (US); Facenda Carauna–Bom Jesus, *Dutra 543* (R); Mun. Julio de Castilhos, between Abacatu & Venado, 13 Nov 1976, *T.M. Pedersen 11475* (C, CTES, K, MO, P); Mun. Vacaria, Jul 1954, *Barreto 577* (BAA); S. Luiz, 24 Nov 1952, *Rambo 53471* (B, US); Faz Englert São Francisco de Paula, 1 Jan 1952, *Rambo 54704* (B, US); Serra de Rocinha, Bom Jesus, 1200 m, 18 Jan 1950, *Rambo 45466* (B); 3 Feb 1953, *Rambo 53816* (B, US); Cambara do Sul, Itaimbezinho, 15 Dec 1973, *Hitchcock 28* (ICN); Taimbezinho, Nov 1977, *Boechat 41059* (ICN); Cambara do Sul, Itaimbezinho, 7 Jan 1977, *Sampaio & Arzivenco 341, 362 & 404* (ICN); Bom Jesus–Faz. Arechavaleta, Cavauna, Jan 1903, *Dutra 538* (ICN); Bom Jesus–estr. Para Vacaria, 15 km apos ponte de saida de B. Jesus, 30 Nov 1975, *Longhi & Sampaio 368* (ICN). **Santa Catârina:** Mun. Mafra, Campo Novo, 7 km from Mafra, 9 Dec 1971, *Smith & Klein 15761* (ICN, K, R, US); Campo Novo, Mafra, 750 m, 12 Dec 1962, *Klein 3872* (K, US); Mun. Porto Uniao, 45 km S,

900–1100 m, 5 Feb 1967, *Smith & Klein 10855* (US); Campo de Areao, Santa Cecilia, 1100 m, 19 Dec 1962, *Reitz & Klein 14172* (US); Mun. Caçador, 8 km N of Caçador, 950–1100 m, 7 Feb 1957, *Smith & Klein 10958* (US); Mun. São Joaquim, source of Río Capivaras, Serra do Oratorio, 10 km E of Bom Jardim da Serra (Cambajuva), 1200 m, 16 Jan 1957, *Smith & Reitz 10127* (US); Mun. Bom Retiro, Fazenda Campo dos padres, 1650 m, 25 Jan 1957, *Smith & Reitz 10428* (US); Mun. Marombas, Curitibaños, Banhado, 900 m, 9 Jan 1962, *Reitz & Klein 11812* (US); Base of Morro Juco Prudente, 1 Jan 1946, *J.R. Swallen 8089* (MO, US); Mun. Bom Jardim de Serra, 10 km S of Bom Jardim at Río Capivaras, 15 Dec 1971, *Smith & Klein 15805* (K, MO, R, US); Mun. Curitibaños, 28 Nov 1971, *Smith & Klein 15474* (K, R, US); Mun. Lajes, 8 km S of Painel, 19 Dec 1971, *Smith & Klein 15916* (K, R, US); 27 km S of Lajes, 20 Dec 1971, *Smith & Klein 15936* (K, R, US); Mun. Chapeco, campo, bog and pinheiral, Fezenda Campo São Vicente, 24 km W of Campo Ere, 900–1000 m, 26 Dec 1956, *Smith et al. 9389* (R, US); Mun. Ere, 6 km W of Campo Ere, 26°22´S, 53°06´W, 900–1000 m, 6 Dec 1964, *Smith & Klein 13674* (K, P, R, US); Campo de Chatorio, *Ule 616* (W); Walde am Capirone, Serra Geval, Mar 1891, *Ule 1959* (P); São Biento, 22 Jun 1885, *Schwaike s.n.* (P); Mun. Río Pardo, 70 m, Nov 1908, *Jurgens 175* (W); Campos Dos Padres, 22 Jan 1957, *Rambo 60082* (B); Curitibaños, Banhadoi, 900 m, 10 Jan 1962, *Reitz & Klein 11948* (B, US). **São Paulo:** Campos do Jordão, in paludosis, 1600 m, Feb 1946, *Leite 3490* (US); Mun. São Roque, 50 km W from, São Paulo, 850 m, 12 Feb 1987, *Tsugaru & Otsuka B-2265* (MO). **PARAGUAY. Caazapa:** Tavai, bosque cercano al hospital, 28 Oct 1988, *Degen 861* (FCQ, MO); galery forest 1 km N of hospital, 26°10´S, 55°27´W, 28 Oct 1988, *Zardinii 7701* (FCQ, MO). **Itapua:** Cordill. San Rafael, Estero Yukeri, *Bernardi 18618* (MO). **URUGUAY.** Caticeiras Rivera, 11 Dec 1907, *Berro 5994* (BAA). **Tacuarembó.** Campos de Tacuarembó, terrenos arenosos, *Arechavalet s.n.* (W); Montevideo, 1826, *D´Orbygny 39* (P); Cerro Largo, Cerro de Las Cuentas, 29 Dec 1938, *Rosengurtt B-2764* (US).

19. Festuca andicola Kunth, Nov. Gen. Sp. (quarto ed.) 1: 153.1816. (**Figs. 23, 24, 83C & D**). *Festuca racemosa* Willd. ex Spreng., Syst. Veg. 1: 352. 1825, *nom. inval.* Type: Ecuador. Carchi, Páramo de Puntas, 3220 m, *Humboldt & Bonpland s.n.* (holotype: P!; isotypes: B!, P!, US-2875373 fragm. ex P!).

Perennials with well developed rhizomes, innovations extravaginal. Culms 50–70 cm tall, erect, solitary, glabrous; nodes 2 or (3) in basal half. Leaf sheaths membranous, brown, striate; auricles absent; ligules 0.5–0.9 mm long, membranous to coriaceous, apex truncate, ciliate; blades 10–17 × 0.1–0.4 cm, flat or conduplicate, green, abaxially glabrous. Panicles 12–17 × 0.5–1 cm, contracted, erect, elongate; branches mostly glabrous. Spikelets 7–9 mm long, florets 3 or 4(–5); rachilla glabrous or with scattered hairs; glumes 1.4–2.5 mm long, membranous to coriaceous, oblong-lanceolate, purplish, apex obtuse ciliate; lower glumes 1.4–1.8 mm long, 1-nerved; upper glumes 2–2.5 mm long, 3-nerved, apex short-ciliate; lemmas 5–5.5 mm long, 5-nerved, membranous to coriaceous, lanceolate, purplish, upper third scabrous, apex acute or short–awned, the awn or mucro 0.5–0.7 mm long; callus glabrous; paleas as long as the lemma, membranous, glabrous, scabrous on keels, apex hairy; lodicules lanceolate, acuminate; anthers 0.8–1.1 mm long; ovary apex glabrous. *Caryopses* not seen.

Leaf blade anatomy.—Cross-sections with 7–9(–11) vascular bundles and 5–7(–9) ribs above; sclerenchyma under abaxial epidermis discontinuous, some fascicles extending to the vascular bundles forming girders; adaxial epidermis with scattered hairs, the hairs 0.05–0.09 mm long.

Observations.—Saint-Yves (1927, 180) mentions *Festuca dissitiflora* Steud., a nom. nud., as belonging to *F. andicola*. Examination of the voucher of *F. dissitiflora* housed at US (*W. Lechler 1829*, US-2875397 fragm. ex GOET!) confirms that this species has nothing to do with *F. andicola* and that it is a synonym of *F. rigescens* (J. Presl) Kunth. Historically, the name *F. andicola* had been applied to a heterogeneous group, and this group was divided into two species by Stančik (2003) where a new type and name, *F. soukupii*, were designated. *Festuca andicola* and *F. soukupii* are morphologically similar to the Venezuelan species, *F. elviae*, and the Peruvian *F. tenuiculmis* Tovar. *Festuca tenuiculmis* differs from the rest of the group by having ramified, opened panicles. *Festuca andicola* differs from the others by having solitary culms with rhizomes, whereas *F. soukupii* is caespitose forming small bunches.

Distribution and habitat.— Festuca andicola ranges from southern Ecuador to northern Colombia. Tovar (1972) mentions *F. andicola* as being

Figure 24. *Festuca andicola.* **A.** Habit. **B.** Ligule. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Lemma with palea and rachilla. **G.** Leaf blade cross-section. A–G, *Stančík 3551* (PRC).

present in Peru but no Peruvian specimens were found during preparation of this revision. It occurs in swamps and margins of streams in the grass paramo zone and Andean mountain forests between 2900–3800(–4000) m. This species is associated, in addition to many others, with communities of the order *Marchantio-Epilobietalia* (Cleef 1981).

Additional specimens examined. **COLOMBIA. Antioquia:** Mun. Urrao, Páramo Frontino, La Cueva, 3450 m, 11 Sep 1986, *Roldán et al. 396* (COL, HUA, MO); Llano Grande, 3400 m, 10 Sep 1986, *Roldán et al. 307* (HUA). **Boyacá:** Mun. Aquitania, Páramo Los Curies, 3500 m, 8 Feb 1999, *D. Stančík 2190* (COL, FMB, PRC); Mun. Mongui, Páramo de Laguna La Colorada, 3600 m, 21 Jan 1999, *D. Stančík 2024* (COL, PRC); Mun. Santa Rosa, Páramo Alto Lamadero, 3200 m, 30 Feb 1988, *D. Stančík 1455* (COL, PRC); Páramo de Pisba, carratera Socha–La Punta, 3570 m, 11 Jun 1972, *Cleef 4376* (COL, U, US); Mun. Arcabuco, way from Laguna Iguaque to Laguna Ojo de Agua, 3650 m, 15 Oct 1998, *D. Stančík 948* (COL, FMB, PRC); Mun. Toca, Páramo Cortadero, 5º30´N, 73º15´W, 3350 m, 14 Nov 1998, *D. Stančík 1365* (COL, FMB, PRC). **Caldas:** Mun. Manizales, Parque Nacional Los Nevados, 4020 m, 18 Sep 1999, *D. Stančík 3412* (COL, PRC); way from Río Nereidas to Casa del Cisne, km 5–7, 4000 m, 18 Sep 1999, *D. Stančík 3399* (COL, PRC); Los Nevados, Villamaría, 3 Feb 1985, *Sahn & Hernán 1060* (FMB). **Cauca:** Macizo Colombiano, Valle de las Papas, alrededores de Valencia, 2910 m, 11 Sep 1959, *Idrobo et al. 3678* (COL). **Cundinamarca:** Mun. San Juan de Sumapaz, Parque Nacional Sumapaz, Alto de Toquilla, 3800 m, 15 Nov 1999, *D. Stančík 3554* (AAU, COL, PRC); 15 Nov 1999, *D. Stančík 3551* (COL, PRC); road from San Juan to Usme, km 5–7, 3650 m, 15 Nov 1999, *D. Stančík 3547* (COL, PRC); Parque Nacional Chingaza, mina Palácio, 3700 m, 11 Oct 1992, *Figueredo 119* (COL, HPUJ); 3700 m, 5 Aug 1992, *Figueredo 126* (HPUJ); Muncipio Fomeque, Valle de los Frailejones, 3150 m, 12 Jun 1989, *Bernal & Jimenez 1127* (HPUJ); Monserrate, Aug 1859, *Lindig 14* (P); Alto San Juan, 4000 m, *R. Fosberg 20749* (US). **Meta:** Páramo de Sumapaz, Hoya El Nevado, Laguna La Guitarra, 3405m, 24 Jan 1973, *Cleef 8285* (COL). **Nariño:** Mun. Tuquerres, Volcán Azufral, road from Vereda San Roque to Laguna Verde, km 3, 2650 m, 9 Mar 1999, *D. Stančík 2775* (COL, PRC, PSO); El Encano, vereda Catapamba, 2900 m, 23 Mar 1999, *D. Stančík 2983* (AAU, COL, PRC, PSO, W); Cumbal, 3300 m, 16 Apr 1986, *Benavides 6497* (COL, PSO). **Norte de Santander:** Mun. Chilos, vereda El Hatico on road Pamplona–Bucaramanga, 3500–3700 m, 1 Dec 2000, *D. Stančík* (COL, PRC). **Risaralda:** Laguna del Otún, quebrada Juntas, 3750 m, 29 Aug 1985, *Sánchez & Hernández 950* (FMB). **Santander:** Páramo de Berlin, cerca del Picacho, 3290 m, 29 Sep 1966, *Robinson & Beltran 3142* (US). **ECUADOR. Carchi:** road Las Juntas–El Angel, km 14, 3400 m, 11 Mar 1992, *S. Laegaard 101731* (AAU, QCA, QCNE). **Chimborazo:** Mun. Riobamba, Volcán Chimborazo, sector Cruce de Los Arenales, 01°28´14″S, 78°54´06″W, 4300 m, 20 Sep 2000, *D. Stančík 3712* (PRC, QCA); *D. Stančík 3705* (AAU, PRC, QCA). **Cotopaxi:** Volcán Cotopaxi, road to Limpiapungo, 00º37´S, 78º27´W, 3850 m, *S. Laegaard 5866* (AAU, QCA). **Imbabura:** Cordillera Oriental, Paramo de Angochagua, 2900–3600 m, *Acosta-Solís 18836* (US); Mun. Urcuquí, road to Cerro Yanaurcu, 00°28´13″N, 78°18´45″W, 4100 m, 15 Oct 2000, *D. Stančík 4092* (PRC, QCA). **Pichincha:** Lloa, 3000 m, *E. Asplund 7524* (AAU, F, S); Paramo de Mojanda–Laguna Negra, 00º08´S, 78º16´W, 3800 m, 14 May 1985, *S. Laegaard 54327* (AAU, QCA, QCNE); Road Pifo–Papallacta, 3 km W of Paso de la Vírgen, 00º18´S, 78º14´W, 3700–3900 m, 7 Aug 1985, *S. Laegaard 54892* (AAU, QCA); Cerro Ungui, 2860 m, *Hartman 7a* (US); Mun. Amiguaña, Volcán Pasachoa, 00°29´51″S, 78°29´25″W, 3700 m, 14 Sep 2000, *D. Stančík 3685* (PRC, QCA); Mun. Amaguaña, Volcán Pasachoa, 00°30´23″S, 78°29´28″W, 3350 m, 14 Sep 2000, *D. Stančík 3683* (AAU, PRC, QCA). **Tungurahua:** Cotalo, 2900 m, *Acosta-Solís 9879* (US); Slope of Mt. Tungurahua above Baños, 2800 m, *E. Asplund 8427* (NY, S).

20. Festuca rubra L., Sp. Pl. 1: 74. 1753. (**Figs. 21, 25, 83A & B**). Type: In paludosis prati regii Upsalia, *Anonymous* (lectotype: GB!, designated by Jarvis et al., Watsonia 16:302. 1987.)

Loosely tufted and rhizomatous perennials with extravaginal (rarely intravaginal) innovations. Culms 20–50 cm tall, erect, glabrous; 1 node in basal half. Leaf sheaths membranous to coriaceous, brown, striate, glabrous or pilose, margins united at base; auricles absent, ligules 0.3–0.5 mm long, membranous to coriaceous; blades 7–15 cm long, 0.7–1 mm wide, conduplicate to involute, green, sometimes glaucous, abaxially glabrous, apex

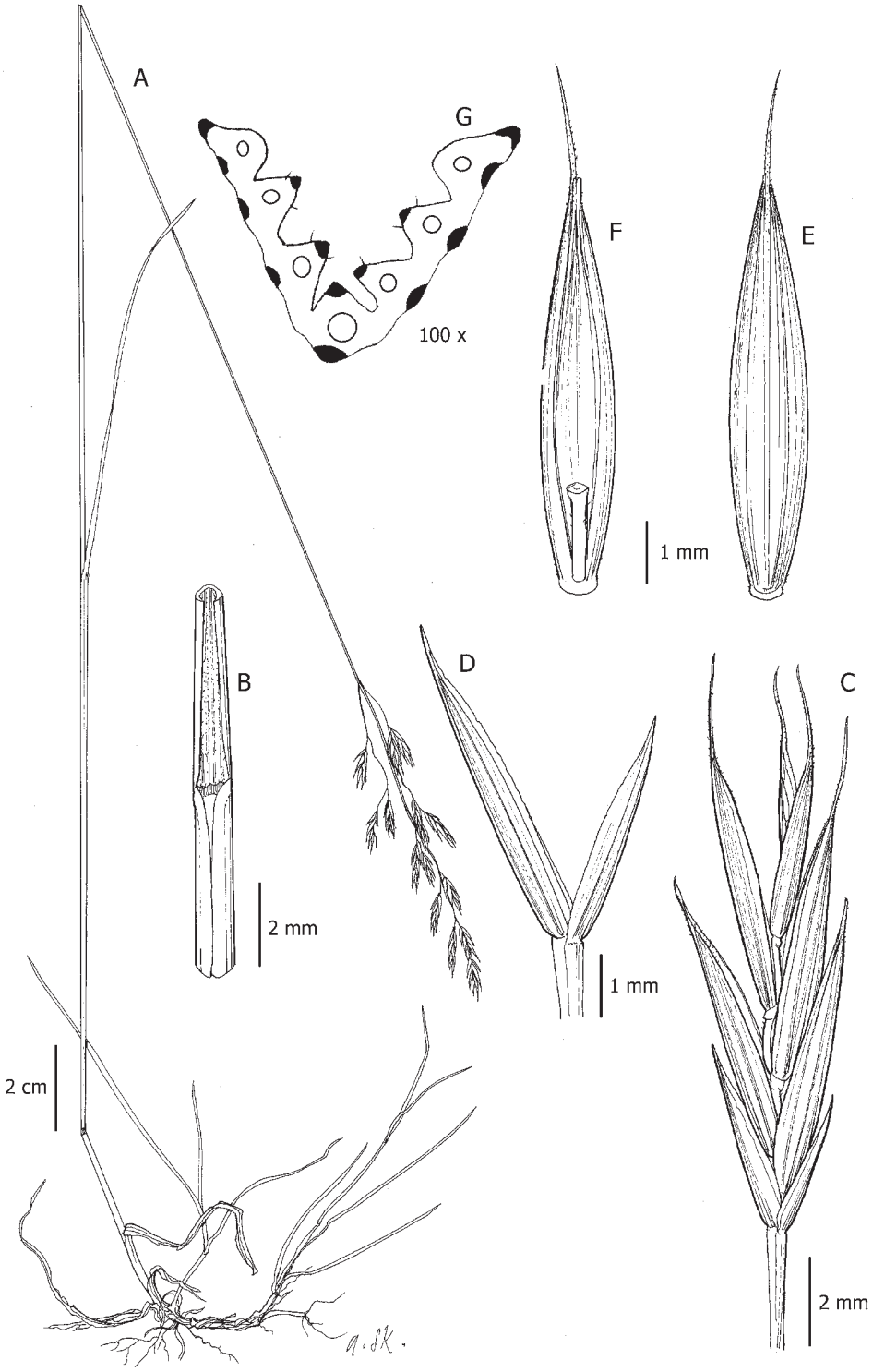


Figure 25. *Festuca rubra.* **A.** Habit. **B.** Ligule. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Lemma with palea and rachilla. **G.** Leaf blade cross-section. A–G, *Stančík 3457* (PRC).

obtuse. Panicles ca. 10 cm long, 3–5 cm wide, erect or spreading; branches scabrous. Spikelets 10–12 mm long, florets 5 or 6; rachilla glabrous or with scattered hairs; glumes 4–5.5 mm long, membranous to coriaceous, lanceolate, purple, apex acute; lower glumes ca. 4 mm long, 1-nerved; upper glumes 5–5.5 mm long, 3-nerved; lemmas 6.5–7 mm long, 5-nerved, membranous to coriaceous, lanceolate, green to purplish, apex scabrous, awned, the awn 2.5–3.5 mm long; callus glabrous; paleas almost as long as the lemma, scabrous on keels, apex hairy; lodicules oblong-lanceolate; anthers 3.5–3.7 mm long; ovary apex glabrous. Caryopses not observed.

Leaf blade anatomy.—Cross-sections with 7 vascular bundles and 5 ribs above; sclerenchyma discontinuous under both abaxial and adaxial epidermis, not forming girders; adaxial epidermis with scattered hairs, the hairs 0.02 mm long.

Distribution and habitat.—This species is introduced from Europe and rarely cultivated.

Additional specimens examined. **COLOMBIA. Caldas:** Mun. Neira. Vereda Chupaderos, Sector Campamentos, pasture, 3650 m, *D. Stančík 3457* (COL, PRC). **ECUADOR. Chimborazo:** Paramo de Urbina, 25 km N of Riobamba, ca. 2 km W of Panamerican Hwy., 3500 m, 28 Jan 2000, *S. Laegaard et al. 20994* (AAU, LOJA, QCA, PRC). **Pichincha:** Picalquí al S de Tabacundo, 2750 m, *Acosta-Solís 16358* (F, US).

21. Festuca soukupii Stančík, Folia Geobot. Phytotax. 39(1): 103, f. 2, 1–5. 2004. (**Figs. 26, 27, 83E & F**). Type: Ecuador. Imbabura, Mun. Cayambe, Volcán Cayambe, 00°31.6´N, 78°55.6´W, swamps below the refuge with *Loricaria* sp., *Festuca glumosa*, *Distichia muscoides* Nees & Meyen, etc., 4450 m, 20 Dec 2000, *D. Stančík 4162* (holotype: PRC!; isotypes: AAU!, QCA!).

Small tussocked perennials with intra- or extravaginal innovations. Culms 10–50 cm tall, erect, glabrous; nodes 1(–2) in basal half. Leaf sheaths membranous, brown, striate, densely hairy and appearing shaggy, margins free; auricles absent; ligules 0.3–0.5 mm long, membranous to coriaceous, apex obtuse, short-ciliate; blades 5–25 cm long, 0.5–0.8 mm wide, conduplicate to involute, green, abaxially glabrous, apex obtuse. Panicles 2.5–13(–17) cm long, 0.3–0.5 cm wide, erect, contracted, elongate; branches hairy. Spikelets 6–8(–9) mm long, florets 3 or 4(–5); rachilla glabrous or with short scattered hairs; glumes 1.2–2.5(–2.7) mm long, membranous to coriaceous, ovate to lanceolate, purplish, apex obtuse, ciliate; lower glumes 1.2–2 mm long, 1-nerved; upper glumes 2–2.5(–2.7) mm long, 3-nerved, apex short-ciliate; lemmas 4.5–5.5 mm long, membranous to coriaceous, lanceolate, 5-nerved, purplish, papillose, apex awned, sometimes scabrous, the awn (0.5–)0.7–1.7 mm long; callus glabrous; paleas as long as the lemma, glabrous, scabrous on keels, apex hairy; lodicules oblong-lanceolate; anthers 0.8–1.1 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 3/5 of total length.

Leaf blade anatomy.—Cross-sections with 5–7 vascular bundles and 3–5 ribs above; sclerenchyma under abaxial epidermis discontinuous, under adaxial epidermis absent [larger plants with 7–9(–11) vascular bundles and adaxial schlerenchyma, sometimes forming 2–4 girders]; adaxial epidermis with scattered hairs, the hairs 0.03–0.05 mm long.

Observations.—Festuca soukupii is morphologically similar to *F. andicola*. However, *F. andicola* has well developed rhizomes (versus tussock forming) and glabrous sheaths (versus densely hairy).

Distribution and habitat.—Festuca soukupii ranges from the Cordillera Central of northern Colombia, through Ecuador to northern Peru. It is known from humid grass paramo and super-paramo vegetations between 3700–4500 m. In addition, this species is found in large tufts along trails and roads up to the forest zone between 2600–3200 m.

Additional specimens examined. **COLOMBIA. Caldas:** Mun. Manizales, Parque Nacional Los Nevados, Hda. La Esperanza, 3500–3700 m, 18 Sep 1999, *D. Stančík 3416* (COL, PRC); Mun. Neira, vereda Chupaderos, sector "Campamentos", 3650 m, 26 Sep 1999, *D. Stančík 3455* (COL, PRC); Páramo de Quindio, 3700–4200 m, 20 Aug 1922, *Pennell 9951* (US). **Cauca:** Mun. Popayan, Parque Nacional Puracé, Pilimbalá, 02º22.1´N, 76º24.06´W, 3250 m, 6 Jul 2000, *D. Stančík 3610* (COL, PRC); Macizo Colombiano, Valle de las Papas, alrededores de Valencia, 2910 m, 11 Sep 1958, *Idrobo et al. 3682* (COL, US). **Nariño:** Mun. Cumbal, Volcán Nevado de Cumbal, NE slopes, 3700 m, 9 Mar 1999, *D. Stančík 2744* (AAU, COL, PSO, PRC); Mun. El Encano, between vereda Catapamba and road Pasto–El Encano, 2800 m, 23 Mar 1999, *D. Stančík 2981* (COL, PSO, PRC); Plain N of Guachucal, 3000 m, 1 Mar 1986, *Wood*

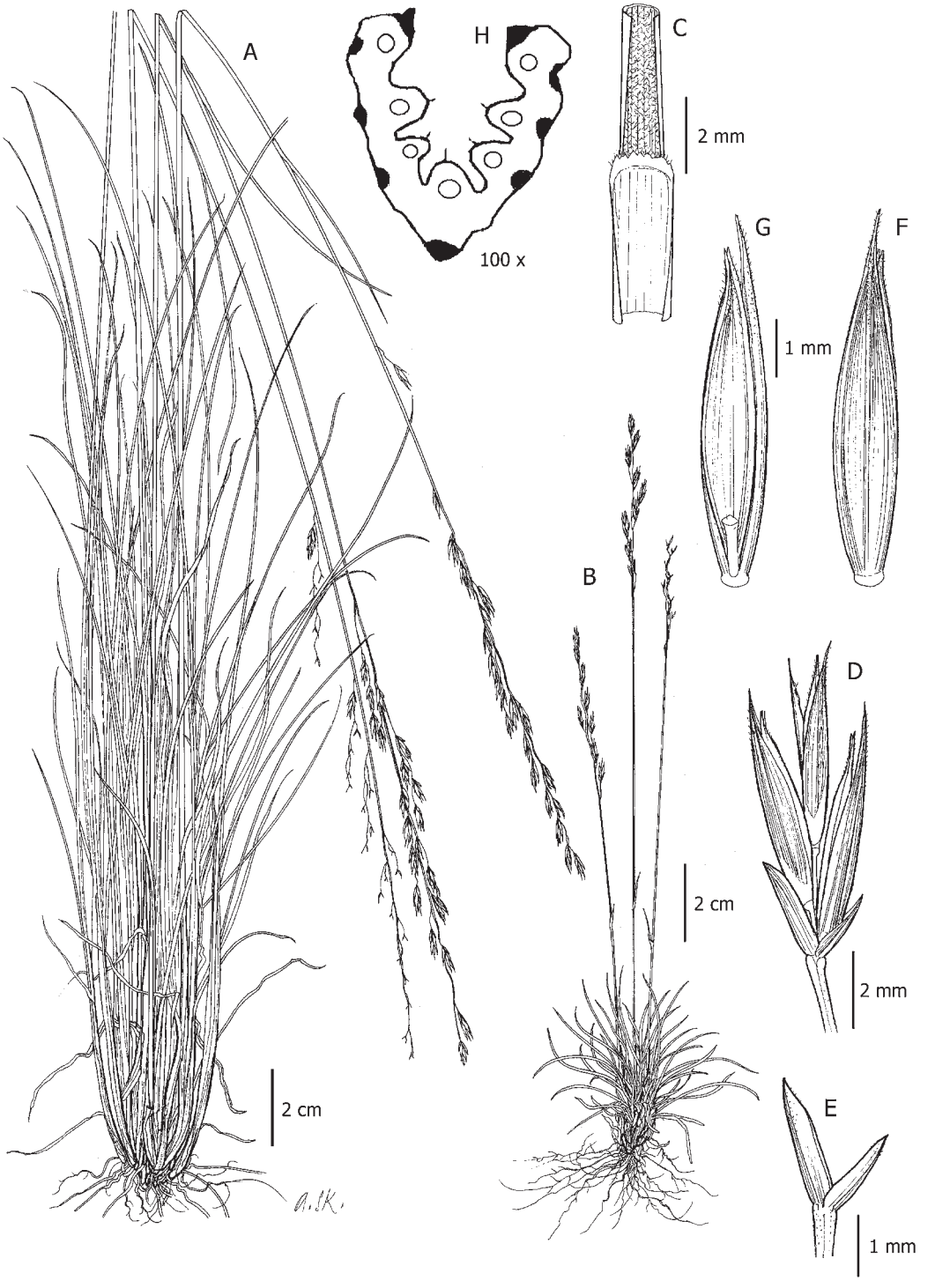


Figure 26. *Festuca soukupii.* **A, B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A, C−G, *Stančík 3887* (PRC); B, *Stančík 3079* (PRC); H, *Stančík 4162* (PRC).

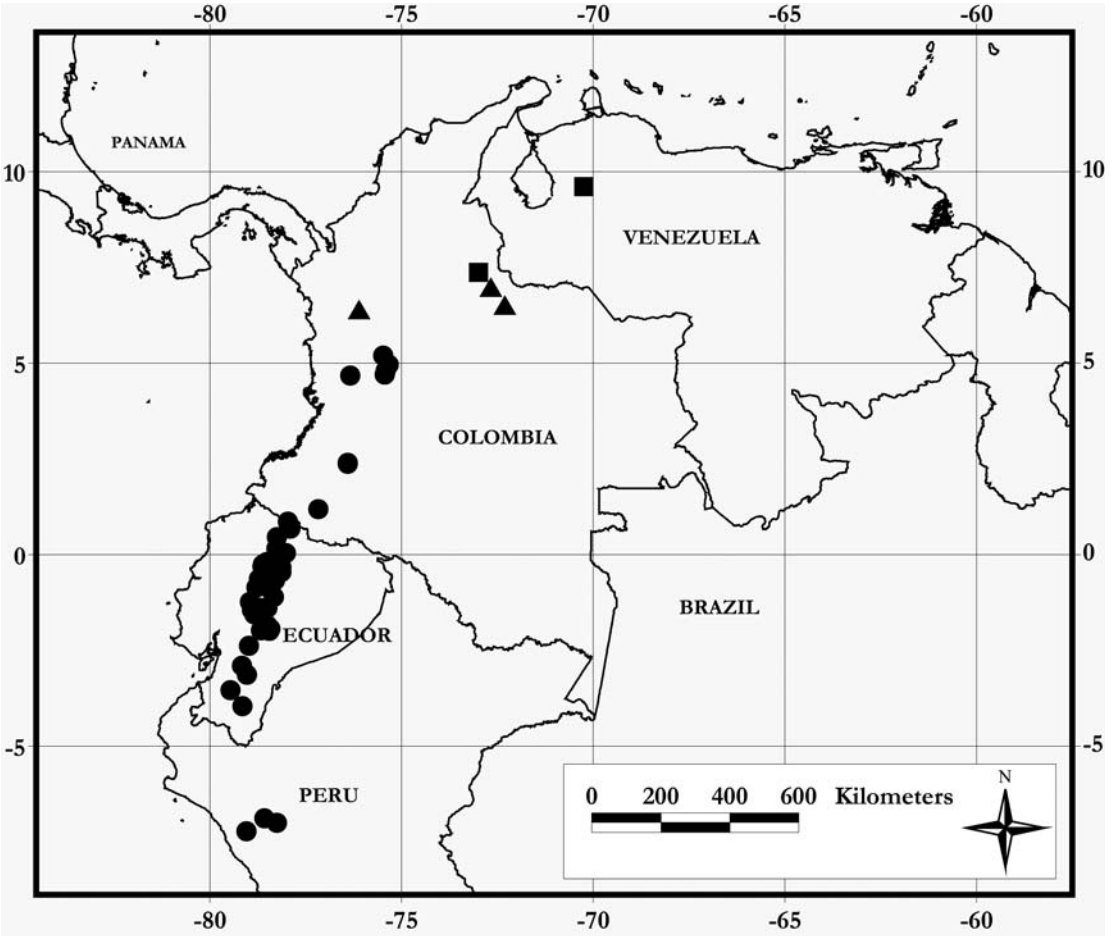


Figure 27. Distribution of *Festuca soukupii* (●), *F. chitagana* (▲), and *F. hatico* (■).

5331 (COL, K). **Risaralda:** Mun. Pereira, Parque Nacional Los Nevados, below Nevado del Cisne, way from Casa del Cisne to Laguna de Otún, km 5, 4100 m, 19 Sep 1999, *D. Stančík 3380* (PRC, W); below Nevado Santa Iabel, crossroads to Villa María, Hda. Potosí and Casa del Cisne, 4000–4100 m, 20 Sep 1999, *D. Stančík 3373* (COL, PRC, US). **Tolima:** N side of Nevado del Ruiz, 3800 m, 19 Feb 1984, *Wood 4247* (COL, FMB, K); Mun. Ibague, Nevado del Tolima, La Cueva, 04º 39´N, 76º19.5´W, 3900 m, 8 Jun 2000, *D. Stančík 3596* (COL, PRC). **ECUADOR. Azuay:** Parque Nacional Cajas, slopes near Laguna Luspa, 3700 m, 21 Apr 1990, *P.M. Peterson 8858, C.R. Annable & M.E. Poston* (QCA, QCNE, US); along Río Miguir, 3480 m, 21 Apr 1990, *P.M. Peterson 8870, C.R. Annable & M.E. Poston* (QCA, QCNE, US); around lake Llaviaucu, 02º56´S, 79º10´W, 3400 m, *Oxford Expedition 30* (K); El Pan, mountain zone, 2800 m, *Harlington 1197* (S); around Lagoon Taglacocha–Tres Cruces, 02°47´S, 79°13´W, 3900–4000 m, 1 Sep 2000, *D. Stančík 3858* (PRC, QCA); road Cuenca–Saraguro, km 42, 03º10´S, 79º02´W, 3450 m, 19 Feb 1985, *S. Laegaard 53580* (AAU, QCA); road Cuenca–Limon, towards antennas, 03º10´S, 79º02´W, 3350 m, 21 Nov 1999, *S. Laegaard et al. 20824* (LOJA, AAU); Mun. Nabon, antennas on the road Loja–Cuenca, 03°12´S, 79°02´W, 3300–3450 m, 30 Aug 2000, *D. Stančík 3802*, *3808* (QCA, PRC). **Bolívar:** pass on road Guaranda–Riobamba, 01º35´S, 78º50´W, 4050–4150 m, 10 Jul 1990, *S. Laegaard 71737* (AAU, QCNE); highway to Guaranda km 66.5 and to Fecundo km 2.2, 4300 m, 03 May 1990, *P.M. Peterson 8996 & C.R. Annable* (MO, QCA, QCNE, US); Simiatung, Hacienda Talahua, 3400 m, *Penland & Summers 583* (F). **Cañar:** road Cañar–Chunchi, 02º24´S, 78º59´W, 3200 m, 05 Mar 1985,

S. Laegaard 53837 (AAU, QCA, QCNE); El Tambo, road El Tambo–Ingapirca, 3400–3500 m, *D. Stančík 3800* (PRC, QCA). **Carchi:** km 21.2 NE of El Angel and 27.8 km SW of Tulcán, above Río Bolo, 3320 m, 14 May 1990, *P.M. Peterson 9139, E.J. Judziewicz & R.M. King* (MO, QCA, US); km 11.4 NE of El Angel on road to Tulcán, 3240 m, *P.M. Peterson 9118, E.J. Judziewicz & R.M. King* (US); km 14 along road Las Juntas–El Angel, 3400 m, 11 Mar 1997, *S. Laegaard* 101718 (AAU, QCA, QCNE). **Cotopaxi:** road Zumbahua–Pujili, km 39, 00º53´S, 78º47´W, 3750–3800 m, *S. Laegaard 102087* (AAU); Paramo de Laguna Salayampe, E of Latacunga, 00º56´S, 78º25´W, 4000–4100 m, *S. Laegaard 54148* (AAU); Volcán Cotopaxi, N slope, 00º39´S, 78º26´W, 4200 m, *Sklenář & Kostečková 1905* (AAU); Parque Nacional Cotopaxi, Laguna Limpiopungo, 00º40´S, 78º30´W, 3800 m, 3 Apr 1982, *Fegan & Falconi 9* (QCA); Falda NNW, 4180 m, 03 Jul 1986, *Ehrenburg 60* (QCA); Valley NW of Limpiapungo, 00º38´S, 78º28´W, 3900–4000 m, 25 Feb 1992, *S. Laegaard 101432 (*AAU, QCA); N slope on the left side of the road to refuge, 00º39´S, 78º26´W, 4200 m, 19 Jul 1995, *Sklenář & Kostečková 85-8, 86-9, 87-6* (NY); Quebrada ca. 3 km de carratera, 00º40´S, 78º30´W, 3400 m, 08 May 1982, *Bravo 56, 58* (QCA); railway station Cotopaxi, 3400 m, *E. Asplund 6478* (S, US); Cotopaxi, 2500 m, *E. Asplund 6400* (S); road Salcedo–Napo, km 27–39, 4000–4100 m, *Sparre 15708* (S); Mun. Chaupi, NE slope of Volcán Illiniza, 37´59″S, 78°42´42″W, 4000–4050 m, 12 Oct 2000, *D. Stančík 4023, 4028, 4031* (PRC, QCA); Mun. Lasso, volcán Cotopaxi, 00º39´6″S, 78; 78º30´55″W, 3530 m, 28 Sep 2000, *D. Stančík 3108, 3128, 3879, 3887* (AAU, PRC, QCA). **Chimborazo:** Volcán Chimborazo, E side, 01º28´S, 78º46´W, 4260 m, *Sklenář & Sklenářová 2262* (AAU); 4300 m, *Sklenář & Sklenářová 2168* (AAU); km 42.7 SW of Ambato on Highway to Guaranda, 4020 m, *P.M. Peterson 8973 & C.R. Annable* (MO, QCA, QCNE, US); km 10 E of Lago Colta on road to Pallatango, 3725m, *P.M. Peterson 9209, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (K, MO, QCA, QCNE, US); between Urbina and Mt. Chimborazo, 3600–4500 m, *A.S. Hitchcock 21981* (US); 3750 m, *E. Asplund 7892* (K, S); 3900 m, *E. Asplund 8447* (P, S); Paramo de Urbina km 25 N of Riobamba, ca. 2 km W of Panamerican Hwy., 01º29´S, 78º42´W, 3500 m, *S. Laegaard et al. 20993* (AAU); S slope of Mt. Chimborazo, 3800 m, *Fagerlind & Wibon 934-bis* (S); km 9 NE of San Juan de Velasco on road to Lago Colta, 3600 m, 21 May 1990, *P.M. Peterson 9235, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (QCA, QCNE, US); Daldal Valley km 10 E of Licto, 01º48´S, 78º32´W, 3700 m, *Ramsay et al. 104A* (K); 00º15´S, 78º28´W, 3450 m, 19 Aug 1987, *Ramsay & Smith 245, 247* (K, QCA, QCNE); along Río Alao, 01º52´S, 78º30´W, 3200–3400 m, *S. Laegaard 55301* (AAU); near pass between Volcán Chimborazo and Carihuairazo, 01º27´S, 78º48´W, 4400 m, *S. Laegaard & Sánchez 20027* (AAU); Carihuasco above Mashahuasca, 01º29´S, 78º49´W, 4500 m, *S. Laegaard & Sklenář 20363* (AAU); road Guamote–Macas km 15, 02º00´S, 78º40´W, 3750 m, S. *Laegaard & Sklenář 20335* (AAU, LOJA); Mun. Riobamba, volcán Chimborazo, sector Cruce de los Arenales, 01°27´51″S, 78°53´58″W, 4150 m, 20 Sep 2000, *D. Stančík 3713* (PRC, QCA). **Imbabura:** Hacienda Mojanda on road to Otavalo, 2900–3000 m, *Sparre 13516* (AAU, S); Laguna Grande, 00º08´N, 78º16´W, 3725–3750 m, *S. Laegaard 52374A* (AAU, QCA); Laguna Cuicocha, 3100 m, *E. Asplund 20217* (S); Mun. Urcuquí, road to Cerro Yanaurcu, 00°26´28″N, 78°15´24″W, 4100 m, 15 Oct 2000, *D. Stančík 4090B, 4093* (PRC, QCA); Mun. Cayambe, volcán Cayambe, 00°00´26.5″N, 78°01´21″W, 4300 m, 20 Oct 2000, *D. Stančík 4158*, *4162* (PRC, QCA); Mun. Urcuquí, road to Cerro Yanaurcu, 00º37´46″N, 78°41´45″W, 4100 m, 15 Oct 2000, *D. Stančík 4094* (PRC, QCA). **Loja:** km 10 along road to Fierra Urcu, 03º41´S, 78º18´W, 3400 m, S. *Laegaard et al. 19066* (AAU, LOJA, QCA); Cerro de Arcos W of road Manu–Zaruma, 03º34´S, 79º28´W, 3500–3600 m, *S. Laegaard & Aguirre 20609* (AAU); Paramo de Carboncillo, km 11 S of Oña, 2800 m, *S. Laegaard 19739* (AAU, QCA); Mun. Saraguro, road to Fierra Urcu, 03°41´S, 79°16´W, 3000–3100 m, 24 Aug 2000, *D. Stančík 3787, 3780* (PRC, QCA, US). **Morona–Santigo:** Hda. Huargualla–Hda. San Eduardo, way to Parque Nacional Sangay, 02°00.25´S, 78; 27´W, 3700 m, 20 Jul 1999, *D. Stančík 3320* (PRC, QCA); Parque Nacional Sangay, Plaza Culebrillas, 01°58´S, 78°25´W, 3500–3600 m, 22 Jul 1999, *D. Stančík 3358*, *3359* (PRC, QCA). **Napo:** Valle Vicioso E of Volcán Cotopaxi, 3600 m, *Holm-Nielsen & Balslev 23755* (AAU); El Tambo SE of Volcán Cotopaxi, 00º42´S, 78º18´W, 3650 m, *S. Laegaard 55535* (AAU). **Pichincha:** road Pifo–Pintag, 2.5 hours horseride above Inga Moserat, 00º19´S, 78º17´W, 3950 m, *S. Laegaard 102268*, *102237* (AAU, QCA); Paramo

de Guamani, 3960 m, 23 Nov 1991, *Leon 1230* (QCA); 4200–4250 m, *S. Laegaard 101384* (AAU); 4300 m, *S. Laegaard & S.A. Renvoize 70519* (AAU); 4100 m, *S. Laegaard 103107* (AAU, QCA); road Quito–Santo Domingo near San Juan, 00º17´S, 78º37´W, 3450–3500 m, *S. Laegaard 52605*, *52607* (AAU, QCA); Andinum Quitensium Pichincha, *Jameson 296* (P, W); from Pichincha, 4000ft, Jun 1859, *Jameson 14* (W); Quito–Panecillo, 2900 m, *E. Asplund 6020* (S, US); Mun. Otavalo, shrubby margin and pajonal on the road from Otavalo to Laguna Mojanda, 00°09´54˝N, 78°17´20˝W, 3450 m, 19 Oct 2000, *D. Stančík 4111* (PRC, QCA); Nevado Cayambe, W side of the volcano, 00º01´N, 78º01´W, 4200 m, *Sklenář & Kostečková 66-10* (US); road to Refuge, 4300 m, *S. Laegaard & S.A. Renvoize 70519* (AAU); Paramo de Trujillo between peaks of Illinizas and Cotopaxi, 3450 m, *Barclay & Juajibioy 7961* (MO, US); Tunel de agua Quito–Papallacta, 00º22´S, 78º08´W, 16 Mar 1994, *Aguirre & Merino 4219* (AAU, LOJA); E slope of Illiniza Sur, 4300 m, *Sklenář & Kostečková 16-1* (US); 4200 m, *Sklenář & Kostečková 15-5* (NY); Volcán Illiniza, N slope, 4000–4100 m, *Sparre 15635* (S); road Lloa–Guagua Pichincha, km 10, 00º13´S, 78º35´W, 4170 m, *Laegaard et al. 102737* (AAU); Rucu Pichincha, 4400 m, *E. Asplund 17313* (S); NE slope, 4300 m, *Sklenář & Kostečková 1-24* (NY); 4600 m, *E. Asplund 8606* (S); slope above Lloa, 3200 m, *E. Asplund 7558* (S); WNW slope of Antisana, 4600 m, *Halloy B-54* (AAU); between La Libertad and San Juan, 3200 m, *E. Asplund 16259* (S); Canal on W side of Volcán Atacazo, 00º20´S, 78º38´W, 3750–3800 m, *S. Laegaard 55673* (AAU, QCA); slopes of Rumiñahui, 3900 m, *Sparre 15871* (S); Mun. Pifo, páramo de Guamaní, 00°19´S, 78°15´W, 3700 m, 19 Jun 1999, *D. Stančík 3004* (AAU, PRC, QCA); Mun. Amaguaña, Volcán Pasachoa, 00°30´23˝S, 78°29´28˝W, 3350 m, 14 Sep 2000, *D. Stančík 3686* (PRC, QCA). **Tungurahua:** km 10 S of Mocha, 3600 m, *Harling et al. 10533* (GB); Cotalo, 2900 m, *Acosta-Solís 9884* (US); *Acosta-Solís 9877* (US); Mt. Carihuayrazo, 4400 m, *E. Asplund 8470* (S); Mun. Pillaro, Las Llanganatis, around Aucacocha lagoon, 01°8´55˝S, 78°20´00.4˝W, 3800 m, 28 Sep 2000, *D. Stančík 3903* (PRC, QCA). **Zamora–Chinchipe:** Road Loja–Zamora, ca. 2–6 km E of pass, 03º59´S, 79º09´W, 2600 m, *S. Laegaard 18736* (AAU, LOJA, QCA, QCNE). **PERU. Cajamarca:** 52 km N of Cajamarca on Hwy 3N towards Bambamarca, small lagoon with *Ranunculus* and open grasslands with *Deyeuxia*, 3780 m, 16 Mar 2000, *P.M. Peterson 14907 & N. Refulio Rodríguez* (MO, US, USM); Prov. Chota, Miracosta, entre Miracosta y Pampa del Lirio, 3380 m, 11 Dec 2000, *Vega et al. 10320* (F, MO); Pampa Larga, al N de la explotacion minera Yanacocha, 3900 m, 14 May 1994, *Vega 7143* (F); Jalca de Kumullca, ruta a Celendín, 3650 m, 7 Feb 1975, *Vega et al. 1638* (F); Cerro Sexcemayo, al W de Cajamarca, jalca graminosa, 3500 m, 4 Feb 1991, *Vega 5419* (F); Prov. Celendín, Cajamarca–Celendín road, especially near large rock outcrops, 3000–3450 m, 28 May 1984, *Smith et al. 7314, 7321a, 7332* (MO); Celendín, Jalca de Kumulca, mountain pass on the road Cajamarca–Celendín, 07°02´31˝S, 78°15´33˝W, humid jalca vegetation with tussock grasses, 3700 m, 26 Aug 2004, *Sklenář & Cruz 8706* (PRC).

22. Festuca azucarica E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 1546. 1984. (**Figs. 28, 29, 84A–D**). Type: Colombia. Valle de Cauca, Cordillera Central, cerro Pan de Azucar, 3700 m, 26 Feb 1969, *J. Cuatrecasas, Espinal & Ramos 27562* (holotype: US-278!; isotypes: COL!, U-5508!).

Dense tussock forming perennials with intravaginal innovations. Culms 70–80 cm tall, erect, glabrous; nodes 1 or 2 in distal half; cataphylls 0.5–1.5 cm long, short, coriaceous. Leaf sheaths coriaceous, brown, glabrous; auricles absent; ligules 0.3–1(–1.5) mm long, coriaceous, apex truncate, short-ciliate; blades 30–50 cm long, 0.9–1.4 mm wide, conduplicate, rigid, olive-green, abaxially glabrous, apex mucronate. Panicles 10–25 × 1–3(–6) cm, lanceolate to ovate, mostly contracted; branches glabrous or finely scabrous. Spikelets 9–10 mm long, lanceolate, florets 4–6; rachilla densely hairy; glumes (2.5–)3–5(–6) mm long, coriaceous, narrowly lanceolate, dark purple, sparsely scabrous; lower glumes (2.5–)3–3.5(–4) mm long, 1-nerved; upper glumes 4–5(–6) mm long, 3-nerved; lemmas (5.5–)6–7.5 mm long, 5-nerved, membranous to coriaceous, lanceolate, dark purple, scabrous and densely hairy, apex entire, awnless or short-awned, the awn 0.3–0.5 mm long; callus sparsely hairy; paleas as long as the lemma, papillose, upper third hairy; anthers 2.5–3.5 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 1/2–3/5 as long as the grain.

Leaf blade anatomy.—Cross-sections with 9–15 vascular bundles and 7–14 ribs; sclerenchyma

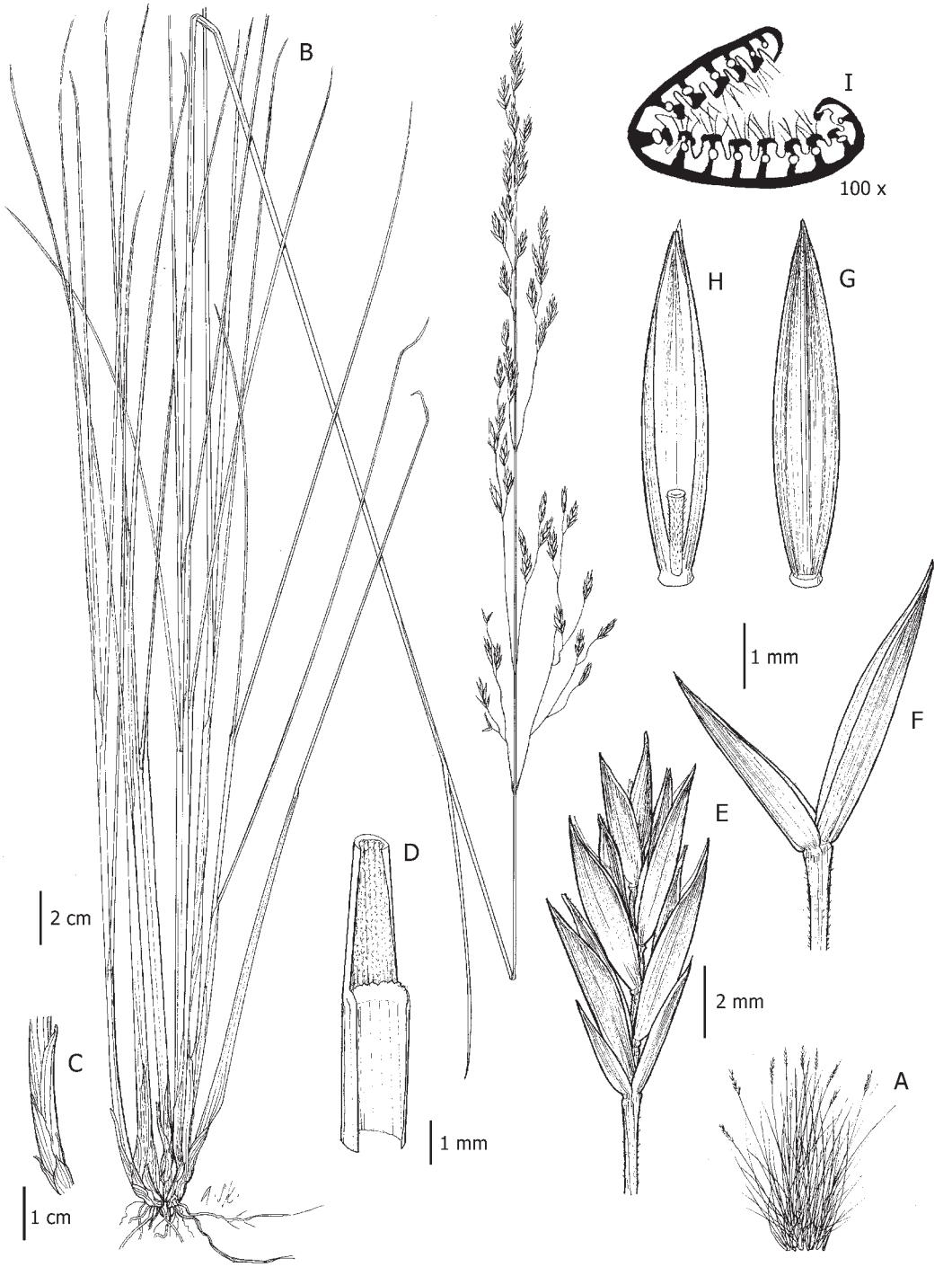


Figure 28. *Festuca azucarica.* **A.** Stylized growth form. **B.** Habit. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 3377* (PRC).

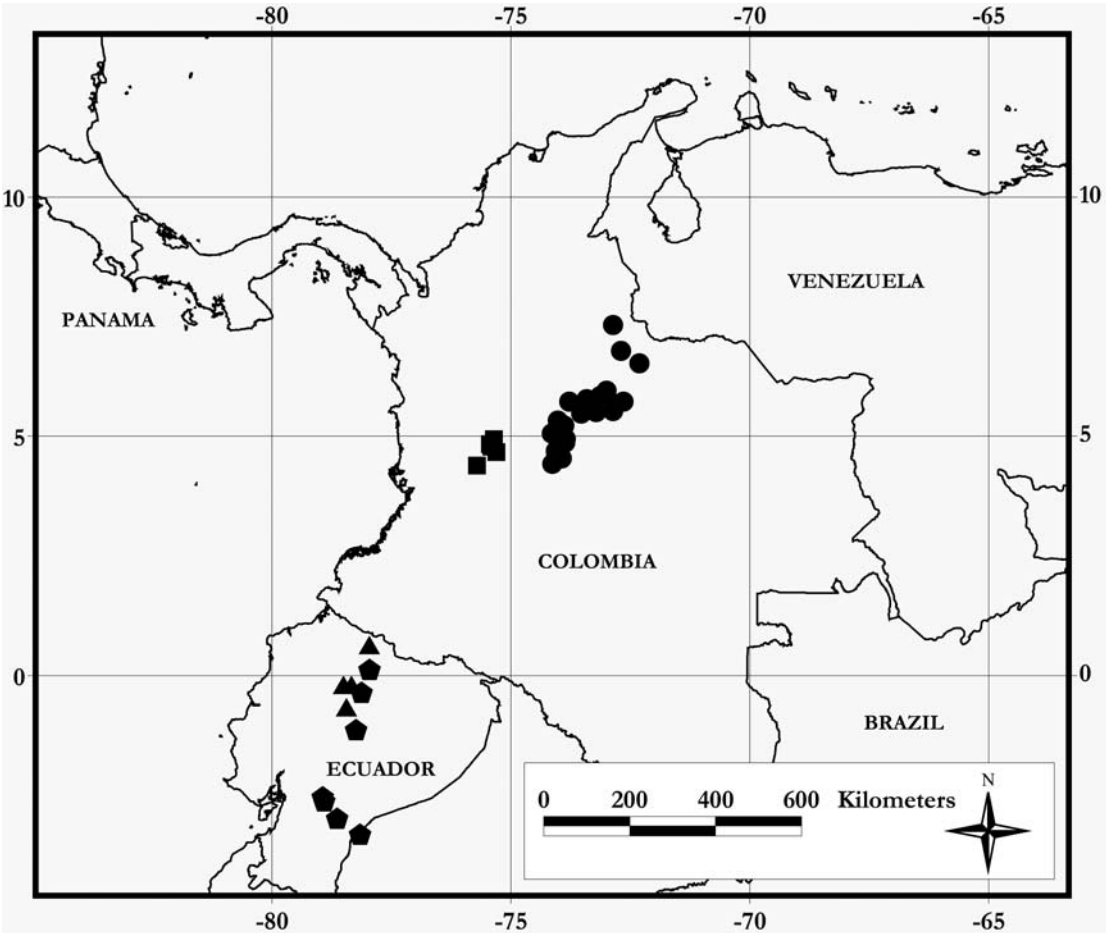


Figure 29. Distribution of *Festuca colombiana* (●), *F. dasyantha* (▲), *F. azucarica* (■), and *F.laegaardii* (⬟).

under abaxial epidermis continuous or discontinuous, united with all the vascular bundles, adaxial sclerenchyma present, extending to all vascular bundles; bulliform cells absent; epidermis densely hairy adaxially, the hairs 0.4–1.3 mm long.

Observations.—Festuca azucarica is morphologically similar to *F. pilar-franceii*, a species endemic to the Colombian Cordillera Oriental. However, *F. azucarica* differs by having short catophylls 0.5–1.5 cm long (versus 2–5 cm in *F. pilar-franceii*) and longer lemmas (5.5–)6–7.5 mm long (versus 4.5–6 mm). *Festuca dasyantha*, *F. colombiana*, *F. laegaardii*, and *F. toca* are all species in *F.* sect. *Cataphyllophorae* that are characterized by the presence of cataphylls.

Distribution and habitat.—Festuca azucarica is endemic to the Colombian Cordillera Central (Caldas, Quindio, Risaralda, Tolima, and Valle de Cauca). It is one of the dominant species of the matorral zone and grass paramo and occurs between 3500–4000 m. This species is found in many different plant communities that contain *Calamagrostis recta* (Kunth) Trin. ex Steud., *Festuca* aff. *sublimis* & *Diplostephium rupestre* (Kunth) Wedd. (Cuatrecasas1934), *Espeletietum hartwegianae-Calamagrostiosum effusum* (Cuatrecasas 1934), *Festuco dolichophyllae-Calamagrostietum effusae* (Salamanca-V. 1991) and *Espeletia hartwegiana* subsp. *centroandina* Cuatrec. and *Calamagrostis recta* (Cleef et al. 1983).

Additional specimens examined. **COLOMBIA. Caldas:** Mun. Manizales, Parque Nacional Los Nevados, way from Casa del Cisne to Río Nereidas, km 5, 3800–4000 m, 18 Sep 1999, *D. Stančík 3404, 3405* (COL, PRC); Nevado El Ruiz Líbano, 4000 m, 21 Jul 1958, *Barclay 6431* (COL, US); 4500 m, Aug 1984, *Yepes-Agredo 760* (COL); 3400–3500 m, 17 Dec 1917, *Pennell 3003*

(US); Nevado de Santa Isabel, Quebrada de León, 3800 m, 24 Nov 1946, *J. Cuatrecasas 23137* (U, US, VALLE); Cabeceras del Río Otún, Laguna Taburetes, 3580 m, 24 Nov 1946, *J. Cuatrecasas 23178* (US, VALLE); Nevado del Ruiz, 8 Oct 1983, *Wood 4033* (AAU, K); Parque Nacional Los Nevados, 5 May 1940, *J. Cuatrecasas 9292* (COL). **Quindío:** Mun. Salento, vereda Cocora, below Nevado del Quindio, 22 May 1989, *J. Luteyn et al. 13051* (COL); Pijao, Páramo de Chilí, 3600 m, 17 Sep 1998, *Correa et al. 129* (COL); Mun. Salento, Páramo de Romerales, 3680 m, 30 Oct 1994, *Vélez et al. 4514* (HUQ). **Risaralda:** Mun. Pereira, Parque Nacional Los Nevados, below Nevado Santa Isabel, crossroads to Villa María, Casa del Cisne and Hda. Potosí, 4000–4100 m, 20 Sep 1999, *D. Stančík 3375*, *3376, 3377* (COL, PRC); Mun. Pereira, Parque Nacional Los Nevados, 3510 m, 27 Jul 1958, *Jaramillo-Mejía & Cleef 5738* (COL); Exped. Botan. Novae-Granatae, sin. loc., *Mutis 5545, 5555* (MA, US). **Tolima:** Mun. Santa Isabel, Quebrada Africa, 3900 m, 19 Feb 1980, *Jaramillo-Mejía et al. 6181* (COL); 3800 m, 10 Feb 1980, *Díaz-Piedrahita & Rangel 2037* (COL); Los Valles, finca La Cascada, cabeceras del Río Anaime, 4000 m, 10 Feb 1980, *Echeverry 1973* (COL, TOLI); Mun. Ibague, Nevado del Tolima, around La Cueva, 04°39´N, 75°19.5´W, grass paramo, 3900 m, 7–8 Jun 2000, *D. Stančík 3599* (COL, PRC).

23. Festuca chitagana Stančík, Darwiniana 41(1–4): 130, f. 12g–k. 2003. (**Figs. 27, 30**). Type: Colombia. Santander, Mun. Cerrito, páramo del Almorzadero, km 15 on the road from Cerrito to Chitaga, 3700 m, 25 Feb 1999, *D. Stančík & Medina 2577* (holotype: PRC!; isotypes: COL!, FMB!).

Rhizomatous perennials forming small tussocks with intra- and extravaginal innovations. Culms 60–80 cm tall, erect, glabrous; nodes 2–4 in distal half; cataphylls short, coriaceous, gray-brown; Leaf sheaths membranous to coriaceous, brownish-gray, glabrous, striate; auricles absent; ligules 0.5–1 mm long, membranous to coriaceous, apex truncate, ciliate; blades 15–20 cm long, 0.7–0.9 mm wide, involute, abaxially glabrous, olive-green, apex obtuse. Panicles 10–12 cm × 9–12 cm, triangular, flexuous, nutant, branches glabrous. Spikelets 6–9 mm long, lanceolate, florets 2 or 3; rachilla sparsely short-hairy; glumes 4–6.5 mm long, membranous, glabrous, apex acute; lower glumes 4–5 mm long, narrowly lanceolate, 1-nerved; upper glumes 5.5–6.5 mm long, oblong-lanceolate, 3-nerved; lemmas 6–7 mm long, 5-nerved, lanceolate, membranous to coriaceous, hairy, apex acute or short-awned, the awn 0.5–1 mm long; callus glabrous; paleas 4/5 as long as the lemma, lanceolate, membranous, densely hairy; lodicules 0.8–1 mm long, lanceolate; anthers 1–1.6 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 4/5 as long as the grain.

Leaf blade anatomy.—Cross-sections with 7–9 vascular bundles and 5–7 ribs above; sclerenchyma under abaxial epidermis discontinuous; adaxial sclerenchyma and girders absent; adaxial epidermis sparsely hairy, the hairs ca. 0.07 mm long.

Observations.—*Festuca chitagana* is morphologically similar to the Mesoamerican species *F. talamancensis* Davidse that is known only from Costa Rica. However, *F. talamancensis* has shorter lower glumes (3.5–3.8 mm versus 4–5 mm in *F. chitagana*), shorter upper glumes (5–5.3 mm versus 5.5–6.6), and an oblong caryopsis (versus lanceolate) with a hilum only 3/5 as long as the grain (versus 4/5).

Distribution and habitat.— This species is endemic to Colombia and is known only from the northern Cordillera Occidental (Páramo de Frontino) and Oriental (Páramo del Almorzadero, Sierra Nevada del Cocuy). It occurs in the grass paramo zone with shrubs mostly on stony substrates between 3400–4000 m.

Additional specimens examined. **COLOMBIA. Antioquia:** Mun. Urrao, Páramo de Frontino, Churumblum–La Mosca, 3400 m, 14 Nov 1984, *X. Londoño et al. 550* (COL, MEDEL). **Boyacá:** Mun. El Cocuy–Güicán, Parque Nacional El Cocuy, Las Cabañas Kanwara, way to Pico Ritacuba along river Playita, 4070 m, *D. Stančík & Carvajal 1866* (PRC).

24. Festuca colombiana E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 1546, f. 2, 7–8. 1984. (**Figs. 29, 31, 84E–F, 85A–B**). Type: Colombia. Cundinamarca, Páramo de Sumapaz, Chisaca, Laguna Negra, orilla sur, pedregal humedo con *Sphagnum* sp., 3800 m, 11 Dec 1971, *A.M. Cleef 181* (holotype: US-2785658!; isotypes: COL!, P!, U!, VEN!).

Short rhizomatous perennials forming small tussocks with intra- and extravaginal innovations. Culms 40–80(–120) cm tall, erect, finely scabrous; nodes 1 or 2(–3) in distal half; cataphylls small

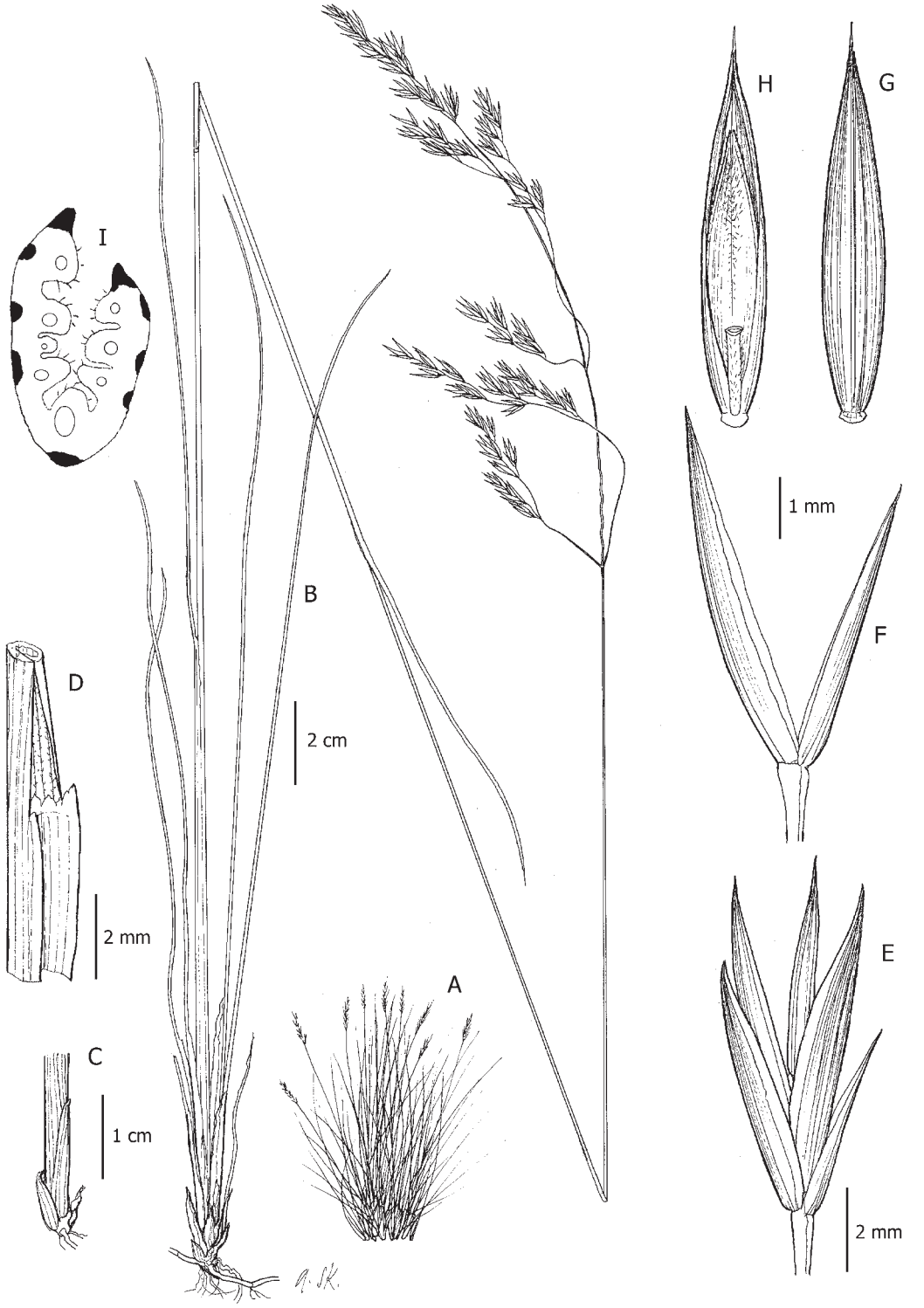


Figure 30. *Festuca chitagana.* **A.** Stylized growth form. **B.** Habit. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík & Carvajal 1866* (PRC).

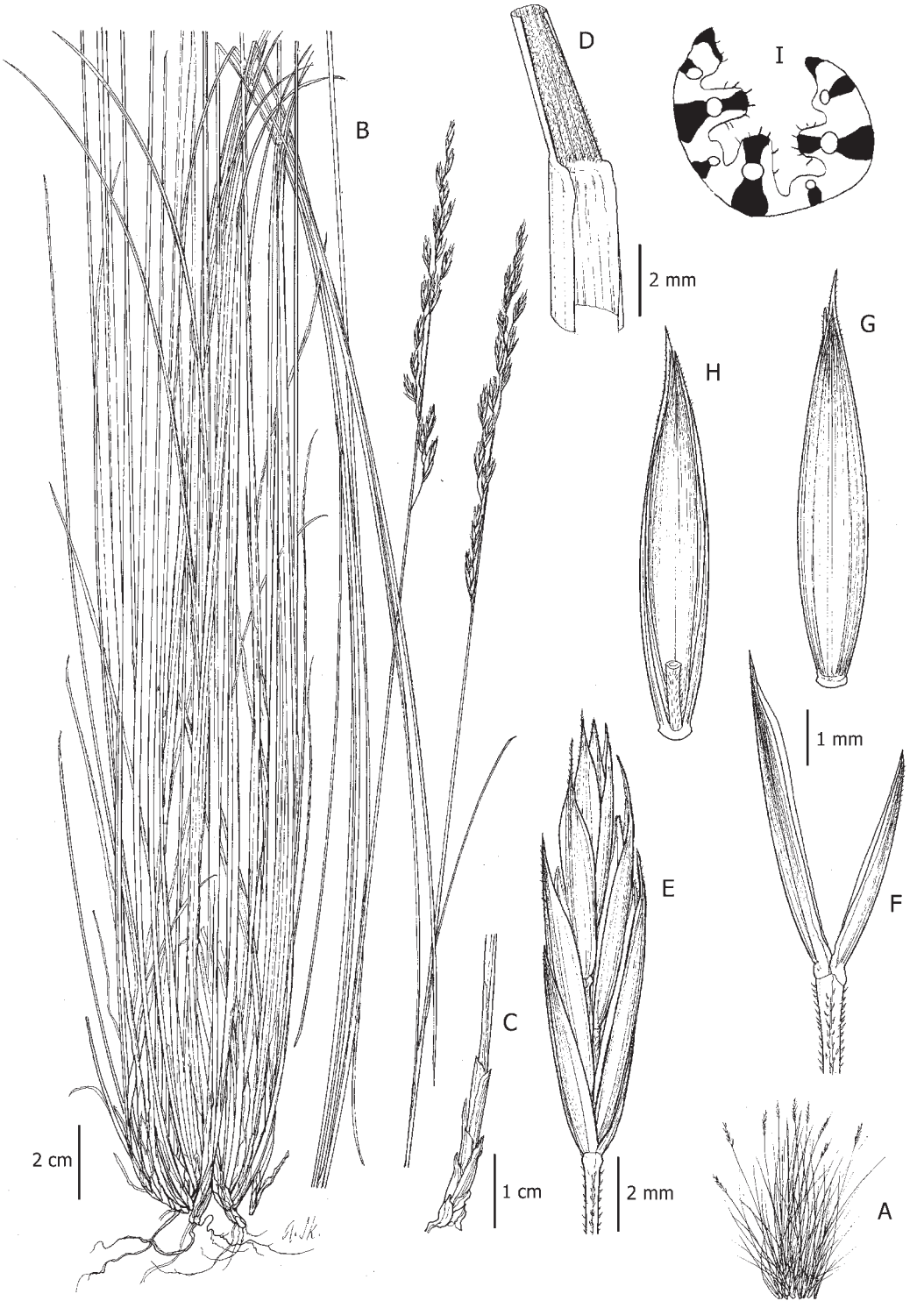


Figure 31. *Festuca colombiana.* **A.** Stylized growth form. **B.** Habit. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 1889* (AAU).

(about 1–2 cm long), coriaceous. Leaf sheaths membranous to coriaceous, glabrous, stramineous to grayish, margins free; auricles absent; ligules 0.1–0.3(–0.5) mm long, coriaceous, apex truncate, short-ciliate; blades (15–)20–30(–40) cm long, 0.4–0.6(–0.8) mm wide, conduplicate to involute, rigid, abaxially glabrous, green, apex acute. Panicles 10–20(–25) × 1–2 cm, contracted; branches densely short-villose. Spikelets 9–12 mm long, oblong-lanceolate, florets 4–6(–7); rachilla densely pilose; glumes 3–5.5(–6.5) mm long, lanceolate, coriaceous, purplish, upper 1/4 scabrous, apex acute; lower glumes 3–4(–4.5) mm long, 1-nerved; upper glumes 4.5–5.5(–6.5) mm long, 3-nerved; lemmas (5.5–)6–7(–7.5) mm long, 5-nerved, lanceolate, membranous to coriaceous, purplish, papillose, upper 1/3 sparsely scabrous, apex entire, mucronate or awned, the awn up to 2 mm long; paleas as long as the lemma, papillose, upper 1/3 hairy; lodicules ca. 1.1 mm long, lanceolate, acuminate; anthers 2–3.5 mm long; ovary apex glabrous. Caryopses oblong-lanceolate; hilum 2/3 as long as the grain.

Leaf blade anatomy.—Cross-sections with 7–9(–13) vascular bundles and 5–11 ribs; sclerenchyma under abaxial epidermis discontinuous, rarely continuous, extending to all the vascular bundles, adaxial sclerenchyma extending to every second vascular bundle; bulliform cells absent; adaxial epidermis densely hairy, the hairs 0.02–0.09 mm long.

Observations.—This species has a relatively large area of distribution and plants from different localities are morphologically variable. It is morphologically similar to *F. azucarica* and *F. pilar-franceii*, as mentioned previously.

Distribution and habitat.—Festuca colombiana is endemic to Colombia where it is known only from the Cordillera Oriental (Boyacá, Cundinamarca, Meta, Santander). It can be found growing in grass paramos between 3200–4000 m. This species is known from the following vegetation communities: *Espeletio argentae-Arcytophylletum nitidi* (Rangel & Ariza 2000), *Diplostephio phylicoidis-Espeletietum grandi-florae* (Rangel & Ariza 2000), *Calamagrostietum planifoli-effusae* (Vargas & Zuluaga 1985), *Espeletio argentae-Calamagrostiosum effusum* (Cuatrecasas 1934), and *Bartsio santolinifoliae-Calamagrostietum effusae* (Rangel & Ariza 2000).

Additional specimens examined. **COLOMBIA. Boyacá:** Mun. Arcabuco, Santuario Iguaque, Laguna Iguaque, 3450–3500 m, 15 Oct 1998, *D. Stančík 928* (COL, FMB, PRC); Mun. Saboyá, Páramo Saboyá, 3000 m, 24 Oct 1998, *D. Stančík 1065,1069* (CO, FMB, PRC); Mun. Aquitania, Páramo Sarna, 3400 m, 20 Jan 1999, *D. Stančík 1969* (COL, FMB, PRC); *D. Stančík 1978* (COL, PRC); 3100 m, 14 Jan 1999, *D. Stančík 1923* (COL, FMB, PRC); *D. Stančík 2003* (COL, PRC); Mun. Aquitania, Páramo Los Curies, 3500 m, 8 Feb 1999, *D. Stančík 2168, 2192* (COL, FMB, PRC); 3500 m, 8 Feb 1999, *D. Stančík 2174, 2218* (COL, FMB, PRC); Mun. Samaca, Páramo Rabonal, 200 m, 1 Nov 1998, *D. Stančík 1323, 1324, 1325* (COL, FMB, PRC); *D. Stančík 1297* (COL, PRC); vereda Ruchcal, 1 Nov 1998, *D. Stančík 1287, 1288, 1290, 1302, 1319, 1321* (COL, FMB, PRC); Mun. Aquitania, road Aquitania–Sisvaca, km 6, 2900 m, 10 Feb 1999, *D. Stančík 2256* (COL, FMB, PRC); 3100 m, 13 Jan 1999, *D. Stančík 1924* (COL, FMB, PRC, W); 3350 m, 14 Jan 1999, *D. Stančík 1921* (COL, FMB, PRC); Mun. El Cocuy, Parque Nacional Nevado del Cocuy, Las Cabañas Kanwara, 3950 m, 30 Dec 1998, *D. Stančík 1875* (COL, FMB, PRC); paramo on the road to Pico Ritcuba, km 2–3 from Cabañas, 4000 m, 30 Dec 1999, *D. Stančík & Carvajal 1811, 1848*, *1891* (COL, FMB, PRC); *D. Stančík & Carvajal 1874* (COL, PRC); El Cocuy–Güicán, Parque Nacional El Cocuy, sector Lagunillas, road from Casa Herrera to lagoons, km 3–4, 3950 m, 30 Dec 1998, *D. Stančík 1851, 1854* (COL, FMB, PRC); Hac. La Esperanza–Valle de los Frailejones, 3750 m, 30 Dec 1998, *D. Stančík & Carvajal 1783, 1787* (COL, FMB, PRC); Hac. La Esperanza, rocky slope in the front of house, fields and rest of the *Polylepis* forest, 3650 m, 30 Dec 1999, *D. Stančík 1842* (COL, FMB, PRC); Mun. Mongui, Laguna La Colorada, 3550 m, 21 Jan 1999, *D. Stančík 2025* (COL, FMB, PRC); Mun. Toca, Páramo Cortadero, 05º30´N, 73º15´W, 3300 m, 14 Nov 1998, *D. Stančík 1352, 1355, 1357, 1391, 1402* (COL, FMB, PRC); Mun. Paipa, cuchilla El Páramo, 3200 m, 3 Dec 1998, *D. Stančík 1512, 1516, 1530, 1531, 1546* (COL, FMB, PRC); NW of Duitama, Páramo de La Rusia, 3400 m, 2 Jul 1984, *Wood 4479* (COL, K). **Cundinamarca:** El Chico, Bogotá, Dec 1946, *Black 46-605* (NY); Mt. Guadalupe above Bogotá, bushy slope, 2800–3300 m, 9 Dec 1917, *Pennell 1923* (NY); Paramo de Guasca, entre Guasca y Gacheta, 3320 m, 1 Jun 1959, *Barclay & Juajibioy 6517* (MO); Páramo entre Cogua y San Cayetano, cercania de la Laguna Seca, 3700 m, 12 Nov 1972, *Cleef 6258* (COL, US); Chapinero near Bogotá, 3000–3100 m, 23 Sep 1917, *Pennell 2018* (MO, US); Páramo de Monserrate, 3300 m,

12 Sep 1987, *Sánchez 283* (COL); Parque Nacional Sumapaz, Laguna Chisacá, 3700–3800 m, 10 Feb 1961, *Pinto-Escobar & Hernández 523* (COL); 3706 m, *Pedraza et al. 491* (COL, PRC); Cuchilla La Rabona, 4020 m, 11 Feb 1972, *Cleef 1587* (COL, U); Mun. Usme, Laguna Negra, 3750 m, 20 Feb 1986, *Rangel & Aguirre 3720* (COL); Páramo de Chisacá, 3910 m, 11 Nov 1958, *Barclay & Juajíbioy 6109* (COL, MO, US); 3650–3700 m, 29 Oct 1959, *J. Cuatrecasas & Jaramillo-Mejía 25742* (COL); Laguna Negra, 3800 m, 11 Dec 1971, *Cleef 181* (COL, P, U, US); 3500 m, 16 Jul 1998, *D. Stančík 303* (COL, PRC); Mun. Guatavita, vereda Carbonel Alto, 3200 m, 30 Oct 1999, *D. Stančík 3500* (COL, PRC); Guadalupe, 3000 m, Jul 1913, *Apollinaire & Arthur 121* (US); Mun. Bogotá, Alto de la Viga, 3550 m, 1 Nov 1999, *D. Stančík 3538, 3540, 3542* (COL, PRC); Mun. Tausa, cuchilla Los Cuervos–Laguna Verde, 3650 m, *D. Stančík 3496* (COL, PRC); Mun. Choachí, Páramo de Cruz Verde, laguna Verjón, 3450 m, 19 Oct 1985, *Castellanos et al. 3* (BOG); 3720 m, Aug 1935, *García-Barriga 1016, 1019* (AAU, COL); Choachí, 2900 m, *Lindig 1013* (K, P); 2900–3200 m, Aug 1859, *Lindig 1053* (US); 3200 m, 18 Dec 1915, *Apollinaire & Arthur 9* (US); Páramo de Palácio, 2 km al lado de Mina, 3750 m, 29 Nov 1972, *Cleef & Urribe 6694* (COL, U, US); Páramo de Guasca, El Santuário, 3200 m, 26 Jan 1972, *J. Cuatrecasas 3550* (MA); Mun. San Juan de Sumapaz, road to Usme, km 5–7, 2950 m, 1 Nov 1998, *D. Stančík 1289* (COL, PRC); 15 Nov 1999, *D. Stančík 3544, 3545, 3546, 3560* (COL, PRC); Mun. Santa Rosa de Viterbo, Paramo Alto Lamadero, Laguna Sagrado Corazón, 3200 m, 30 Nov 1998, *D. Stančík 1436* (COL, FMB); Mun. Siachoque, páramo Siachoque, 5º28´51˝N, 73º12´44˝W, 23 Jan 1999, *D. Stančík 2073* (COL, PRC); Las Tronaderas, 3770 m, 24 Jan 1999, *D. Stančík 2063* (COL, PRC); vereda Carnichoque Arriba; 3400 m, 24 Jan 1999, *D. Stančík 2053* (COL, PRC); 23 Jan 1999, *D. Stančík 2052* (PRC, COL); 1998, *D. Stančík 2408* (COL, PRC); Vereda San Antonio, 3600 m, 16 Oct 1999, *D. Stančík 3491, 3492, 3493*, *3494* (COL, PRC); cuchilla El Muchacho, 3600 m, 16 Oct 1999, *D. Stančík 3480* (COL, FMB, PRC); Mun. Zipaquirá, páramo Guerrero, 3500 m, 16 Oct 1999, *D. Stančík 3481* (COL, FMB, PRC); Páramo de Chisacá, way to Chisacá, near Río Tunjuelito, 3750 m, 20 Sep 1966, *T.R. Soderstrom 1229* (COL, K, TULV); Paramo El Tablazo, frequent in recently burned paramo, 3200 m, 2 Apr 1983, *Wood 3612* (K). **Meta:** Macizo de Sumapaz, Hoya de la Quebrada Clarincito, Los Frailes, 3720 m, 2 Jul 1981, *Díaz-Piedrahita 2367* (COL). **Santander:** Mun. Cerrito, Páramo del Almorzadero, vereda Mortyño–La Cascada, 3400 m, 25 Feb 1999, *D. Stančík 2527, 2550*, *2562, 2563, 2564*, *2565* (COL, FMB, PRC); 25 Feb 1999, *D. Stančík 2560, 2561* (COL, PRC); Mun. Concepción, vereda Juradito, Páramo de Gallina, 3200 m, 24 Feb 1999, *D. Stančík 2487, 2507, 2508, 2511, 2512* (COL, FMB, PRC); Vicinity of Vetas, rocky hillside, 3100–3250 m, 20 Jan 1927, *Killip 17329* (US); Exped. Botan. Novae-Granatae, sin. loc., *Mutis 5570* (MA).

25. Festuca dasyantha Kunth, Nov. Gen. Sp. (quarto ed.) 1: 154–155. 1816. (**Figs. 29, 32, 85C & D**). Type: Ecuador. Cotopaxi, in Montis Cotopaxi, 4090 m, *Humboldt & Bonpland s.n.* (holotype: P!; isotypes: B!, BAA-1187 fragm. ex B!, B-W-2071!, US-2875395 fragm!, W!).

Tufted perennials with short rhizomes and intravaginal innovations. Culms 40–100 cm tall, erect, glabrous; nodes 2 or 3(–4) in basal half; cataphylls 1–4 cm long, coriaceous, dark brown, striate. Leaf sheaths membranous to coriaceous, brown, striate, glabrous or scabrous; ligules 0.3–0.5 mm long, membranous to coriaceous, margins ciliate, apex truncate; blades 15–35 cm long, 0.7–1.4(–2.2) mm wide, mostly conduplicate, green, abaxially glabrous. Panicles 15–30 × 1–3 cm, narrow, erect, branches glabrous or sparsely scabrous. Spikelets 10–11 mm long, florets 4 or 5; rachilla densely pilose; glumes 3–5 mm long, lanceolate, membranous to coriaceous, green, distal 1/3 often densely hirsute, apex acute; lower glumes 3–3.5 mm long, 1-nerved; upper glumes 4.5–5 mm long, prominently 3-nerved; lemmas 5.5–6 mm long, lanceolate, 5-nerved, membranous, green, densely hairy, apex entire, acute or short-awned, the awn, up to 1 mm long; paleas as long as the lemma, glabrous, upper 1/3 hirsute; lodicules lanceolate, acuminate; anthers 2.3–3.3 mm long; ovary apex glabrous. Caryopses not seen.

Leaf blade anatomy.—Cross-sections with 9–17 vascular bundles; sclerenchyma discontinuous under both abaxial and adaxial epidermis, extending to every other or nearly all vascular bundles forming girders; bulliform cells not observed; adaxial epidermis densely hairy, the hairs 0.7–1.3 mm long.

Observations.—Festuca dasyantha differs from all other species in *F.* sect. *Cataphyllophorae*,

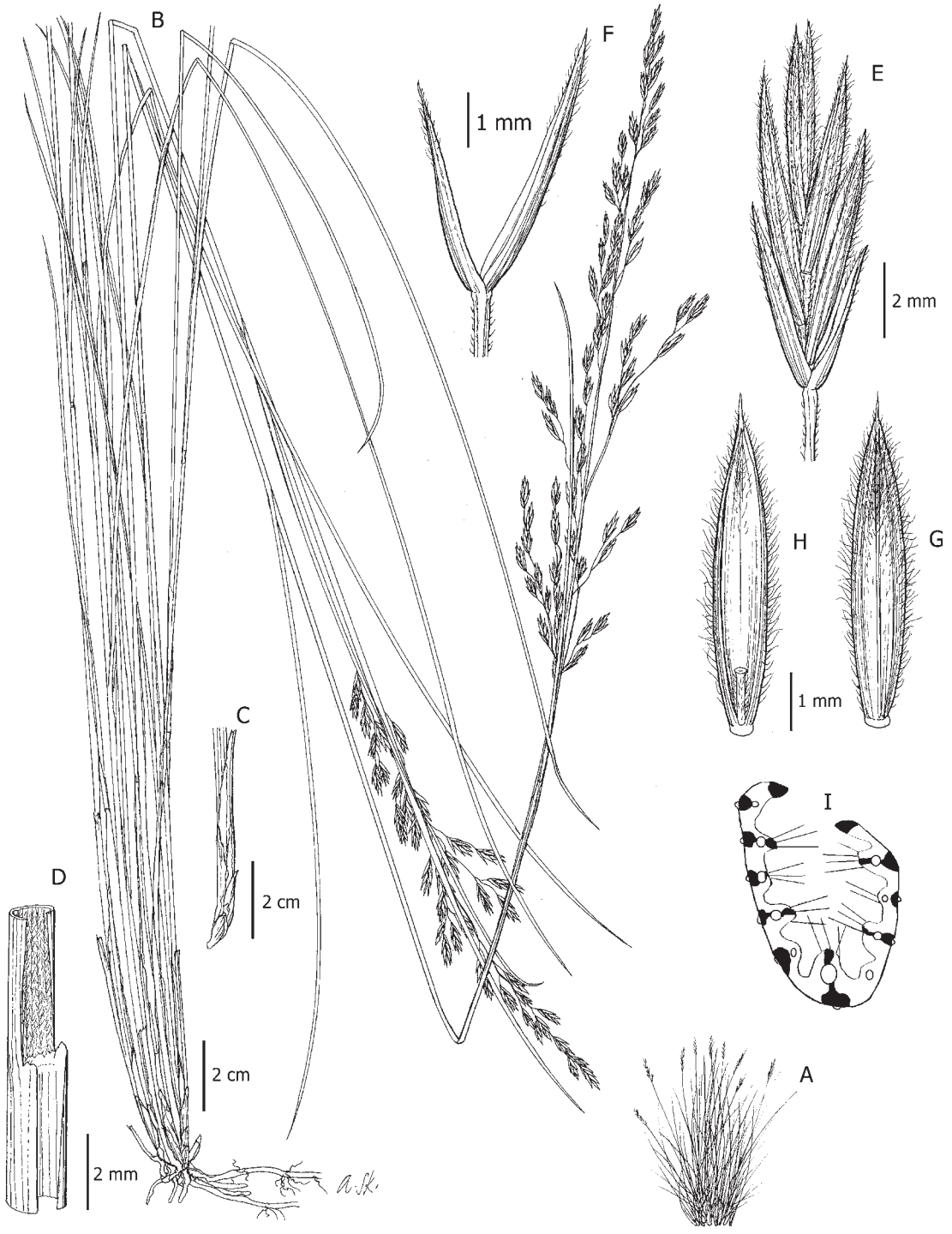


Figure 32. *Festuca dasyantha.* **A.** Stylized growth form. **B.** Habit. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–H, *Laegaard 101260* (AAU); I, *Mille 664* (QPLS).

such as *F. procera*, *F. colombiana*, and *F. laegaardii*, by having glumes and lemmas bearing long hairs.

Distribution and habitat.—Festuca dasyantha is endemic to central Ecuador (Carchi, Imbabura, Pichincha). It occurs in grass paramos between 2800–3000 m.

Additional specimens examined. **ECUADOR. Carchi:** Road el Angel–Mira, km 3, 00°37′N, 77°58′W, 2950 m, *S. Laegaard 101260* (AAU, QCA). **Imbabura:** Entre Yuquín y Cebadal, Sigsipamva, 2800 m, *Acosta-Solís 18729* (US). **Pichincha:** Pifo, pascuis andinis et subandinis, 3000 m, *Mille 664* (QPLS); 2700 m, *Mille 659* (QPLS); between Pifo and Los Coralles, 2800 m, *E. Asplund 6978* (K, NY, S, US); Quito–Panecillo, *Sodiro s.n.* (MO, NY, QPLS, US).

Note.—Specimen *Mutis 5554* (US ex MA) comes from Ecuadorian collection of F.J. Caldas and dating to the period of Mutis's stay in Colombia.

26. Festuca hatico Stančík, Darwiniana 41(1–4): 119, f. 12l-p. 2003. (**Figs. 27, 33, 86A & B**). Type: Colombia. Norte de Santander, Mun. Chilos, Vereda Hatico on road Bucaramanga–Pamplona, 3500–3700 m, 1 Dec 2000, *D. Stančík 4290* (holotype: PRC; isotype: COL).

Tussocked perennials with rhizomes and intra- and extravaginal innovations. Culms 60–70 cm tall, erect, glabrous; nodes 2 or 3 in distal half; cataphylls coriaceous, gray-brown, striate. Leaf sheaths coriaceous, brownish-stramineous, glabrous, striate; auricles absent; ligules 0.3–0.5 mm long, membranous to coriaceous, bilobed; blades 30–40 cm long, 0.7–0.9 mm wide, conduplicate to involute, abaxially glabrous, green, apex obtuse. Panicles 10–20 × 0.5–1 cm, contracted, narrow; branches finely scabrous. Spikelets ca. 9 mm long, lanceolate, florets 3 or 4; rachilla short, papillose; glumes 3.2–5 mm long, coriaceous, glabrous, apex acute; lower glumes 3–3.6 mm long, narrowly lanceolate, 1-nerved; upper glumes 4.5–5 mm long, lanceolate, 3-nerved; lemmas 6–6.5 mm long, 5-nerved, membranous to coriaceous, oblong-lanceolate, papillose, apex scabrous and two-dentate, awned, the awn 0.3–0.7 mm long; callus glabrous; paleas 4/5 as long as the lemma, lanceolate, membranous, papillose, upper 1/2 hairy; lodicules ca. 1.7 mm long, triangular; anthers ca. 3.5 mm long; ovary apex glabrous. Caryopses not seen.

Leaf blade anatomy.—Cross-sections usually with 9 vascular bundles and 7 ribs above; sclerenchyma under abaxial and adaxial epidermis discontinuous, extending to some vascular bundles forming girders; adaxial epidermis hairy, the hairs, 0.4–0.9 mm long, often numerous.

Observations.—Festuca hatico is morphologically similar to *Festuca colombiana*. However, the latter species has wider panicles (1–2 cm versus 0.5–1 cm), spikelets with 4–7 florets (versus 3 or 4), pilose rachillas (versus papillose), and paleas as long as the lemmas (versus 4/5 as long).

Distribution and habitat.—Festuca hatico is endemic to the northeastern Andes and is known from Colombian Cordillera Oriental (Norte de Santander, Santander) and Venezuela (Lara). It can be found growing in shrubby patches of the paramo zone between 3100–3900 m.

Additional specimens examined. **COLOMBIA. Norte de Santander:** Mun. Chilos, Vereda Hatico on road Bucaramanga–Pamplona, 3500–3700 m, 1 Dec 2000, *D. Stančík 4290* (COL, PRC). **Santander:** East slope of Páramo de las Coloradas, above La Baja, 3900 m, 27 Jan 1927, *Killip 18479* (US). **VENEZUELA. Lara:** Mun. Humocaro Alto, Parque Nacional Dinira, 9°35′39″N, 70°07′12″W, 3170 m, *D. Stančík 4289* (CAR, COL, PRC).

27. Festuca laegaardii Stančík, Folia Geobot. Phytotax. 39(1): 107, f. 4, 6–10. 2004. (**Figs. 29, 34, 86C−F**). Type: Ecuador. Tungurahua/Napo, Mun. Pillaro, Las Llanganatis, 01º09′37.5″S, 78º14′50.8″W, Valle de los Frailejones, margins of the swamp dominated by *Carex* sp. and dryer shrub formation, 3500 m, 28 Sep 2000, *D. Stančík 3983* (holotype: PRC!; isotypes: AAU!, QCA!).

Rhizomatous and loosely caespitose perennials with extravaginal innovations. Culms (15–)30–100 cm tall, erect, glabrous; nodes 2 or 3(–5) in distal half; cataphylls present, short, membranous, brown, striate. Leaf sheaths membranous, purplish-brown, striate, hairy; ligules 1–1.5(–2) mm long, membranous to coriaceous, apex truncate, ciliate; blades 20–25 × 0.5–1.1 cm, conduplicate, abaxially glabrous, rarely hairy. Panicles (5–)10–15(–18) × 1–2 (–11) cm, compressed, rarely flexuous, branched; branches densely hairy. Spikelets (7.5–) 8–10(–12) mm long, florets (3–)4 or 5(–6); rachilla sparsely pilose; glumes 2.8–5.5(–6) mm long, coriaceous, narrowly lanceolate, purple, upper 1/3 densely hairy, apex acute; lower glumes 2.8–3.7 (–4) mm long, 1-nerved; upper glumes 4.5–5.5

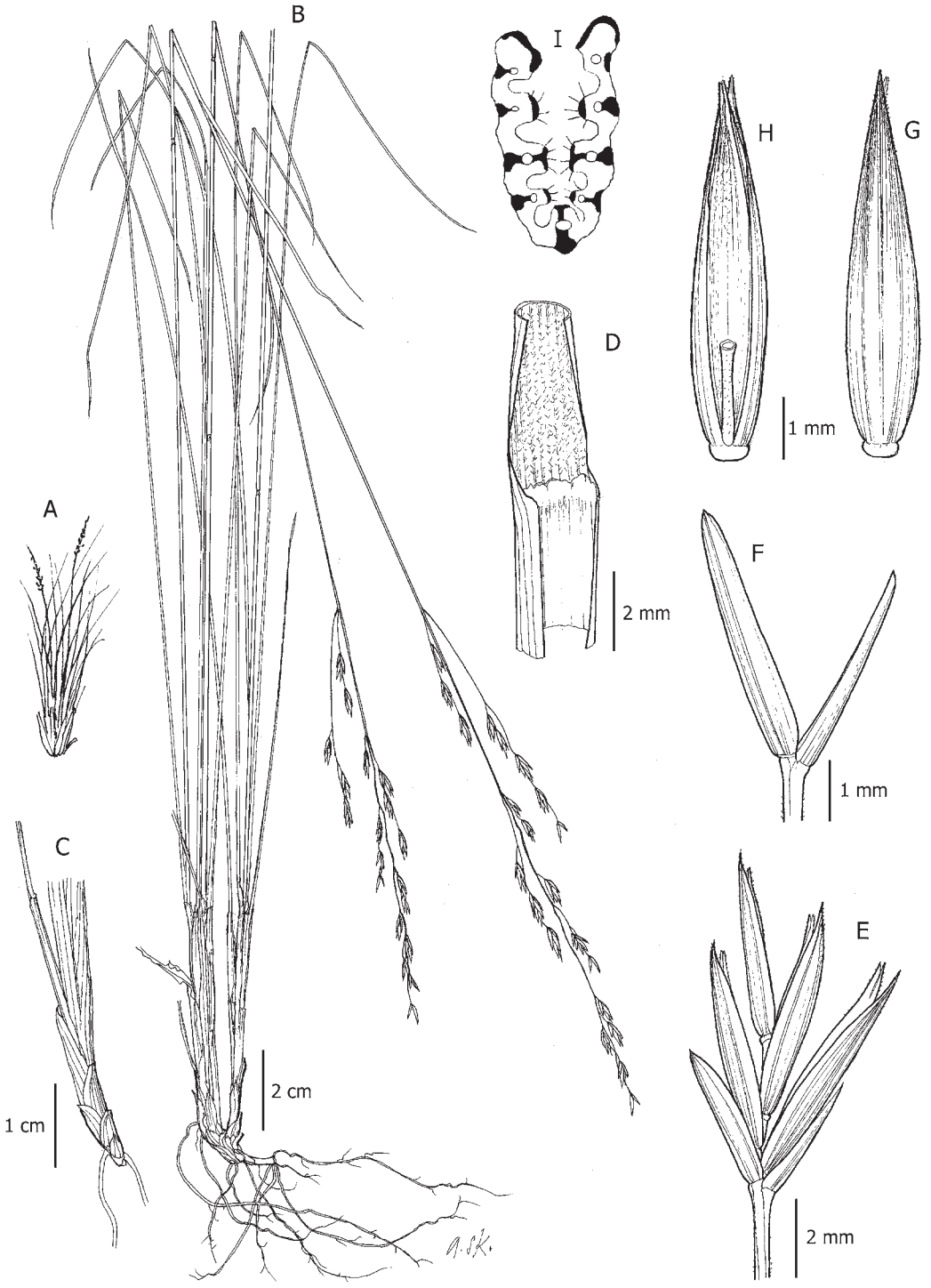


Figure 33. *Festuca hatico.* **A.** Stylized growth form. **B.** Habit. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 4290* (PRC).

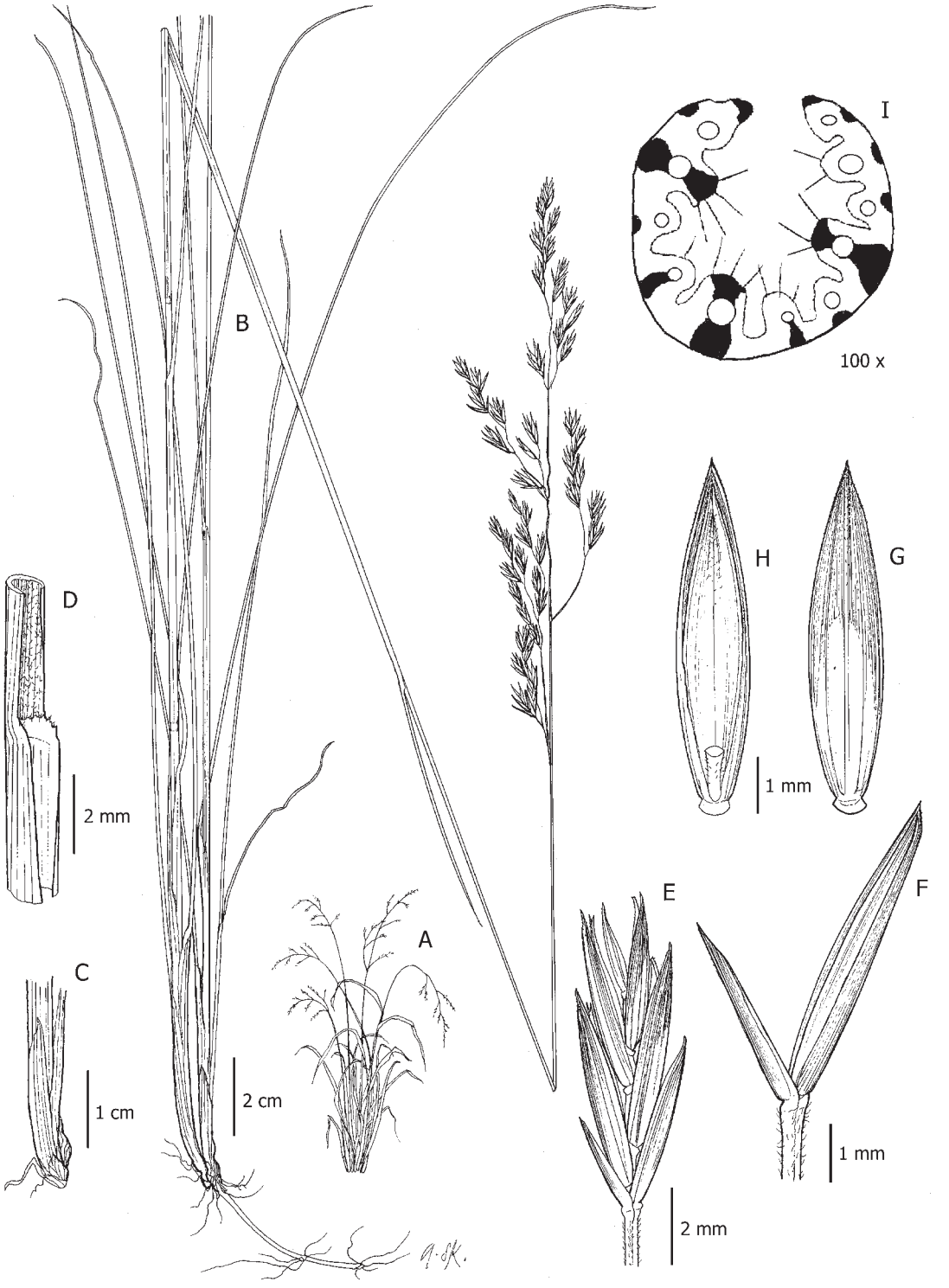


Figure 34. *Festuca laegaardii.* **A.** Stylized growth form. **B.** Habit. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 3983* (PRC).

(–6) mm long, 3-nerved; lemmas 5.5–6.5 mm long, 5-nerved, lanceolate, membranous to coriaceous, green-purple, apex acute, entire, upper 1/3 hairy; paleas almost as long as the lemma, glabrous or inconspicuously scabrous, apex hairy; lodicules obovate; anthers 2.4–2.8(–3) mm long; ovary apex glabrous. Caryopses not observed.

Leaf blade anatomy.—Cross-sections with 7–11 vascular bundles and 3–7 ribs above; sclerenchyma under both abaxial and adaxial epidermis discontinuous, extending to some vascular bundles forming girders; bulliform cells not observed; adaxial epidermis usually with scattered hairs, the hairs 0.45–0.7 mm long.

Observations.—Festuca laegaardii is morphologically similar to *Festuca dasyantha*. However, the latter species has densely hairy adaxial epidermis(versus scattered hairs in *F. laegaardii*), lemmas densely hairy throughout (versus only short hairy on the upper third), shorter ligules (0.3–0.5 mm long), and glabrous panicle branches.

Distribution and habitat.— Festuca laegaardii is endemic to Ecuador and is known only from Azuay, Cañar, Carchi, and Napo. This species occurs in humid and swampy patches in grass paramos between 2900–3400 m.

Additional specimens examined. **ECUADOR. Azuay:** Road Gualaceo–San Juan Bosco, ca. 3 km from pass, 03°00´S, 78°39´W, 3250–3350 m, *S. Laegaard 53965* (AAU, QCA); Road Cuenca – Saraguro, km 68, 03°20´S, 78°10´W, 3350 m, *S. Laegaard 53597* (AAU, QCA). **Cañar:** Road Biblián–Cañar, 3400 m, *Harling et al. 8635* (GB). **Carchi:** Alor–Hda. San Rafael, 2900–3000 m, *Acosta-Solís 21031* (US). **Morona-Santiago:** Parque Nacional Sangay, Plaza Culebrillas, 01°58´S, 78°25´W, forest grassy patches, 3500–3700 m, *D. Stančík 3365* (PRC, QCA). **Napo:** Laguna San Marcos NE of Volcán Cayambe, 00°07´N, 77°58´W, 3370 m, *B. Øllgaard et al. 34039* (AAU, PRC); Papallacta–NE de la laguna principal, 3400 m, *Jaramillo et al. 11855* (QCA); *Jaramillo et al. 11856* (MO, QCA).

28. Festuca pilar-franceii Stančík, Darwiniana 41(1–4): 121, f. 14a–e. 2003. (**Figs. 35, 37, 87A & B**). Type: Colombia, Cundinamarca, Mun. Bogotá D.C., sector Santa Rosa–Laguna Chisacá, 3500–3650 m, 7 Aug 1998, *D. Stančík 3585* (holotype: PRC!; isotype: COL!).

Densely tussocked perennials with intravaginal innovations. Culms 70–100(–120) cm tall, erect, glabrous; nodes 1 or 2 in distal half; cataphylls 2–5 cm long, membranous to coriaceous. Leaf sheaths membranous to coriaceous, brown-straminеous, glabrous; auricles absent; ligules 0.1–0.3 mm long, coriaceous, apex truncate; blades 30–60 cm long, 0.7–1.1 mm in diameter, conduplicate to involute, abaxially glabrous, green, apex obtuse. Panicles (12–)15–20(–25) × 1–7 cm, oblong-lanceolate, branched, flexuous, erect; branches glabrous or finely scabrous. Spikelets (8–)9–11 mm long, lanceolate, florets 4–6(–7); rachilla densely pilose; glumes 2–5 mm long, narrow lanceolate, coriaceous, glabrous, purple or purplish-green, apex acute; lower glumes 2–3(–3.5) mm long, 1-nerved; upper glumes 3–5 mm long, 3-nerved; lemmas 4.5–6 mm, lanceolate, 5-nerved, membranous to coriaceous, purplish-green, scabrous or hairy, apex mucronate or short-awned, the awn < 1 mm long; paleas as long as the lemma, papillose, upper 1/3 hairy; lodicules lanceolate, acuminate; anthers 2.5–3.5 mm long; ovary apex sparsely hairy. Caryopses not seen.

Leaf blade anatomy.—Cross-sections with 11–15 vascular bundles and 9–13 ribs; sclerenchyma under abaxial epidermis continuous, extending to all the vascular bundles forming girders; bulliform cells absent; adaxial epidermis densely hairy, the hairs 0.8–1.2 mm long.

Observations.—Festuca pilar-franceii is morphologically similar to *F. azucarica*, a species from the Cordillera Central. In the Cordillera Oriental, *F. cleefiana* is another species that is morphologically similar to *F. pilar-franceii*. However, *F. cleefiana* lacks cataphylls, has longer ligules [(0.5–)1–2(–2.5) mm], and has longer lemmas (6–8 mm).

Distribution and habitat.—This species is endemic to the Colombian Cordillera Oriental (Macizo de Bogotá, Páramo de Sumapaz). It occurs in the swampy patches and margins of lagoons in grass paramos between 3600–4000 m. *Festuca pilar-franceii* is associated with two communities: *Baccharis revoluta* & *Cortaderia cf. nitida* (Sturm & Rangel 1985) and *Chusquea tesellata, Espeletia grandiflora, and Calamagrostis effusa* (Sturm & Rangel 1985).

Additional specimens examined. **COLOMBIA. Cundinamarca:** Cabrera, Páramo de Cruz Verde, 3720 m, VIII 1935, *García-Barriga 1018* (COL); Sumapaz, a 2 km de la división de carretera a San Juan, 3960 m, 3 Oct 1978, *Rangel 1650* (COL); km 51–60 vía San Juan, 10 Feb 1986, *Torres-Romero & Lozano 2982* (COL); Laguna

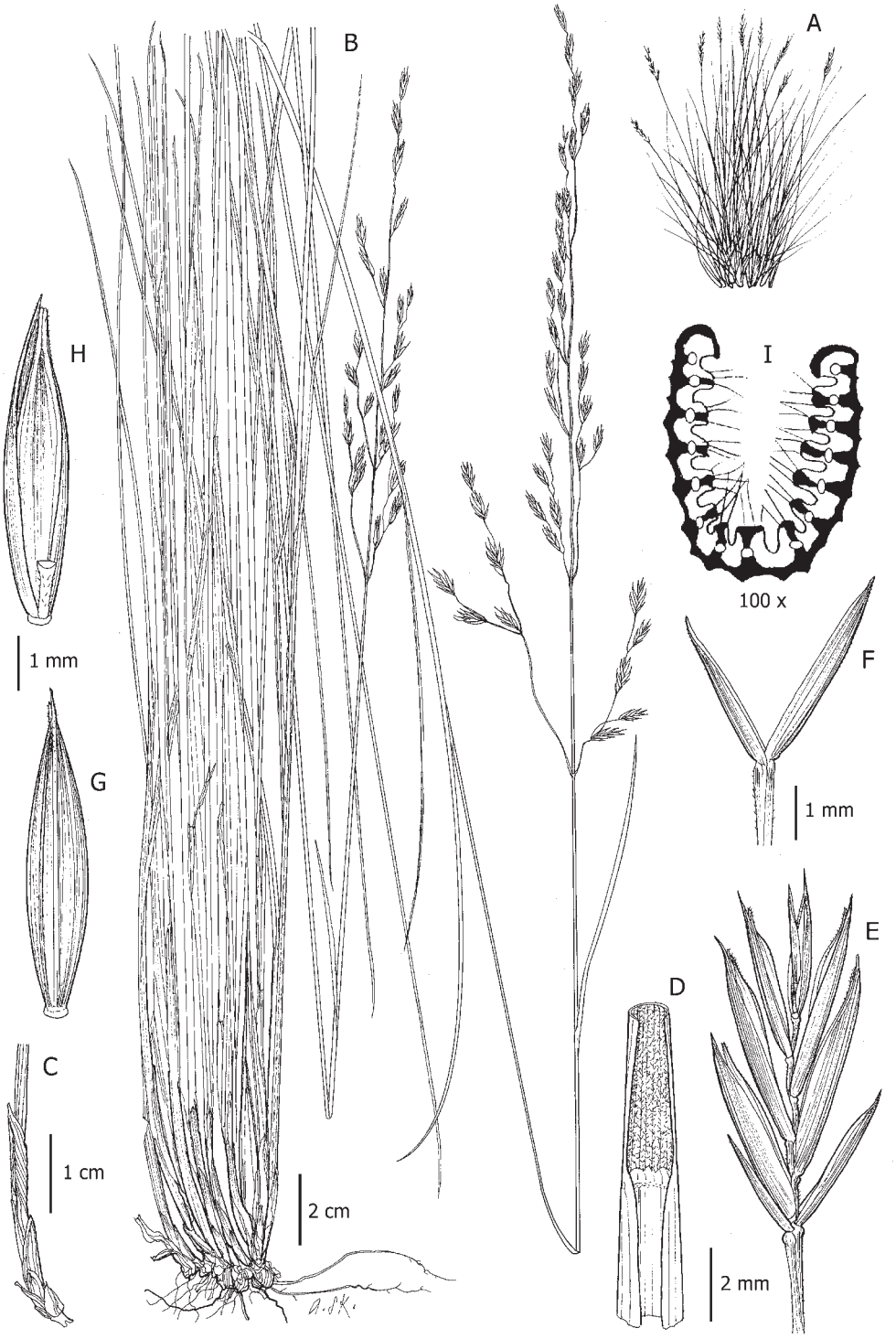


Figure 35. *Festuca pilar-franceii.* **A.** Stylized growth form. **B.** Habit. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 315* (PRC).

Chisacá, 3625m, 25 Aug 1972, *Cleef 5259* (COL, U, US); Páramo Chisacá, 3750–3960 m, Oct 1966, *T.R. Soderstrom 1307* (US, TULV); near headwater of Río San Juan, 18 km E of Cabrera, 4°5′N, 74°12′W, 4000 m, 11 Aug 1943, *R. Fosberg 20745* (US); Macizo de Bogotá, Laguna Negra, 3720 m, 11 Sep 1961, *J. Cuatrecasas & Jaramillo-Mejía 25865* (COL, US); 3600–3700 m, III 1973, *Cleef 3605* (COL, P, U); 16 Jul 1998, *D. Stančík 210, 217, 218, 224, 225, 226, 231, 241, 248, 250, 256, 257, 258, 264, 265, 267, 268, 270, 277, 278, 302, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321* (COL, PRC); 9 Aug 1999, *D. Stančík 3559, 3562, 3563, 3564, 3565, 3569, 3568, 3579, 3580, 3583, 3584, 3586, 3587, 3589, 3590* (COL, PRC); Mun. Bogotá, Laguna Chisacá, 9 Aug 1999, *D. Stančík 3566, 3567, 3570, 3572, 3573, 3574, 3575, 3576, 3577, 3578, 3581, 3582, 3585, 3588* (COL, PRC); 6 Jan 1997, *D. Stančík 491* (COL, PRC); 15 Nov 1999, *D. Stančík 3559* (COL, PRC, US); 7 Aug 1998, *D. Stančík 228* (COL, PRC); *D. Stančík 3494* (COL, PRC); *D. Stančík 3561* (COL, PRC); Parque Nacional, Sumapaz, vereda Santa Rosa, ladera de la quebrada Bijuacales, localidad 20, 3500 m, 07 Aug 1998, *Pedraza et al. 228*, *242, 278 (*COL, PRC); Páramo de Sumapaz, between St. Rita and San Juan, 3600 m, 15 Jul 1984, *Wood 4539* (K, US). **Meta:** Páramo Sumapaz, Hoya de Quebrada Sitiáles, 0.5 km al SW de Laguna La Primavera, 3550 m, 26 Jan 1972, *Cleef 1048* (COL, U); Cerro Nevado de Sumapaz, 3615m, 29 Jan 1972, *Cleef 1272* (COL); lado SW, 3590 m, 12 Jan 1973, *Cleef 7704* (COL).

29. Festuca procera Kunth, Nov. Gen. Sp. (quarto ed.) 1: 154. 1816. (**Figs. 36, 37, 87C−F**). *Diplachne procera* (Kunth) Spreng., Syst. Veg. 1: 351. 1825. *Festuca orgyalis* Willd. ex Spreng., Syst. Veg. 1: 351. 1825, *nom. inval. Festuca scabra* Willd. ex Steud., Nomencl. Bot. (ed. 2) 1: 632. 1840, *nom. inval. Festuca procera* Nees & Meyen, Nov. Actorum Acad. Caes. Leop.-Carol. German. Nat. Cur. 19(1): 166–167. 1843, *nom. illeg. hom. Festuca orgyalis* Willd. ex E. Fourn., Biol. Cent.-Amer., Bot. 3: 582. 1885, *nom. illeg. superfl.* Type: Ecuador. Pichincha, Crescit locis alsis, subfrigidis regni Quitensos prope Chillo, San Antonio de Lulumbamba et Lloa, inter alt. 1280–1470 hexap., floret Aprili, Majo, *Humboldt & Bonpland s.n.* (lectotype: B!, designated by Alexeev, Novosti Sist. Vyss. Rast. 23: 12. 1986; isolectotype: P!).

Festuca peruviana E.B. Alexeev, Bjull. Moskovsk. Obšč. Isp. Prir., Otd. Biol. 89(4): 114. 1984, *hom. illeg.* Type: Peru. Tabina, Jul 1854, *Lechler 2114* (holotype: LE!; isotype: S).

Festuca sublimis Pilg., Bot. Jahrb. Syst. 25(5): 718. 1898. Type: Ecuador. Azuay, Pucara de Chisaló, 1 Feb 1874, *A. Stübel 297* (holotype: B!; isotypes: BAA-1341 fragm. ex B!, US-81580 ex B!).

Tussocked perennials with intra- and extravaginal innovations. Culms 80–170 cm tall, erect, glabrous; nodes 1; cataphylls 1–4 cm long, membranous to coriaceous, grayish-brown, striate. Leaf sheaths membranous to coriaceous, brownish-gray, glabrous or with short hairs; ligules 0.3–0.7 mm long, coriaceous, margins ciliate, apex truncate; blades 30–50 cm long, 0.8–1.6 mm wide, conduplicate, abaxially glabrous or sometimes scabrous, green, apex obtuse. Panicles 15–25 × 3–15(–20) cm, oblong to ovate, lax, densely flowered; branches glabrous or rarely sparingly scabrous. Spikelets 11–15 mm long, oblong-lanceolate, florets (4–)6 or 7; rachilla densely hairy; glumes (2–)3–5.5 mm long, membranous, glabrous below, upper 1/3 hairy, purplish-green, apex acute; lower glumes (2–)3–3.5 mm long, lanceolate, 1-nerved; upper glumes (4–)4.5–5.5 mm long, oblong, 3-nerved; lemmas (6–)6.5–8 mm long, lanceolate, 5-nerved, membranous to coriaceous, purplish-green, papillose, upper 1/3 scabrous, apex mucronate or short-awned, the awn 0.3–0.8 mm long; callus glabrous sometimes sparsely hairy; paleas as long as the lemma, lanceolate, membranous, hairy along upper 1/4 and keels, apex with longer hairs; lodicules ca. 1 mm long, obovate; anthers 2.8–3.5 mm long; ovary apex glabrous or with sparse hairs. Caryopses not observed.

Leaf blade anatomy.—Cross-sections with (11–)15–21 vascular bundles and (5–)7–11 ribs above; sclerenchyma under abaxial epidermis continuous or discontinuous extending to all vascular bundle; adaxial epidermis discontinuous, extending to every second vascular bundle; adaxial epidermis with dense covering of curly to straight hairs, the hairs 0.15–0.2 mm long.

Observations.—Festuca procera differs from other species of *F.* sect. *Cataphyllophorae* by forming large tussocks with tall culms (80–170 versus 60–80 cm tall in other members), long, densely flowered panicles, and long spikelets [(9–)11–13 (–15) versus 6–11(–12) mm in other members]. This

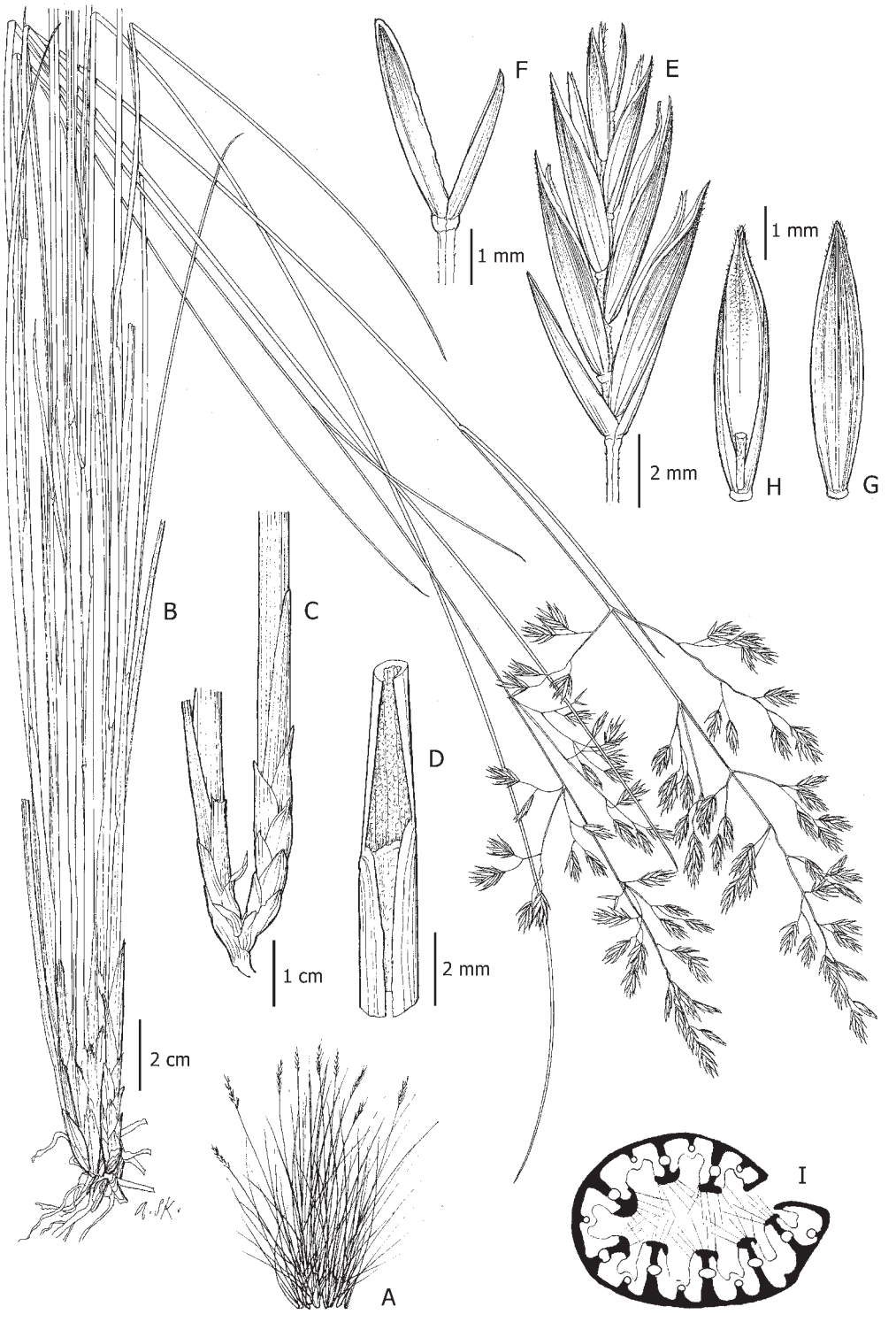


Figure 36. *Festuca procera.* **A.** Stylized growth form. **B.** Habit. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 3313* (PRC).

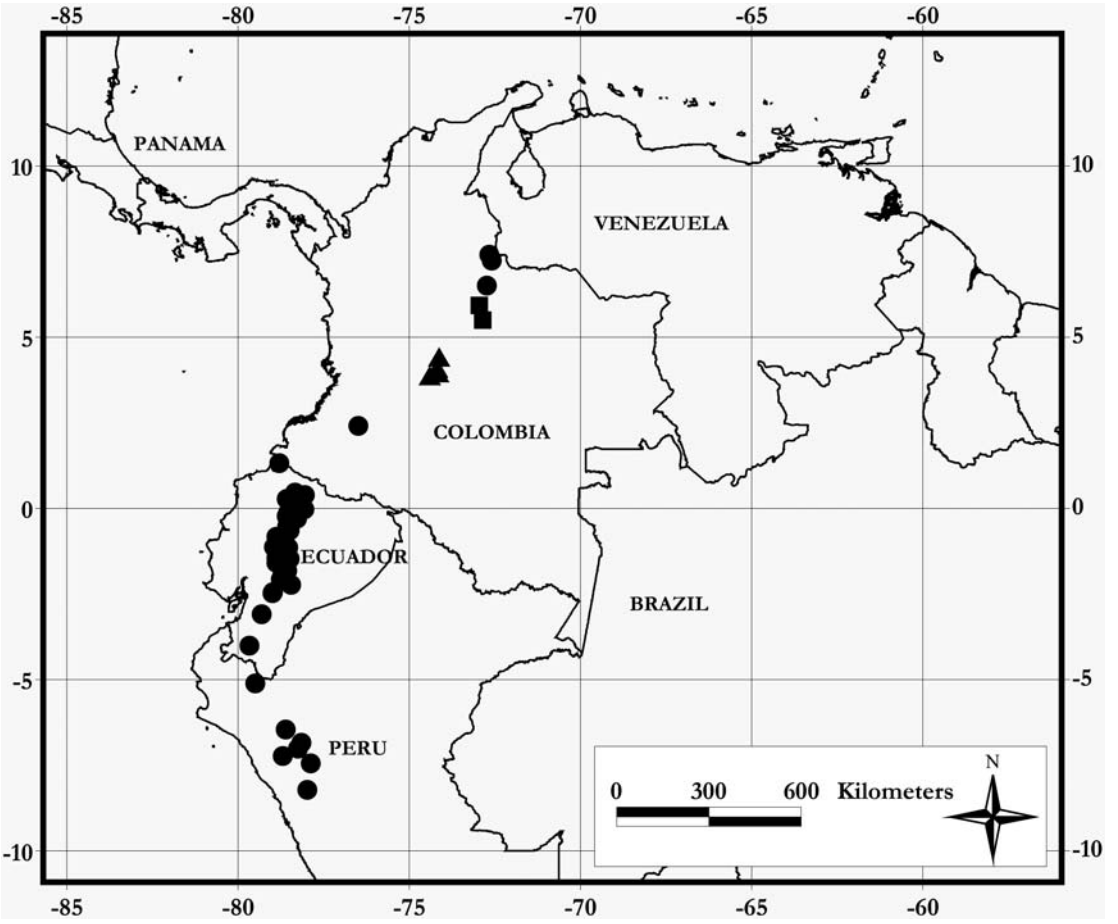


Figure 37. Distribution of *Festuca procera* (●), *F. pilar-franceii* (▲), and *F.boyacensis* (■).

species is morphologically quite variable. Specimens of *F. procera* from southern Ecuador (region Azuay and Cañar) present striking differences in abaxial surface texture of the leaf blades. Some specimens have sparingly scabrous leaf blades, inflorescence branches that are scabrous, and narrower panicles. In addition, all of these unusual specimens lack cataphylls, although this may be an artifact of the collection. Taxonomic status of this group of specimens needs further study.

Distribution and habitat.—This species ranges from Colombia (Cordillera Central and Oriental), to Ecuador, and Peru. It occurs along margins of the Andean mountain forests and in matorral and transitional zones of grass paramo between 3400–3900 m.

Additional specimens examined. **COLOMBIA. Boyacá:** Cañon de Chicamocha, Mun. Sativasur, 17 Oct 1992, *Etter 662* (COL); Mun. El Cocuy–Güicán, Parque Nacional El Cocuy, Hda. La Esperanza, Valle de los Frailejones, 3800 m, 30 Dec 1998, *D. Stančík 1788* (COL, FMB, PRC). **Cauca:** Mun. San Sebastián, Macizo Colombiano, Valle de las Papas, 2910 m, 11 Sep 1958, *Idrobo et al. 3737* (COL, US); Mun. Puracé, Parque Nacional Puracé, quebrada San Nicolás, 3100 m, 6 Apr 1985, *Wood 4797* (COL, K). **Norte de Santander:** Quebrada del Río Chitagu, 3400–3500 m, 20 Jul 1940, *J. Cuatrecasas & García-Barriga 10036* (COL); 3400–3500 m, 20 Jul 1940, *J. Cuatrecasas & García-Barriga 10037* (COL); Pamplona–Cerro al NE, 2770 m, 3400–3500 m, 26 Jul 1940, *J. Cuatrecasas & García-Barriga 10207* (COL). **ECUADOR. Azuay: ca.** 7 km S of road to Nabon, 03º07´S, 79º19´W, 3250–3350 m, *S. Laegaard 101856* (AAU). **Bolívar:** km 14.5 E of Guaranda on road to Riobamba, 2950 m, *P.M. Peterson 9297 & E.J. Judziewicz* (K, MO, QCA, QCNE). **Cañar:** km 11.6

NW of Tambo on Panamerican Highway and 2.2 km E of road to microwave station, 3220 m, *P.M. Peterson 8846, C.R. Annable & M.E. Poston* (MO, QCA, US); S of El Tambo, ca. 1.5–3 km along road to Carshao, 02º28´S, 78º59´W, 3100 m, *S. Laegaard & Sklenář 20296* (AAU, LOJA, PRC); El Tambo, 3400–3500 m, *D. Stančík 3793* (AAU, PRC, QCA); *D. Stančík 3794* (PRC, QCA); Road Pimo–Santa Rosa, 3000 m, *Acosta-Solís 21439A, B* (US); Paramo road ca. 10 km WNW of Cañar, 02º30´S, 79º00´W, 3550 m, *S. Laegaard 71031* (AAU, PRC, QCA). **Cotopaxi:** at Laguna Quilotoa, 00º51´S, 78º53´W, 3500–3600 m, *S. Laegaard 101350* (AAU, QCA); 3480–3500 m, *S. Laegaard 101355* (AAU, QCA); 3700–3800 m, *S. Laegaard 101340* (AAU, QCA); 00º52´S, 78º53´W, 3500–3750 m, *Ceron 21862* (QAP); road Angamarca–Corazón km 11, 01º09´S, 78º57´W, 2880 m, 5 Apr 1992, *S. Laegaard 102164* (AAU, QCA); Parque Nacional Cotopaxi, 3200 m, *Izuriete 129* (AAU, QCA); 3500 m, *Escalona & Gallegos 287* (US); Parque Nacional Cotopaxi, 2.4 km W of entrance, 2870 m, *P.M. Peterson 8734, C.R. Annable & M.E. Poston* (K, MO, QCA, QCNE, US); ca. 3 km de la entrada, 00º40´S, 78º30´W, 3200 m, 3 Jan 1982, *Argüello 2, 33, 37, 440* (QCA); *Sosa et al. 43* (QCA); 13 Nov 1982, *Balslev & T. de Vries 3471* (QCA); km 2 N of Lasso on Panamerican Highway, 3270 m, 14 Apr 1990, *P.M. Peterson 8747, C.R. Annable & M.E. Poston* (K, MO, QCA, QCNE, US); Panam Highway, ca. 6 km N of Lasso, quebrada ENE Pastocalle, 3400 m, *Sparre 15827, 15836* (S); Latacunga, paroquilla Sigchos, 2800 m, 30 Jun 1990, *Ceron 10605* (QAP); Latacunga, paroquilla Belisario, Quevedo–Cerro Putzalagua, 00º57´S, 78º33´W, 2800–3500 m, *Ceron 25977* (QAP). **Chimborazo:** road from San Fernando toward Mt. Chimborazo and El Arenal, 3930 m, *Barclay & Juajiboy 8178* (COL, MO, US); Arenales de Palmira, ca. 7 km S of Guamote, 01º59´S, 78º43´W, 3150 m, *S. Laegaard et al. 18672 (*AAU, LOJA, QCA,QCNE); ca. 7 km S of Palmira, 02º00´S, 78º43´W, 3170 m, 20 Mar 1992, *S. Laegaard 101814* (AAU, QCA, QCNE); 02º02´S, 78º45´W, 3200–3300 m, *S. Laegaard 71695* (AAU, QCA, QCNE); W of Arenales de Palmira, 02º01´S, 78º45´W, 3330 m, *S. Laegaard 105102* (AAU); km 8.9 N of Palmira, 3260 m, *P.M. Peterson 8815* (K, MO, QCA, QCNE, US); km 10 on road Alao–Chamlo, 01º50´S, 78º34´W, 3000 m, *S. Laegaard 55410* (AAU, QCA); km 4.6 of Pungala on road to Alao, 2970 m, *P.M. Peterson 9179, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (K, MO, QCA, QCNE, US); km 9 S of Guamote, then 1.6 km SW on track to Alausi, 3300 m, *P.M. Peterson 9316 & E.J. Judziewicz* (K, MO, QCA, QCNE, US); Chimborazo, Chuquipoyo, 3900 m, *Andre 3919* (K, US); ca. km 10 S of Palmira, 3250 m, 11 Nov 1985, *S. Laegaard 55566* (AAU, QCA); ca. 5 km S of Palmira, 02º06´S, 78º45´W, 3300 m, *S. Laegaard 20379* (AAU, LOJA); Mt. Chimborazo, *Sodiro s.n.* (QPLS); Puela, 01º30´N, 78º30´W, 2315m, *Ceron 15102* (QAP). **Imbabura:** Laguna Cuicocha, 00º18´N, 78º22´W, 3000–3100 m, *S. Laegaard & S.A. Renvoize 70873, 70882 (*AAU, K, QCA, QCNE); 2900–3100 m, 24 May 1991, *Peñafiel et al. 69* (MO, QCNE, PRC); 3100 m, *E. Asplund 20176* (S); road Yahuarcocha–Mariano Acosta km 9, 00º22´N, 78º03´W, 2900 m, 7 Feb 1992, *S. Laegaard 101131* (AAU, QCA); Entre Muyurco y Tallachupa, Nevado Cotacachi, 3000 m, *Acosta-Solís 19006* (US); 3200–3300 m, *Peñafiel et al. 1187* (MO); Mun. Otavalo, road from Laguna Mojanda to Cochasquí, 00°04´55″N, 78°17´50″W, 3450 m, 19 Oct 2000, *D. Stančík 4106* (PRC, QCA). **Loja:** km 1 E of Guachamana on road Macara–Catacocha, 2670 m, 9 Jun 1990, *P.M. Peterson 9512 & E.J. Judziewicz* (K, MO, QCA, QCNE, US). **Morona–Santiago:** Hda. Huargualla–Hda. San Eduardo, 01°57´S, 78°32´W, 3600 m, 19 Jul 1999, *D. Stančík 3312, 3313, 3314* (PRC, QCA); way to Parque Nacional Sangay, 02°15´S, 78°27´W, 3700 m, 19 Jul 1999, *D. Stančík 3317* (PRC, QCA). **Pichincha:** road to Yanaurco on N side of Volcán Pichincha, 00º07´S, 78º34´W, 3600 m, 17 Jun 1981, *S. Laegaard 52301* (AAU, QCA); Volcán Pichincha, 00º09´S, 78º32´W, 3200–3400 m, 5 Feb 1988, *S. Laegaard 70002* (AAU, QCA, OCNE); *Sodiro s.n.* (QPLS, US); km 41 on road Quito–Latacunga, 3350 m, 13 Apr 1990, *P.M. Peterson 8717, C.R. Annable & M.E. Poston* (QCNE, US); km 41, 3350 m, *Buendia 2* (QCA); Environments of Quito, *Jameson 191* (K); Panecillo, Sep 1887, *Sodiro s.n.* (QPLS); vicinity of Quito, 3100 m, *E. Asplund 6151* (AAU, MO, S, US); Prop. Quito, *Sodiro s.n.* (QPLS, US); 3250 m, *E. Asplund 6154* (AAU, S); 3500 m, 13 Jan 1926, *E. Asplund 6139* (S, US); Road Pifo–Pintag, above Inga Monserrat 00º19´S, 78º17W, 3400–3500 m, *S. Laegaard 102285* (AAU, QCA, QCNE); Sep 1890, Mt. Pichincha, *Sodiro s.n.* (MO, NY, QPLS); along road to the antennas, 00º09´S, 78º32´W, 3200–3400 m, *S. Laegaard 70016* (AAU, QCA, QCNE); *Mille 283, 285* (US); SE of Ungui,

3000 m, *Firmin 116* (US); above Quito, 3300 m, *E. Asplund 16161* (S); 5 Feb 1988, *S. Laegaard 70014* (AAU, QCA, QCNE); between Quito and Conocoto, 3000 m, *E. Asplund 10375* (S); between Quito–Lloa, 3200 m, *E. Asplund 7392* (S), 3600 m, *Sparre 16006* (S); Volcán Cayambe, entrance to Parque Nacional, 00º03´S, 78º04´W, 3550 m, *S. Laegaard & S.A Renvoize 70485* (AAU, K, QCA, QCNE); 3870 m, *Escalona & Gallegos E384* (MO); Antisana, road to Hacienda Pinatura, 3000–3100 m, 3 Mar 1988, *S. Laegaard & S.A Renvoize 70542* (AAU, K, QCA, QCNE); 00º26´S, 78º20´W, 3400 m, *S. Laegaard 102857* (AAU, QCA, QCNE). **Tungurahua:** road Ambato–Guaranda, km 25, 01º18´S, 78º48´W, 3300 m, 5 May 1999, *S. Laegaard & Sánchez 20033* (AAU, LOJA, QCA); 01º24´S, 78º51´W, 4000–4100 m, *S. Laegaard 54802, 54809* (AAU, QCA); Pillaro, along irrigation ditch, 2850 m, 10 Aug 1939, *E. Asplund 8135* (NY, QCA, S, US). Baños, 1800 m, 26 Sep 1923, *A.S. Hitchcock 21926* (NY, US); Llangahua, 3300 m, *Acosta-Solís 16678* (US); Pucara de Chisalo, *Stübel 297* (K). **PERU. Ancash:** Prov. Pallasca, 5 km S of road towards Cabaña steep slope with *Puya, Oxalis, Festuca, Tillandsia*, 3210 m, 27 Mar 1997, *P.M. Peterson 13922 & N. Refulio Rodríguez* (K, MO, US, USM). **Arequipa:** Volcán de Misti, open slopes and canyon sides, 3100–3300 m, 4 Nov 1925, *Pennell 13231* (F). **Cajamarca:** Prov. Cajamarca, a 9 km de la Cajamarca, sobre carretera Cajamarca–Pacasmayo, 2800 m, 6 Nov 1984, *Vega & Ruiz 3584* (MO); surrounding of Cajamarca, 2750 m, 21 May 1980, *Becker et al. 1234* (LPB); Prov. Chota, near Las Palmas, ca. 24 km NE de Chota, fragmented mountain forest, 78°37´W, 06°29´S, 2789m, 17 Apr 1993, *M. Dillon et al. 6359A* (F, MO); Distr. Baños del Inca, a 3 km arriba de Banos del Inca, caretera Cajamarca–Celendín, 16 Mar 1984, *Vega 3239* (F); km 13 de la carretera Cajamarca–Cumbe Mayo, frequent, 3000 m, 4 Sep 1984, *Vega 3324* (F); Quebrada de la Esperanza, carratera a Cumbe Mayo, quebrada que converga al Valle de Cajamarca, arribe Cerro Sta. Apolonia, 2800 m, 4 Mar 1984, *Vega et al. 3283* (F); Distr. San Juan, carretera Cajamarca–San Juan, 2350 m, 6 Dec 1993, *Vega 723* (F); Distr. De Chetilla, ruta a Llullapuquio bosque perennifolio, 2650–2750 m, 21 May 1986, *Vega et al. 4117* (F); Quebrada de la Esperanza, carratera a Cumbe Mayo, quebrada que converga al Valle de Cajamarca, arribe Cerro Sta. Apolonia, 2800 m, 4 Mar 1984, *Vega et al. 3283* (F); a 1 km arriba de San Juan, siguiendo la carretera a Cajamarca, 2300 m, 6 Feb 1985, *Vega et al. 3855* (F); Sexcemayo, al W de la ciudad de Cajamarca, 3500 m, 20 Jun 1991, *Vega et al. 5745* (F); a la altura del Paso El Gavilán, 3200 m, 18 Apr 1976, *Vega et al. 1393* (F); Entre La Encanada y Kumullca, 3300 m, 17 Jun 1975, *Vega et al. 1598* (F); Prov. Celendín, Guanambra, a 11 km de la carretera Celendín–Cajamarca, 2830 m, 3 Dec 1988, *Vega 4661* (F); al E de la ciudad de Celendín, 2600 m, 5 Apr 1980, *Vega 3830* (F); Celendín–Cajamarca road, 78°12´W, 06°58´S, 2800–3400 m, 25 Feb 1984, *Smith 6222* (MO); above Celendín, 2750 m, 23 Mar 1988, *S.A. Renvoize 4879* (K); Bajando el paso de Gelig, sobre la carretera Celendín–Balsas, 3000 m, 15 Jun 1981, *Vega 2576* (F); Prov. Chota, 5 km N of Chota on road towards Conchan, 2560 m, 18 Mar 2000, *P. M. Peterson 14968 & N. Refulio Rodríguez* (MO, US, USM); 20 km NW of Bambamarca on Hwy 3 N towards Chota, 2900 m, 18 Mar 2000, *P.M. Peterson 14953, 14955, 14957 & N. Refulio Rodríguez* (K, MO, US, USM); Chota–Tacabamba road, 6–8 km from Chota, 78°38´W, 06°32´S, 2650 m, 20 Feb 1983, *Smith et al. 3627* (K, MO); Distr. Llacanora, sobre la carretera a Cajabamba, 2760 m, 6 Jul 1980, *Vega 2250* (F); Prov. Cutervo, 10 km NW of Chiguirip and 19 km SE of Cutervo, 2630 m, 19 Mar 2000, *P.M. Peterson 14989, 14992 & N. Refulio Rodríguez* (K, MO, US, USM); Prov. Hualgayoc, cerro La Llama de las Ventanillas, al SW de Bambamarca, 3890 m, 5 Mar 1991, *Vega et al. 5696* (F); Prov. San Marcos, Yanupacha, al E de Ichocan, 3100 m, 26 Mar 1994, *Vega et al. 6933* (F). **Cuzco:** Prov. Paucartambo, altura de Teleban, 3700–3800 m, 16 Jul 1990, *Cano 3780* (F); Huayna Pichu, rocks, 68°07´W, 16°17´S, 3000 m, 5 Aug 1937, *Tutin 1285* (BM). **Junín:** Huancayo, 18.5 km NW of Huancayo up Río Shullcas, just above Acopalca, 3890 m, 12 Apr 1997, *P.M. Peterson 14224 & O. Tovar* (K). **La Libertad:** Prov. Bolívar, arriba de Longotea, ruta Bolívar, 2800 m, 28 Aug 1989, *Vega 5013* (F). **Lambayeque:** Prov. Ferrenafe, Incahuasi, 3400 m, 22 Jun 1986, *Quiroz 1929* (F, MO). **Piura**. Prov. Huancabamba, San Antonio, km 25 de la carretera Huancabamba–Salala, 2850 m, 5 Jan 1990, *Vega et al. 5185* (F); 30 km N of Huancabamba and 3 km N of Salala, 2980–3200 m, 2 Apr 2000, *P.M. Peterson 15178 & N. Refulio Rodríguez* (K, US, USM).

30. Festuca toca Stančík, Darwiniana 41(1–4): 123, f. 10h–m. 2003. (**Figs. 38, 39, 88A & B**). Type:

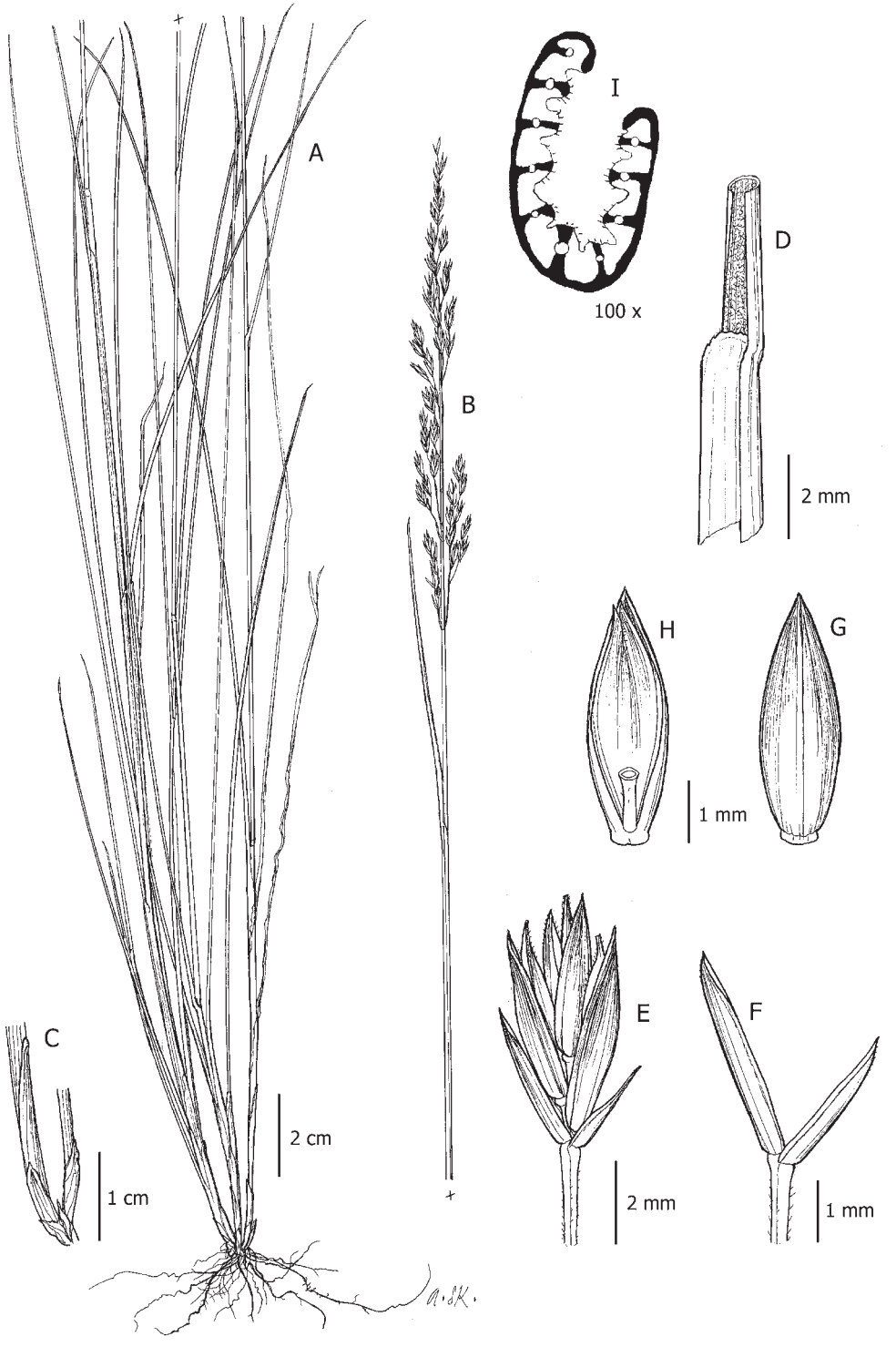


Figure 38. *Festuca toca.* **A.** Habit. **B.** Inflorescence. **C.** Cataphylls. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–I, *Stančík 1418* (PRC).

Colombia. Boyacá, Mun. Toca, road from Pesca to Toca, km 4–5, Páramo Cortadero, 5º30´N, 73º15´W, 2700 m, 14 Nov 1998, *D. Stančík 1404* (holotype: PRC!; isotypes: COL!, FMB!).

Rhizomatous perennials with extravaginal innovations. Culms 50–90 cm tall, erect, solitary, glabrous or finely scabrous; nodes 2–4; cataphylls short, coriaceous, gray-brown. Leaf sheaths membranous, brown, striate; auricles absent; ligules 0.1–0.5 mm long, membranous, apex truncate; blades 10–35 cm long, 0.5–1.1 mm wide, conduplicate or conduplicate to involute, green, abaxially glabrous. Panicles 6–15(–20) × ca. 0.5 cm, erect, contracted, elongate; branches scabrous. Spikelets 6–8 mm long, florets 4 or 5(–6); rachilla glabrous or with scattered hairs; glumes 2–4 mm long, lanceolate, membranous to coriaceous, purplish, apex acute, scabrous; lower glumes 2–3 mm long, 1-nerved; upper glumes 3–4 mm long, 3-nerved; lemmas 4–5 mm long, lanceolate, 5-nerved, membranous to coriaceous, purplish, upper 1/3 scabrous, apex mucronate; callus glabrous; paleas as long as the lemma, membranous, papillose, upper 1/3 hairy, lodicules lanceolate, acuminate; anthers 1.1–1.6 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 3/5 of total lenght.

Leaf blade anatomy.—Cross–sections with 7–15 vascular bundles and 5–13 ribs above; sclerenchyma under abaxial epidermis discontinuous, sometimes abaxial continuous, extending to some (rarely to all) vascular bundles forming girders; adaxial epidermis with scattered hairs, the hairs 0.2–0.9 mm long.

Observations.—Festuca toca differs from the remaining species of *F.* sect. *Cataphyllophorae* by having solitary culms. *Festuca toca* is morphologically similar to *F. andicola* (*F.* sect. *Aulaxyper*), but differs by having longer glumes (lower glumes 2–3 versus 1.4–1.8 mm; upper glumes 3–4 versus

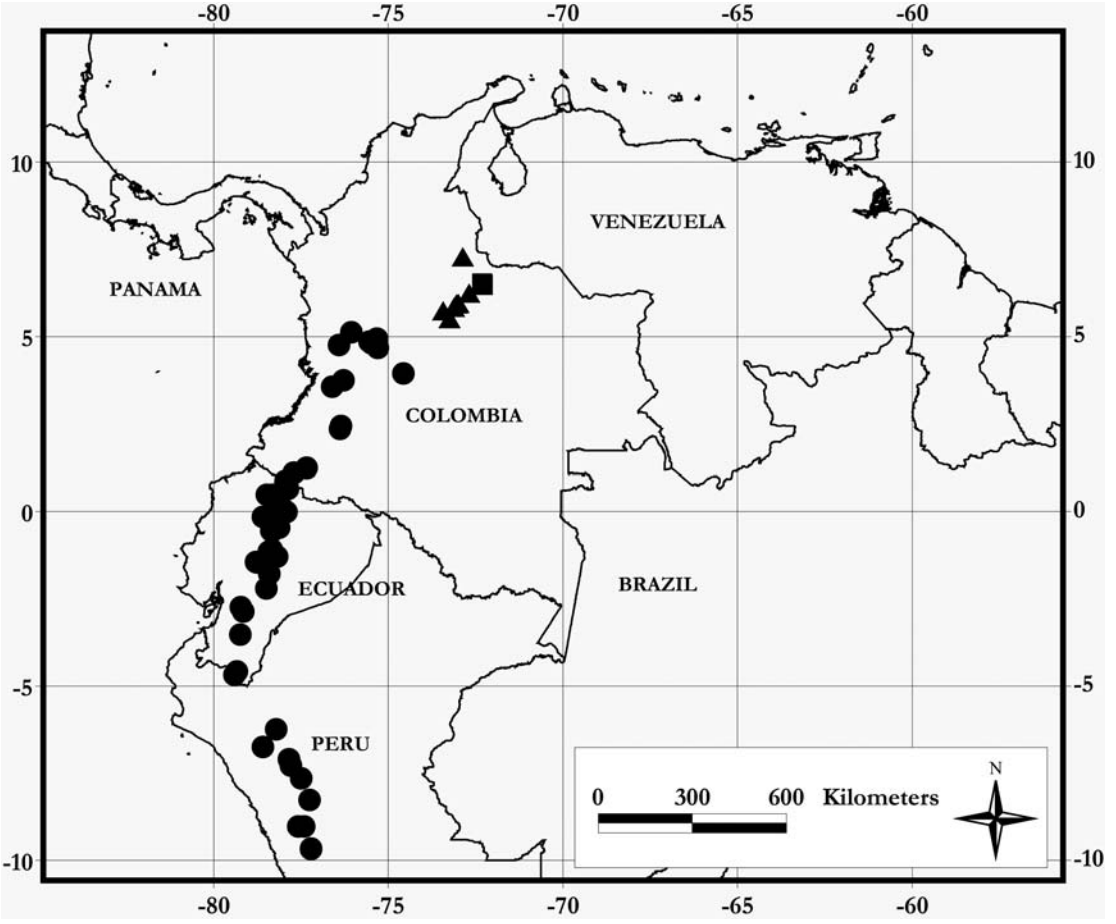


Figure 39. Distribution of *Festuca asplundii* (●), *F. toca* (▲), and *F. cocuyana* (■).

2–2.5 mm) and longer anthers (1.1–1.6 versus 0.8–1 mm).

Distribution and habitat.—This species is endemic to Colombia where it is known only from the Cordillera Oriental (Boyacá, Norte de Santander). It occurs in swampy patches in grass paramo zone between 3100–3500 m. *Festuca toca* is present in different vegetation communities such as: *Lysipomia sphagnophilla* subsp. *minor* (Cleef 1981).

Additional specimens examined. **COLOMBIA. Boyacá:** Mun. Duitama, páramo Pan de Azucar, 3450 m, 30 Nov 1998, *D. Stančík 1418* (COL, PRC); Páramo de Rusia, 3400 m, 2 Jan 1984, *Wood 4481* (COL, FMB, K); 3570 m, 13 Dec 1972, *Cleef 7139* (COL); summit of road from Duitama to Abendanos, 3490 m, 12 Feb 1972, *D. Stančík 2371* (COL, PRC); Hda Los Tres Corrales, 5°55′3.2″N, 73º4′13.5″W, 3490 m, *Hernández 1022A* (COL); Mun. Toca, road from Pesca to Toca, km 4-5, paramo Cortadero, 5º30′N, 73º15′W, 2700 m, 14 Nov 1998, *D. Stančík 1404* (COL, FMB, PRC); 3350 m, 14 Nov 1998, *D. Stančík 1365* (COL, FMB, PRC); Mun. Susacón, road km 20, margin of Río Susacón, 3150 m, 24 Feb 1999, *D. Stančík 2513* (COL, PRC); Páramo Guantiva (Sanjuanero), 3300 m, 10 Aug 1977, *Ruiz & Romero 3* (COL); Mun. Paipa, Cuchilla El Páramo, 3200 m, 4 Dec 1998, *D. Stančík 1533* (COL, PRC); Mun. Arcabuco, Santuario Iguaque, way from Laguna Iguque to Laguna Ojo de Agua, 3650 m, 15 Oct 1998, *D. Stančík 948* (COL, FMB, PRC). **Norte de Santander:** Páramo de Santurban, 3200 m, 4 Jan 1984, *Wood 4507* (COL, FMB, K).

31. Festuca asplundii E.B. Alexeev, Bjull. Moskovsk. Obšč. Isp. Prir., Otd. Biol. 89(4): 116. 1984. (**Figs. 39, 40, 88C–F**). Type: Ecuador. Pichincha, Iter Regnellianum quartum, Flora Aequatoriensis, prov. Pichincha, vicinity of Quito, Rucu Pichincha, 4650 m, 31 Aug 1939, *E. Asplund 8586* (holotype: S!).

Tussocked perennials with intravaginal innovations. Culms up to 80 cm tall, erect, scabrous; nodes 1 near base. Leaf sheaths wide, coriaceous, stramineous, scabrous; ligules 0.5–1.5 mm long, coriaceous, apex truncate or emarginate, short-ciliate; blades ca. 40 cm long, 1–1.4 mm wide, conduplicate to involute, rigid, somewhat abaxially scabrous, green, apex obtuse. Panicles 12–27 × 3–4(–10) cm, contracted, rarely with open branches; branches scabrous. Spikelets sterile, forming 1(–2) shoots (i.e., vegetative proliferation), florets 1–4, up to 6 when shoots lacking; glumes 4.5–6(–7) mm long, coriaceous, dark purple, scabrous dorsally, distal margins (upper 1/2) membranous, apex acute; lower glumes 4.5–5(–6) mm long, lanceolate, 1-nerved; upper glumes 5–6(–7) mm long, oblong-lanceolate, 3-nerved; lower lemmas sterile, 4.5–6(–7) mm long, 5-nerved (sometimes inconspicuously), lanceolate, scabrous or papillose dorsally, margins membranous, apex entire or slightly two-dentate and short-awned, the awns up to 0.8 mm long, dark purple; lodicules and sexual organs absent; upper lemmas converted into prolifering shoots 1–2.5 cm long, 1–3-leafed are prolonged into leafy bracts.

Leaf blade anatomy.—Cross-sections with 11–17 vascular bundles and 9–15 ribs; sclerenchyma under abaxial epidermis continuous extending to all the vascular bundles; adaxial epidermis discontinuous extending to every other vascular bundle; bulliform cells absent; abaxial epidermis with prickles and densely hairy adaxially, the hairs 0.04–0.09 mm long.

Observations.—This species does not seem to be morphologically similar to any other species of *Festuca* from South America. St.-Yves (1927) considered *F. asplundii* to be a viviparous form of *F. procera* only lacking cataphylls. Individual specimens of *F. asplundii* are highly variable in spikelet size, panicle shape, and ligule characteristics. We include numerous specimens from Peru in *F. asplundii*, although Alexeev considered this species to be endemic only to Colombia and Ecuador. He attributes Peruvian specimens to the unclearly described species, *F. ancachsana* and invalidly described, *F. peruviana* (Alexeev 1986). In *Festuca*, vivipary occurs rarely in developing spikelets, although, it can sometimes be found in a few individuals of *F. subulifolia*, *F. procera,* and *F. tolucensis*.

Distribution and habitat.—Festuca asplundii is known from northern Peru, Ecuador, and Colombia (Cordillera Central and Cordillera Occidental). It is found in swampy and humid patches of grass paramo and the lower zones of superparamo between 3300–4300 m. It is a dominant and co-dominant species in communities of *Espeletia hartwegiana* subsp. *centroandina y Calamagrostis recta* (Cleef et al. 1983), *Festuca dolichophylla, Senecio latiflorus & Pentacalia vernicosa* (Sturm and Rangel 1985), *Festuco dolichophyllae-Calamagrostietum effusae*

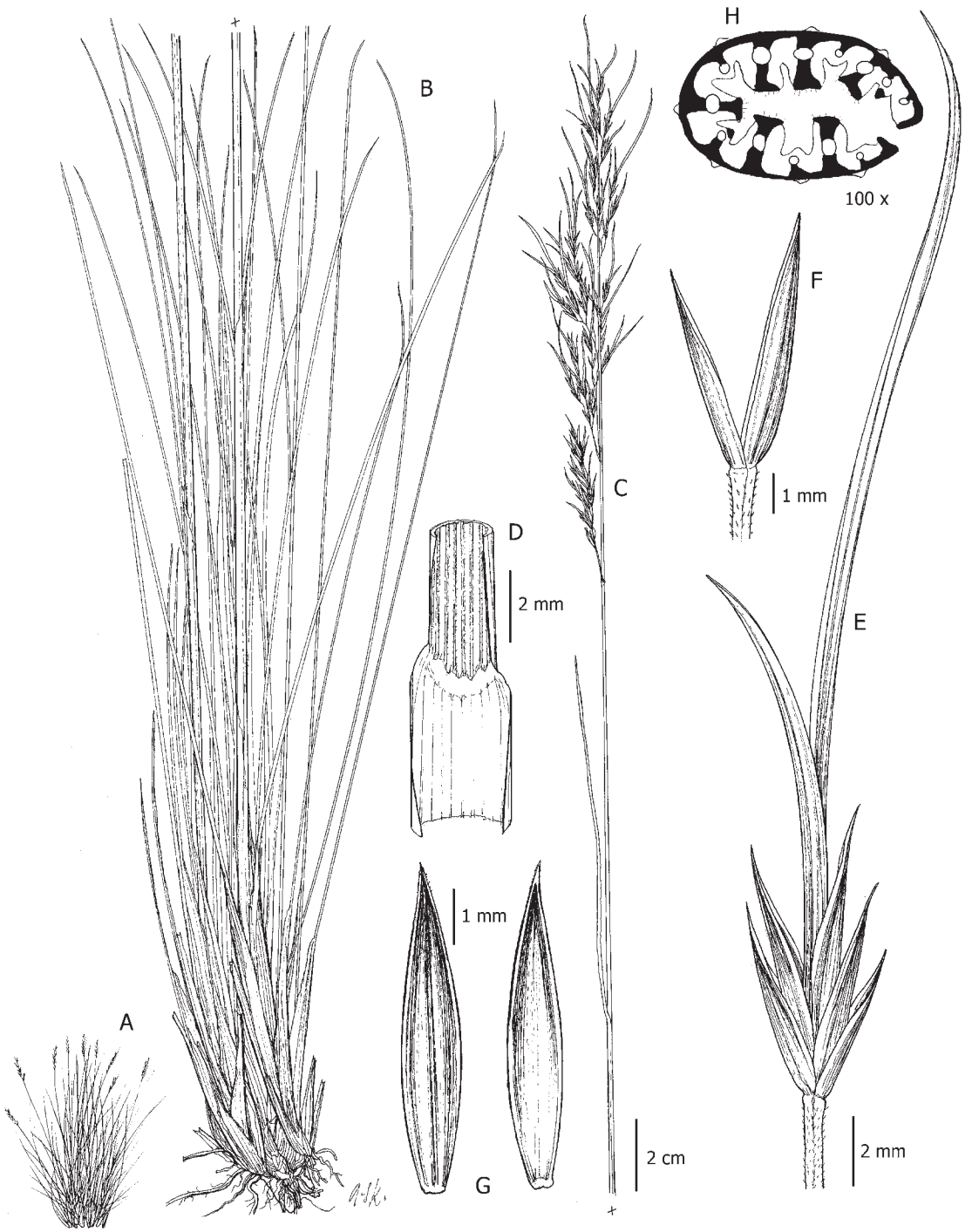


Figure 40. *Festuca asplundii.* **A.** Stylized growth form. **B.** Habit. **C.** Inflorescence. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemmas. **H.** Leaf blade cross-section. A–H, *Stančík 3675* (PRC).

(Salamanca et al. 1991), *Senecionetum rufescentis-Agrostiosum* (Cuatrecasas 1934), *Calamagrostis effusa* and *Loricaria* cf. *complanata* (Rangel et al. 1995), *Espeletia pycnophylla* & *Arcytophyllum capitatum* (Rangel and Luteyn 1995), *Gynoxyo-Polylepidetum sericae* (Salamanca et al. 1991), *Loricaria thuyoides* & *Pentacalia vernicosa* (Rangel et al. 1995), *Loricaria thuyoides* & *Arcytophyllum capitatum* (Rangel et al.1995), *Calamagrostis effusa* & *Festuca* aff. *dolichophylla* (Salamanca 1991), and *Calamagrostis recta, Festuca* aff. *sublimis* & *Diplostephium rupestre* (Cuatrecasas 1934).

Additional specimens examined. **COLOMBIA. Caldas:** Mun. Manizales, Parque Nacional Los Nevados, entrance, 4020 m, 18 Sep 1999, *D. Stančík 3410, 3411* (COL, PRC); road from Casa del Cisne to Río Nereidas, km 5, 3800–4000 m, 18 Sep 1999, *D. Stančík 3401, 3402* (COL, PRC); Carretera Manizales–Nevado del Ruiz, km 72, 4100 m, 1 Mar 1977, *Forrero et al. 3644* (COL, MO); Carretera entre Manizales y el Nevado del Ruiz, 4000 m, 5 May 1959, *Pinto-Escobar 415* (COL, PSO); Páramo de Herves, division de Aguato, 3300 m, Feb 1852, *Triana 810* (COL); 3500 m, Feb 1852, *Triana s.n.* (US); alrededores del Nevado del Ruiz, 4140–4300 m, 9 Oct 1978, *Rangel et al. 1800* (COL); Nevado del Ruiz, 8 Oct 1983, *Wood 4030* (AAU, K); Páramo El Ruiz, 3700–4200 m, 26 Dec 1936, *Chardon 5010* (COL); 3400–3700 m, 17 Dec 1917, *Pennell 3064* (K, MO, US); Nevado del Ruiz, arenales de Ruiz, 3 km a de la Olleta, 4250 m, 14 Oct 1972, *Cleef et al. 5983* (COL, U, US); 3900–4200 m, 5 May 1940, *J. Cuatrecasas 9311* (COL, US); Carretera El Ruiz–Otún, Hda. Buenos Aires, 3940 m, 20 May 1979, *Salamanca AC172* (COL); 3500 m, Dec 1974, *Llana 71* (MEDEL); Páramo de Quindio, 4300–4500 m, 20 Aug 1922, *Pennell 9890* (K, US). **Cauca:** Mun. Popayan, Parque Nacional Puracé, Pilimbala, 02º20.07´N, 76º23.65´W, 4200–4300 m, 6 Jul 2000, *D. Stančík 3611* (COL, PRC); Puracé, Laguna San Rafael, 3300 m, 6 Apr 1985, *Wood 4802* (COL, FMB, K). **Nariño:** Mun. Cumbal, Nevado del Cumbal, N-NE slope, 4100 m, 9 Mar 1999, *D. Stančík 2724* (COL, PRC); Mun. Tuquerres, Volcán Azufral, Laguna Verde, 3750 m, 9 Mar 1999, *D. Stančík 2759* (COL, PRC); Mun. Pasto, Volcán Galeras, 3920 m, 6 Aug 1977, *Pinto-Escobar 1845* (COL); 3900 m, 29 Oct 1983, *Wood 4062* (COL); Volcán Galeras, 3900 m, *Wood 4063* (FMB, K). **Risaralda:** Mun. Santuario, SE del Cerro Ventanas, Macizo del Tamará, 3820 m, 11 Feb 1983, *Torres-Romero et al. 1875* (COL); Mun. Pereira, Parque Nacional Los Nevados, Laguna del Otún, 3800 m, 16 Feb 1980, *Jaramillo-Mejía et al. 5634* (COL); Nevado de Sabanta Isabel, 4300 m, 17 Feb 1980, *Jaramillo-Mejía et al. 5683* (COL). Mun. Santa Rosa, Volcán Santa Rosa, 4280 m, 20 Feb 1980, *Jaramillo-Mejía et al. 5770* (COL); Páramo entre Termales y Líbano, 4000 m, 21 Dec 1958, *Barclay & Juajíbioy 6456* (COL, MO, US). **Tolima:** Mun. Ibague, 04º38.5´N, 75º19.1´W, 4250 m, 8 Jun 2000, *D. Stančík 3606* (COL, PRC); Mun. Santa Isabel, vertiente oriental abajo del paso de El Otún, 4200 m, 7 Feb 1980, *Jaramillo-Mejía 6237* (COL); Quebrada Africa, 4200–4300 m, 5 Feb 1980, *Díaz-Piedrahita & Jaramillo-Mejía 1821* (COL, U). **Valle de Cauca:** Mun. Cali, Farallones de Cali, 03º19.78´N, 76º41.7´W, 3950 m, 9 Jul 2000 *D. Stančík 3612, 3613, 3614* (COL, PRC); 3650–3700 m, *D. Stančík 3637* (COL, PRC). **ECUADOR. Azuay:** Parque Nacional Cajas, Totorococha–Mazan Valley, 02º53´S, 79º10´W, 4000 m, 12 Nov 1987, *Ramsay & Smith 502* (K, QCA, QCNE); Cuenca–Molleturo road, 3600–4200 m, 26 Jul 1982, *Clements et al. 2170* (AAU, QCA, QCNE); Paramo de Soldados ca. 14 km above Soldados, 02°08´54˝S, 79°08´17˝W, 3900 m, 9 Jan 2000, *S. Laegaard et al. 20931* (AAU, LOJA); between Huagrarancha and Loma de Galapagos, 3140–3505m, *J. Steyermark 53481* (US); Mun. Cuenca, Parque Nacional Cajas, N side of Lagoon Taglococha, 02°47´S, 79°15´W, 4100–4200 m, 1 Sep 2000, *D. Stančík 3849*, *3871* (PRC, QCA). **Carchi:** Volcán Los Chiles, along road ca. 1 km E of pass, 00º49´N, 77º57´W, 3950–3980 m, *S. Laegaard 101695* (AAU, QCNE); *D. Stančík 3241, 3279* (PRC, QCA); 00º48´N, 77º56´W, 3850–4000 m, *S. Laegaard 54972* (AAU, QCNE); SW slope of Volcán Chiles, 3740 m, *B. Øllgaard & Balslev 8545* (AAU); S slope, *Ramsay 896* (K, QCA); Paramo del Angel, 3700 m, *S. Largaard 101284* (AAU, QCA); sector El Volador, 00º38´N, 67º53´W, 3400–3800 m, *Davalos 19* (US). **Chimborazo:** E slope of Mt. Chimborazo, 4450 m, *E. Asplund 7927* (S); 4250 m, *E. Asplund 7806* (S); El Altar, N side of the Volcán, 4200–4300 m, *Sklenář & Kostečková 1106* (QCNE); Páramo de los Altares, Collanes valley, 4200 m, *Ramsay & Smith 415B* (K, QCA, QCNE); N side of Volcán, 4200–4400 m, *Sklenář & Kostečková 1028* (AAU); 4300 m, *Sklenář & Kostečková 97-10* (QCA); N side, 4400 m, *Sklenář*

& Kostečková 91-8 (US); from campsite above Río Alao 8.5 km E of Guardiana Alao, 3350–3550 m, *P.M. Peterson 9204, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (K, MO, QCA, QCNE, US); W of pass Alao–Huamboya, 01°48´S, 78°25´W, 3750–3800 m, *S. Laegaard 55425* (AAU, QCA). Cerro Yanaurcu, 02°14´S, 78°30´W, 4000–4200 m, *Sklenář & Kostečková 1478* (AAU); Paramo de Las Tres Cruces, N and E of Alao, 3500 m, *Barclay & Juajibioy 8804* (MO, US); between Mt. Chimborazo and Urbina, 3600–4500 m, *A.S. Hitchcock 21978* (US). **Cotopaxi:** Cerro Verde, road San Miguel–Puerto Nuevo, km 29, 3950–4050 m, *B. Øllgaard & Balslev 9924* (MO). **Imbabura:** Proantag, 3500–3800 m, *Acosta-Solís 19199* (US); Mun. Urcuquí, road to Cerro Yanaurcu, 00°28.5´N, 78°20´W, 4150 m, 15 Oct 2000, D. Stančík 4097 (PRC, QCA). Mun. Cayambe, Volcán Cayambe, 00°00´31.6˝N, 78°00´55.6˝W, 4450 m, 20 Oct 2000, *D. Stančík 4150*, *4151* (PRC, QCA). **Loja:** Jionbura–Yumba road, ca. 3 km W of pass, 04°44´S, 79°25´W, 3450 m, *S. Laegaard et al. 18606* (AAU, LOJA, QCA, QCNE); along road to Fierra Urcu, ca. 10 km from main road Loja–Saraguro, 03°33´S, 79°15´W, 3400 m, *S. Laegaard et al. 18859* (AAU, LOJA, QCA, QCNE); Cordillera de Amaluza, Laguna de Jimbira, 04°42´S, 79°25´W, 3400 m, *Cabrera 438* (LOJA); Laguna Chuquiraga E of Amaluza, 04°37´S, 79°22´W, 3300 m, *S. Laegaard et al. 19280* (AAU, LOJA, QCNE); Mun. Saraguro, road to Fierra Urcu, 03°42´40˝S, 79°18´12˝W, 3400–3450 m, 24 Aug 2000, *D. Stančík 3763*, *3767* (PRC, QCA). **Napo:** Parque Nacional Las Llanganatis, base of Cerro Hermoso on W side, near lake 78°18´W, 01°14´S, 3850 m, 13 Nov 1999, *D.A. Neill et al. 12042* (MO); W of Cerro Hermoso, near saddle between headwaters of Río Verde and Río Topo, 78°19.5´W, 01°11´S, 3950 m, *D.A. Neill et al. 11992* (MO); camino desde el Páramo de Soguillas hasta Aucacocha, 78°19´W, 01°08´S, 3940 m, 16 Nov 1999, *Narvazez et al. 548* (MO); Páramo de Soguillas, near Las Torres de Llanganatis, 3850–4000 m, 16 May 1982, *B. Øllgaard & Holm-Nielsen 38728* (MO). **Pichincha:** W side of Sincholagua, 13–14,500 ft, Feb 1880, *Whymper 1326* (K). W side of the mountain ridge ca. 2 km W of Cerro Saraurcu, 4200 m, *Sklenář & Kostečková 1817* (AAU); Nevado Cayambe, W side, 4200 m, *Sklenář & Kostečková 1142* (QCA); SW slope, 4400 m, *Sklenář & Kostečková 1890* (AAU); SW slope, 4250 m, *Molau & Eriksen 3244* (QCA); NE side of Cayambe Mountain, ca. 4900 m, *Cazalet & Pennington 5763* (K, US); 3 km S of Refugio on the SW slope, 4220 m, *P.M. Peterson 9076, E.J. Judziewicz & R.M. King* (K, MO, QCA, QCNE, US); along road to refuge, 00°04´S, 77°57´W, 4300 m, *S. Laegaard & S.A. Renvoize 70511* (AAU, K, QCA, QCNE); W side, 4200 m, *Sklenář & Kostečková 64-19* (US); N slope, 3750–3800 m, *B. Øllgaard et al. 34202* (K, MO); base of Volcán Sincholagua, 00°34´S, 78°22´W, 4200 m, *Holm-Nielsen 6612* (AAU, S); Cerro Sincholagua, 3900–4000 m, *Balslev et al. 3901* (AAU, MO, QCA); W side, 13,000–14,500 ft, *Whymper s.n.* (K); Paramo de Guamani, *E. Asplund 17174* (S); Laguna Linda, 3 km W of Paso de Guamani, 3900 m, *Sparre 17719* (S); 01°19´S, 78°12´W, 4000 m, *S. Laegaard 18449* (AAU, LOJA, QCA, QCNE); 00°56´S, 78°23´W, 3600 m, *S. Laegaard 53343* (AAU, QCA, QCNE); 4050 m, *B. Øllgaard & Balslev 10122* (MO); Laguna de Papallacta, 3750 m, *B. Øllgaard & Balslev 8170* (MO); antenna, 4000–4100 m, *B. Øllgaard & Balslev 10074* (M); *Aguirre et al. 4206* (LOJA); 4050 m, *S. Laegaard 51318* (AAU, QCA); S of Paso de la Vírgen, 00°21´S, 78°13´W, 4050–4250 m, *S. Laegaard 55680* (AAU, QCA); 4200–4250 m, *S. Laegaard 101383* (AAU, QCA); W slopes, 3800–4100 m, *Balslev 1615* (AAU); 4060 m, *Fierrp 24* (QCA); 4050 m, *Naranyo 4* (QCA); 3960 m, *Len 1139* (QCA); Volcán Cotacachi, 00°35´S, 78°20´W, 4150 m, *Ramsay & Smith 785* (K, QCNE); 4200 m, *Sklenář & Kostečková 112-25* (QCA); vicinity of Quito, Rucu Pichincha, 465 m, *E. Asplund 8576* (MO, NY, QCA, S); Volcán Antisana–Laguna Micacocha, *B. Øllgaard & Balslev 8868* (MO); 3850–3950 m, *S. Laegaard 101595* (AAU, QCA, QCNE); valley NW of N peak of Volcán, 4000–4300 m, *Grubb et al. 639* (K); Paramo de Mojanda, between Laguna Grande and L. Negra, 00°08´N, 78°16´W, 3700–3800 m, *S. Laegaard 54581* (AAU, QCA, QCNE); Mun. Pifo, Páramo de Guamaní, grass paramo, 00°19´S, 78°12´W, 4300 m, 19 Jun 1999, *D. Stančík 3044, 3050* (PRC, QCA); Mun. Amaguaña, summit of Volcán Pasachoa, 00°28´S, 78°29´W, 4200 m, 14 Sep 2000, *D. Stančík 3675* (PRC, QCA, US); 4150 m, *D. Stančík 3703* (PRC, QCA). **Sucumbíos:** Páramo Mirador, SW of Playon de San Francisco, 3400–3600 m, *P.M. Peterson 9154, E.J. Judziewicz & R.M. King* (US). **Tungurahua:** Cordillera de Llanganatis, El Tambo near Lake Yanacocha, 3650 m, *E. Asplund 10000*

(S); below summit of Pan de Azucar, 4100 m, *B. Øllgaard et al. 38541* (AAU, MO, NY, QCA); *B. Øllgaard et al. 38540* (AAU); N slope towards Río Golpe just N of Chosca Aucacocha, 3600 m, *B. Øllgaard et al. 38670* (AAU, MO, NY, QCA); Las Tolas, ca. 5 km SE of Laguna Pisayambo, 01°07′S, 78°21′W, 3900–4000 m, *S. Laegaard et al. 20733* (AAU, LOJA); Paramo de Jaramillo, 01°08′10″S, 78°08′22″W, 4000–4250 m, *S. Laegaard 53289* (AAU, QCNE); Faldas de Cazahuala, 3200 m, *Acosta-Solís 5097* (US); Mun. Pillaro, Las Llanganatis, Río Milín, 01°07′37″S, 78°21′W, 3750 m, 28 Sep 2000, *D. Stančík 3904* (PRC, QCA). **Zamora-Chinchipe:** Sendero Amaluza–Palanda, cerca de la Laguna Arrebatadas, 3350 m, *Larsen et al. 21* (AAU, NY, QCA). **PERU. Amazonas:** Prov. Chachapoyas, upper slope of Cerro Campanario, 3600–3900 m, 3 Aug 1962, *J. Wurdack 1572* (US). **Ancash:** Yungay Prov., Huascarán Parque Nacional Llanganica Sector, Quebrada Ancachs at portachuelo, 09°03′S, 77°35′W, 4770–4870 m, 31 Dec 1984, *Smith et al. 8879* (QCA, U); Yungay Prov., Huascarán Parque Nacional, 4700 m, *Smith 11318* (MO, QCNE); Prov. Huari, Catac-Chavin road, 40 km from Catac, Huascarán Parque Nacional, 9°42′S, 77°13′W, 4360 m, 18 Aug 1984, *Smith 8284* (MO, US); Prov. Recuy, Huascarán Parque Nacional, camino over Cahuish Tunnel, puna, 09°41′S,77°15′W, 4550–4500 m, 7 Oct 1985, *Smith et al. 11127* (MO); Prov. Yungay, Huascarán Parque Nacional, Morococha at largest lake 08°55′S, 77°35′W, 4550 m, 15 Jan 1985, *Smith et al. 9225* (MO). **Cajamarca.** Prov. Cajamarca. 52 km N of Cajamarca on Hwy 3 N towards Bambamarca, and ca. 1 km W on a small road, Carretera Lagunas Yanacanchilla, 3800 m, 16 Mar 2000, *P.M. Peterson 14892 & N. Refulio Rodríguez* (MO, US, USM); Prov. Hualgayoc, desvio de la carretera Coymolache–Chugur, Cerro Tantahuatay, 3700 m, 29 Apr 1994, *Vega 7087* (F); Cajamarca–Bambamarca road, 55 km N of Cajamarca, 06°55′S, 78°35′W, 3750 m, 6 Feb 1984, *Smith et al. 7428* (MO). **La Libertad:** Prov. Bolívar, entre Longotea y Bolívar, en jalca, 3600 m, 2 Jun 1960, *López & Sagásteguii 3340* (US); Prov. Pataz, Paso de Alaska, Carretera a Tayabamba, 3900 m, 24 Jun 1974, *López & Sagásteguii 8180* (MO). **San Martin.** Prov. Mariscal Caceres, grassland in NW sector Río Abiseo Parque Nacional, 07°40′S, 77°30′W, 3650 m, *B. León & Young 1662* (MO).

32. Festuca boyacensis Stančík, Darwiniana 41(1–4): 128, f. 7f–k. 2003. (**Figs. 37, 41, 89A & B**). Type: Colombia. Boyacá, Mun. Aquitánia, páramo Los Curies, 3500 m, 8 Feb 1999, *D. Stančík & Medina 2166* (holotype: PRC!; isotypes: COL!, FMB!).

Tussocked perennials with intravaginal innovations. Culms 30–60 cm tall, erect, glabrous; nodes 1 near base with 2 short leaves. Leaf sheaths membranous, stramineous, occasionally brownish, glabrous; auricles absent; ligules 0.3–0.6 mm long, membranous, apex truncate, ciliate; blades 15–20 cm long, 0.4–0.7 mm wide, conduplicate to involute, glaucous, abaxially finely scabrous, apex acute. Panicles 6–15 × 0.5–1 cm, contracted, narrow; branches scabrous. Spikelet 8–9.5 mm long, lanceolate, florets 3 or 4; rachilla glabrous; glumes 3–5.2 mm long, membranous, glabrous, margins finely ciliate, purplish, apex acute; lower glumes 3–3.7 mm long, lanceolate, 1-nerved; upper glumes 4–5 mm long, ovate, 3-nerved; lemmas 6–7.5 mm long, lanceolate, 5-nerved, membranous, glabrous, purplish, awned, the awn 1–2 mm long; callus glabrous; paleas 5/6 as long as the lemma, glabrous, keels ciliate; lodicules lanceolate, acuminate; anthers 0.9–1.2 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 1/2 as long as the grain.

Leaf blade anatomy.—Cross-sections with 5–7 vascular bundles and 3–5 ribs above; sclerenchyma only abaxially present, discontinuous or almost continuous; bulliform cells absent; adaxial epidermis with sporadic hairs, the hairs 0.01–0.1 mm.

Observations.—Festuca boyacensis is morphologically similar to the Ecuadorian species, *F. chimborazensis*. However, *F. chimborazensis* has smaller culms [8–15(–28) versus 30–60 cm], smaller panicles (2–8 versus 6–15 cm), and glumes with obtuse (acute in *F. boyacensis*) apices.

Distribution and habitat.—Festuca boyacensis is endemic to Colombia, known only from the Cordillera Oriental (Boyacá). It occurs in swampy patches and margins of lakes and springs in grass paramos between 3000–3500 m.

Additional specimens examined. **COLOMBIA. Boyacá:** Mun. Santa Rosa de Viterbo, páramo Alto Lamadero, 3200 m, 30 Nov 1999, *D. Stančík 1493* (COL, MB, PRC).

33. Festuca carchiense Stančík, Folia Geobot. Phytotax. 39(1): 98, f. 1, 1–5. 2004. (**Figs. 42, 44,**

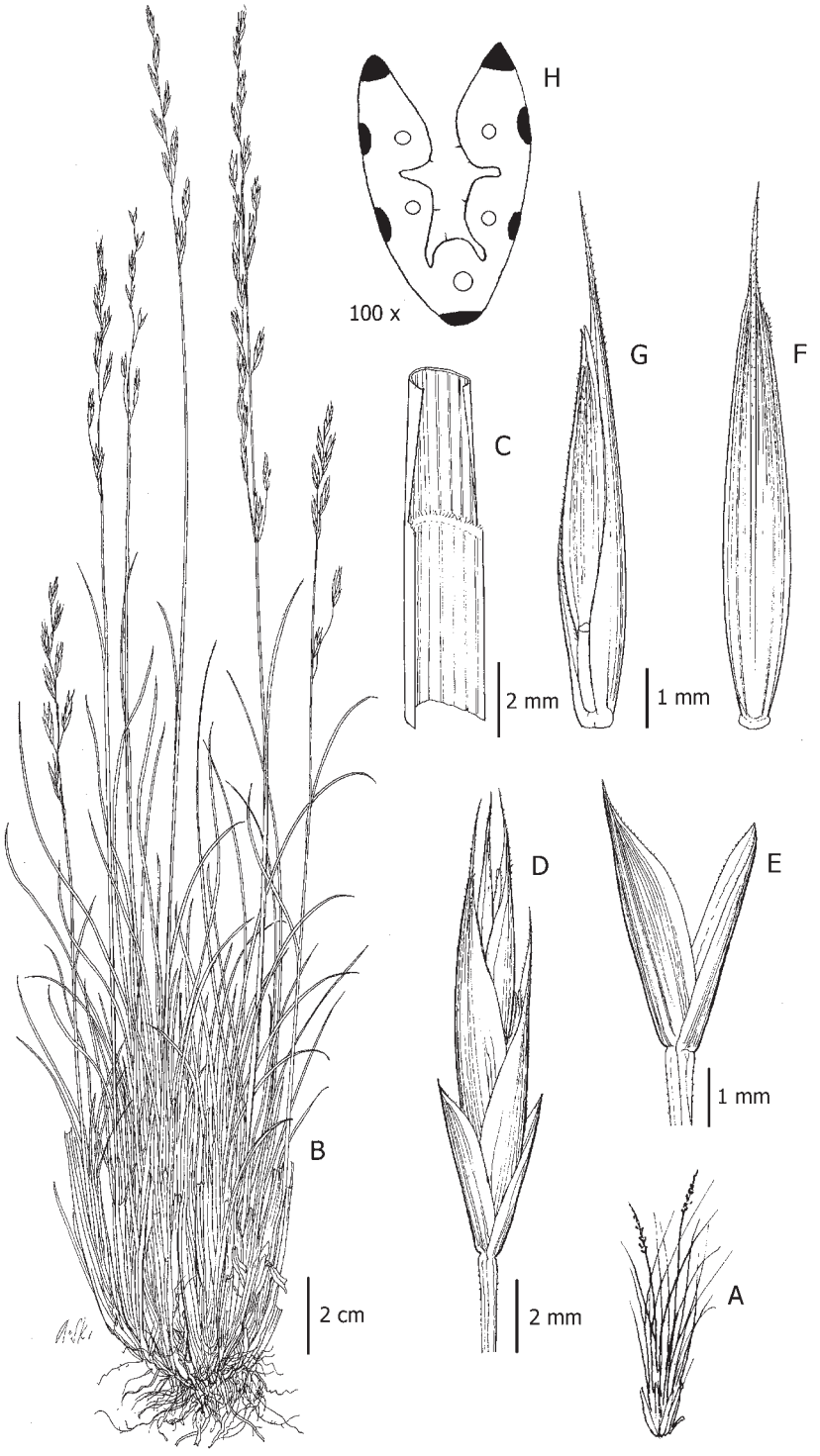


Figure 41. *Festuca boyacensis.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 1493* (PRC).

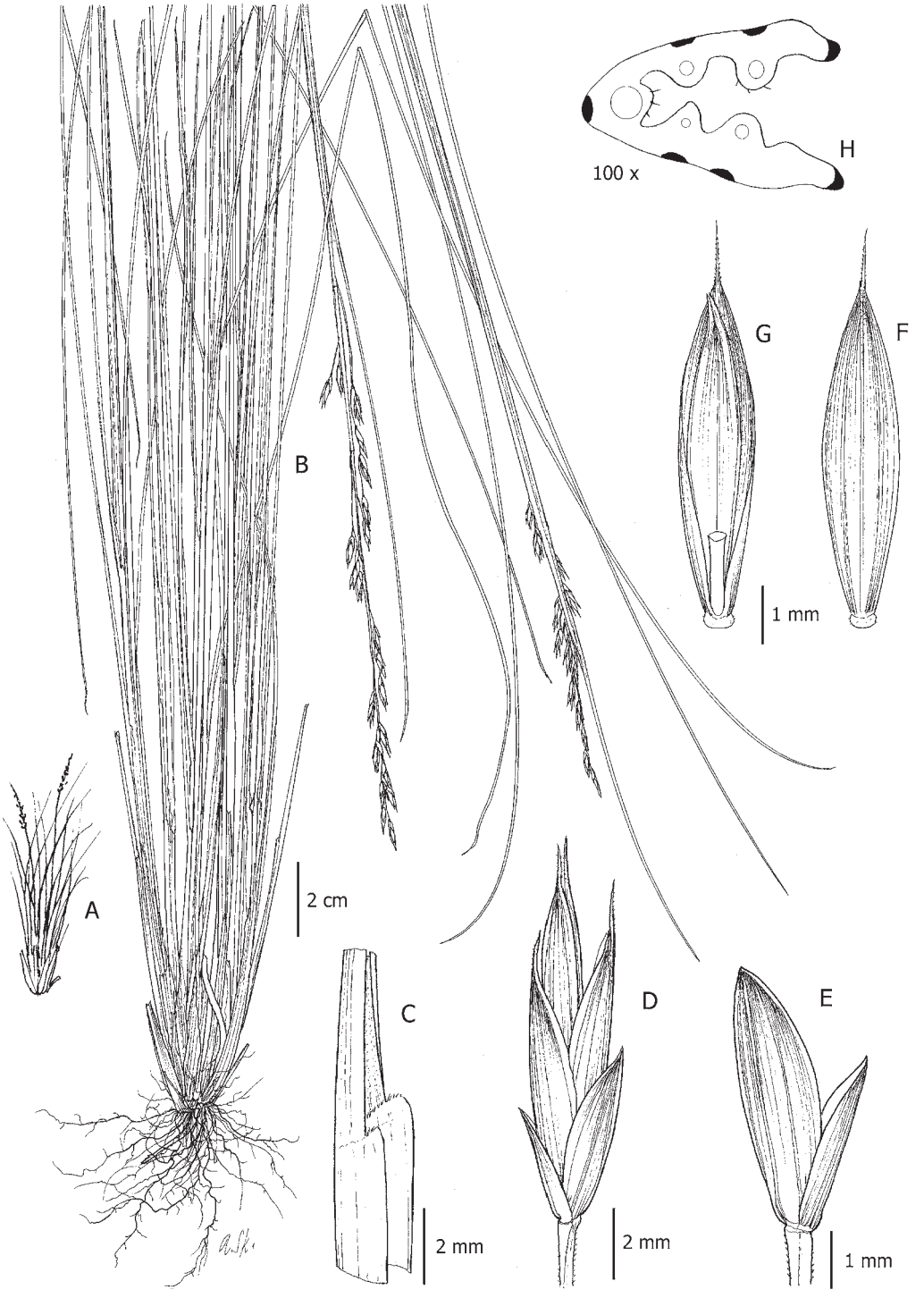


Figure 42. *Festuca carchiense.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Laegaard 101162* (AAU).

89C & D). Type: Ecuador. Carchi, km 11 along road Las Juntas (Tulcan)–El Angel, 77º50´W, 00º43´N, 3330 m, 11 Mar 1992, *S. Laegaard 101716* (holotype: AAU!; isotypes: PRC!, QCA!, QCNE!).

Densely tussocked perennials with intravaginal innovations. Culms 50–60 cm tall, erect, glabrous; nodes 1, basal. Leaf sheaths membranous, brownish-gray, glabrous, inconspicuously striate; ligules 0.5–0.8 mm long, apex short-ciliate; blades 25–40 cm long, 0.4–0.7 mm wide, conduplicate to involute, finely abaxially scabrous, green, apex obtuse. Panicles 10–20 × ca. 0.7 cm, contracted, slender; branches scabrous. Spikelets 9–10.5 mm long, lanceolate, florets 3 or 4; rachilla with scattered hairs; glumes (3.5–)4–6.5 mm long, membranous, purplish-green, upper 1/5 scabrous; lower glumes (3.5–)4–4.5 mm long, oblong-lanceolate, 1-nerved, apex acute; upper glumes 5–6.5 mm long, oblong, 3-nerved, apex acute; lemmas (6–)7–7.5 mm long, lanceolate, 5-nerved, membranous, purplish-green, scabrous distally, awned, the awn 0.8–1.5 mm long; callus with scattered hairs; paleas as long as the lemma, membranous, upper 1/3 and keels scabrous to hairy; lodicules ca. 0.7 mm long, lanceolate; anthers 1.1–1.3 mm long; ovary apex glabrous. Caryopses not observed.

Leaf blade anatomy.—Cross-sections with 5 vascular bundles, 3(–5) ribs above; sclerenchyma discontinuous and small under abaxial epidermis, absent under adaxial epidermis; adaxial epidermis with scattered hairs, the hairs ca. 0.09 mm long.

Observations.—Festuca carchiense is morphologically similar to *F. glumosa* and *F. imaburensis*. (See details in *F. glumosa* section).

Distribution and habitat.—This species is known only from northern Ecuador (Carchi, Imbabura) and it occurs in grass paramo between 3200–3800 m.

Additional specimens examined. **ECUADOR. Carchi:** Páramo del Angel, lakes at Los Voladeros, 00º41´N, 77º53´W, 3700 m, *S. Laegaard 101294* (AAU, QCA); 3200–3800 m, *S. Laegaard 55769* (AAU). **Imbabura:** road Yahuarcocha–Mariano Acosta, km 20, Paramo de Mariano Acosta, 00º20´S, 78º00´W, 3600–3650 m, 8 Feb 1992, *S. Laegaard 101162* (AAU, QCA, PRC).

34. Festuca chimborazensis E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 1549. 1984. (**Figs. 43, 44, 90A & B**). Type: Ecuador. Chimborazo, Iter Regnellianum quartum, Flora Aequatoriensis, prov. Chimborazo, southern slopes of Mt. Chimborazo, hard dry ground along a rivulet, 3900 m, 21 Aug 1939, *E. Asplund 8446* (holotype: S!; isotypes: NY!, QCA!).

Densely tufted perennials with intravaginal innovations. Culms 8–15(30) cm tall, erect, glabrous; nodes 1, basal with a single short leaf. Leaf sheaths coriaceous, grayish, finely striate, glabrous; ligules 0.3–0.4 mm long, membranous, apex truncate, short-ciliate; blades 4–15 cm long, 0.4–0.6 mm wide, conduplicate to involute, curved to mostly straight, glaucous, apex obtuse. Panicles 2–10 cm long, 5–7 mm wide, contracted, narrow; branches scabrous on all surfaces. Spikelets 8–10(–11.5) mm long, lanceolate, florets 3 or 4(–5); rachilla with scattered short hairs; glumes 2.5–5 mm long, 2/5–1/2 the length of the spikelet, membranous to coriaceous, finely ciliate on margins, whitish-green, apex obtuse; lower glumes 2.5–3.5 mm long, oblong, 1-nerved; upper glumes 3.5–5 mm long, ovate, 3-nerved; lemmas 6–6.5(–7) mm long, lanceolate, 5-nerved, membranous, glabrous, whitish-green, sometimes purplish, awned, apex acuminate, the awn 1–2 mm long; callus glabrous; paleas 5/6 as long as the lemma, glabrous, ciliate on keels; lodicules ca. 0.8 mm long, lanceolate, acuminate; anthers 0.7–0.8 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 1/2–3/5 as long as the grain.

Leaf blade anatomy.—Cross-sections with 5(–7) vascular bundles and 3(–5) ribs above; sclerenchyma present abaxially, continuous or discontinuous; bulliform cells absent; adaxial epidermis with few hairs, the hairs ca. 0.09 mm long.

Observations.—Morphologically it appears that *F. boyacensis* from the Colombian Cordillera Oriental is most similar to *F. chimborazensis*. Other species that appear similar morphologically are *F. glumosa, F. imbaburensis*, *F. carchiense*, and *F. sumapana*. All of these species are more robust, i.e., with larger culms and have straight and often scabrous leaf blades.

Distribution and habitat.—This species is endemic to Ecuador (Bolívar, Chimborazo, Cotopaxi, Pichincha, Tungurahua). It is known from humid or swampy patches in the superparamo growing between 3500–4500 m.

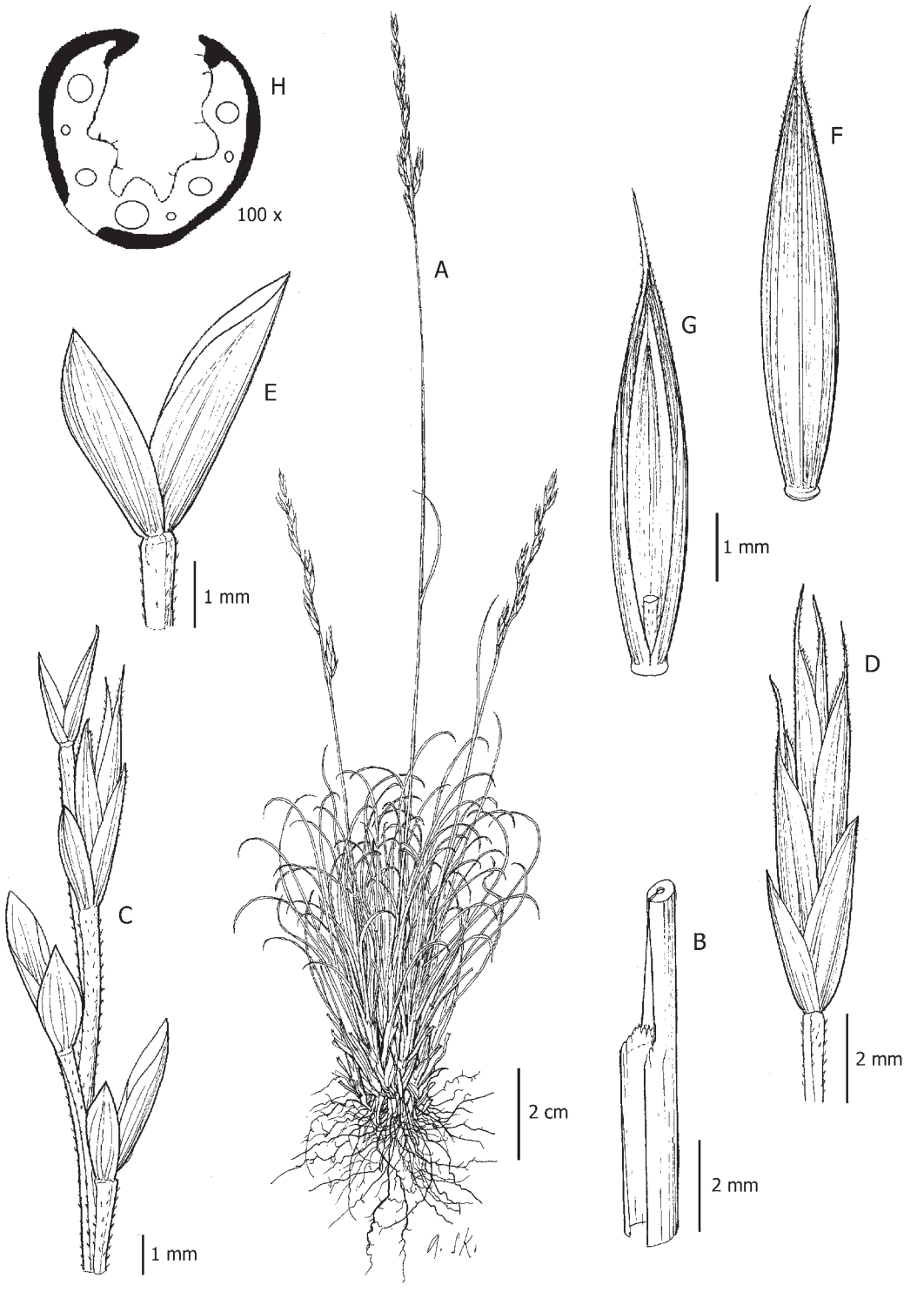


Figure 43. *Festuca chimborazensis* subsp. *chimborazensis*. **A.** Habit. **B.** Ligule. **C.** Inflorescence (detail). **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 3883* (PRC).

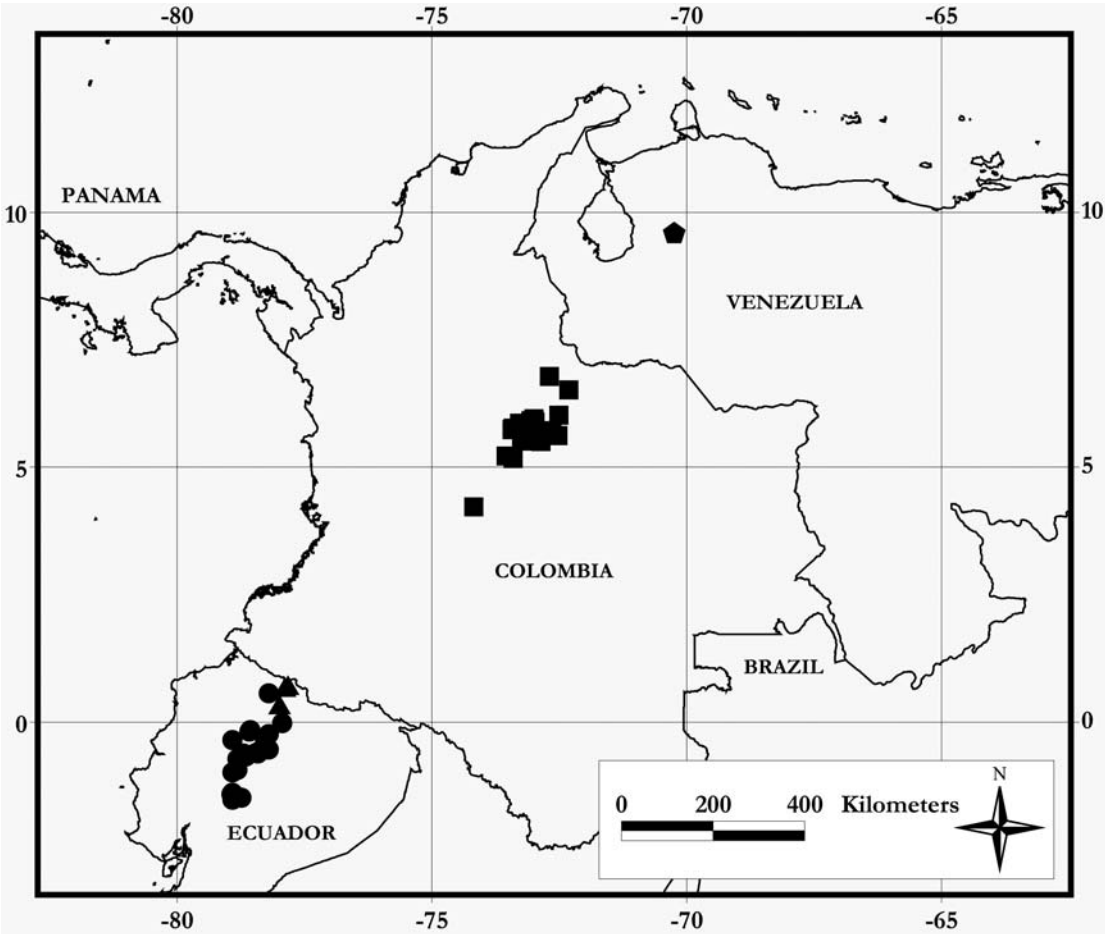


Figure 44. Distribution of *Festuca chimborazensis* (●), *F. carchiense* (▲), *F. cleefiana* (■), and *F. dinirica* (⬟).

KEY TO THE SUBSPECIES OF *FESTUCA CHIMBORAZENSIS*

1. Leaf blades 4–9 cm long, curved; leaf cross-sections with only 5 vascular bundles; culms 8–15 cm tall; panicles 2–8 cm long, ca. 5 mm wide; upper glumes 4.5–5 mm long ..... **34a. F. chimborazensis** subsp. **chimborazensis**
1. Leaf blades 11–15 cm long, mostly straight; leaf cross-sections with (5–)7 vascular bundles; culms 22–40 cm tall; panicles 8–10 cm long, ca. 7 mm wide; upper glumes 3.5–4 mm long ..... **34b. F. chimborazensis** subsp. **micacochensis**

34a. Festuca chimborazensis subsp. **chimborazensis (Fig. 43)**.

Culms 8–15 cm tall. Leaf blades 4–9 cm long, curved; leaf cross-sections with only 5 vascular bundles. Panicles 2–8 cm long, ca. 5 mm wide. Spikelets with upper glumes 4.5–5 mm long.

Additional specimens examined. **ECUADOR. Bolívar:** Road Ambato–Guaranda, 12 km W of intersection between old and new road, 01°26´S, 78°56´W, 4150 m, 1 Aug 1985, *S. Laegaard 54820* (AAU, QCNE); 55.4 km SW of Ambato, 4050 m, 3 May 1990, *P.M. Peterson 8979 & C.R. Annable* (MO, QCA, QCNE, US); 66.5 km SW of Ambato,

4300 m, *P.M. Peterson & C.R. Annable 8995* (MO, QCA, US); km 4 on the road Los Arenales–Salinas, 01°24´S, 78°55´W, *S. Laegaard 55346* (AAU); 66.5 km SW of Ambato on Hwy to Guaranda and 2.2 km on road to Fecundo Vela, sandy volcanic soil in *Festuca-Calamagrostis* grassland, 4300 m, 5 Mar 1990, *P.M. Peterson & C.R. Annable 8996A* (MO). **Chimborazo:** Southern slope of Mt. Chimborazo, 3900 m, *E. Asplund 8411, 8446* (NY, QCA, S); 3800 m, *Fagerlind et al. 934bis* (S); along Whymper road ca. 15 km S of Cruce de Los Arenales, 01°32´S, 78°52´W, 3950 m, 18 Sep 1998, *S. Laegaard 19155* (AAU, QCNE); Urbina towards Mt. Chimborazo, 3700 m, *E. Asplund 7892* (K, NY); sector Cruce de los Arenales, swampy, 01°28´14˝S, 78°54´06˝W, 4300 m, 20 Sep 2000, *D. Stančík 3711, 3719* (PRC, QCA); 01°27´0.8˝S, 78°53´57.5´W, 4150 m, 20 Sep 2000, *D. Stančík 3710, 3720* (AAU, PRC, QCA). **Cotopaxi:** Volcán Cotopaxi, N side of the mountain, superparamo vegetation, sandy slope, 00°39´S, 78°42´W, 4250–4450 m, *Sklenář & Kostečková 858* (AAU); Parque Nacional Cotopaxi, NW of Limpio Pungo, 00°37´S, 78°27´W, 3850–4000 m, *S. Laegaard 52125* (AAU); Hacienda Pauzacha S of Volcán Cotopaxi, 00°44´S, 78°49´W, 3650 m, *S. Laegaard 55736* (AAU); along road El Chaupi–Pastocalle, 00°41´S, 78°39´W, 3500 m, 2 Jul 1985, S. *Laegaard 54594* (AAU, QCA, QCNE); Angamarca road 5 km from junction to road Latacunga–La Mana, 01°00´S, 78°55´W, 4250–4280 m, *S. Laegaard 102156* (AAU); 21.5 km E of Pilalo, 3820 m, 15 Apr 1990, *P.M. Peterson 8768, C.R. Annable & M.E. Poston* (MO, QCA, US); Tililac, 4000 m, *Acosta-Solís 16765* (US); Mun. Chaupi, NE slope of Volcán Illiniza Norte, 00°38´S, 78°42´W, 4000–4050 m, 12 Oct 2000, *D. Stančík 4024, 4031B*, 4033B (PRC, QCA); swampy patches, 00°38´S, 78°42´W, 4000–4050 m, 12 Oct 2000, *D. Stančík 4034* (AAU, PRC, QCA, US); Mun. Lasso, Parque Nacional Cotopaxi, NNE slope of Volcán Cotopaxi, valley of Quebrada Taniloma, 00°36.8´S, 78°24.3´W, 3750 m, 21 Jun 1999, *D. Stančík 3080* (AAU, PRC, QCA, W); E slope of Volcán Cotopaxi, 00°38´S, 78°25´W, 4300 m, 28 Sep 2000, *D. Stančík 3880* (AAU, PRC, QCA); plain below SE slope of Volcán Cotopaxi, 0°37´S, 78°24´W, 3800–3900 m, 28 Sep 2000, *D. Stančík 3883* (PRC, QCA). **Pichincha:** Iter Regnellianum quartum, Flora Aequatoriensis, prov. Pichincha, Sincholagua, 4200 m, 7 Jul 1939, *E. Asplund 8641* (S-paratype); mountain ridge ca. 2 km to the W from Cerro Saraurcu, 4200–4350 m, *Sklenář & Kostečková 1322* (AAU); Volcán Iliniza, NE slope below the refugio, 00°39´S, 78°42´W, 4430 m, *Holm-Nielsen 24871* (AAU); Entre Pifo y boqueron de Cerro Corrales, Paramo de Guamaní, 4050 m, *Barclay & Juajibioy 8905* (COL, MO); Volcán Antisana, between campsite IMAP and Laguna Micacocha, 00°33´S, 78°12´W, 3850–3950 m, *S. Laegaard 101583* (AAU, QCA, QCNE); N side, ca. 12 km along road from Hacienda Antisana, 00°27´S, 78°10´W, *S. Laegaard 102892* (AAU); 00°30´S, 78°00´W, 4100 m, *Grubb et al. 620* (NY, US); NE slope of Rucu Pichincha, 00°10´S, 78°34´W, 4300 m, *Sklenář & Kostečková 1-24* (NY). **Tungurahua:** Comunidad Rumipata, pasture in paramo, 00°22´S, 78°55´W, 4000 m, *Brandbyge 42597* (AAU, MO).

34b. Festuca chimborazensis subsp. **micacochensis** Stančík, Folia Geobot. Phytotax. 39(1): 105, f. 3, 6–10. 2004. Type: Ecuador. Pichincha/Napo, Volcán Antisana, between Campamento IMAP and Laguna Micacocha, 00°33´S, 78º12´W, naked soil on trail, 3850–3950 m, 7 Mar 1992, *S. Laegaard 101612* (holotype: AAU!; isotypes: PRC!, QCA!, QCNE!).

Culms 22–40 cm tall. Leaf blades 11–15 cm long, mostly straight; leaf cross-sections with (5–)7 vascular bundles. Panicles 8–10 cm long, ca. 7 mm wide. Spikelets with upper glumes 3.5–4 mm long.

Distribution and habitat.—Festuca chimborazensis subsp. *micacochensis* has so far only been recorded from three sites: western slopes of Antisana, northern slopes of Chimborazo, and at Guagua Pichincha. At all three sites this subspecies is sympatric with *F. chimborazensis* subsp. *chimborazensis*.

Additional specimens examined. **ECUADOR. Bolívar:** 55.4 km SW of Ambato on Highway to Guaranda, 4050 m, 3 May 1990, *P.M. Peterson 8982 & C.R. Annable* (K, MO, QCA, QCNE, US); km 42.7, 4020 m, 3 May 1990, *P.M. Peterson 8973 & C.R. Annable* (MO, QCA, QCNE, US); along main road ca. 1 km W of Cruce de Los Arenales, 01º25´S, 78º54´W, 4050–4100 m, *S. Laegaard 101517* (AAU). **Pichincha:** Pifo–Pintag road, in valley 2.5 hours horseride above Inga Monserrat, 00º19´S, 78º17´W, 3625–3725m, 11 Apr 1992, *S. Laegaard 102253* (AAU, QCA, QCNE); road Lloa–Guagua Pichincha, km 11, 00º12´S, 78º35´W, 4300 m, *S. Laegaard et al. 102744* (AAU); *S. Laegaard et al. 102739* (AAU, QCA).

35. Festuca chita Stančík, Darwiniana 41(1–4): 129, f. 13a–f. 2003. (**Figs. 45, 49**). Type: Colombia. Boyacá, Cañon del Chicamocha, Mun. Chita, Vereda Los Colorados, 3300 m, 14 May 1991, *Etter 661* (holotype: COL!).

Tussocked perennials with intravaginal innovations. Culms 40–60 cm tall, erect, glabrous; nodes 1, basal; cataphylls small, coriaceous. Leaf sheaths membranous, brown to purplish-brown, glabrous; auricles absent; ligules 0.3–0.5 mm long, membranous, apex truncate, short-ciliate; blades 10–15 cm long, 0.4–0.6 mm wide, involute, green, abaxially glabrous, apex obtuse. Panicles ca. 8 cm long, ca. 3 cm wide, contracted; branches glabrous. Spikelets 8–9 mm long, lanceolate, florets 3 or 4; rachilla densely hairy; glumes 5.5–8(–8.5) mm long, coriaceous, dark purple; lower glumes 5.5–6.5 mm long, narrowly lanceolate, 1-nerved; upper glumes 7–8(–8.5) mm long, lanceolate, 3-nerved, sparsely scabrous; lemmas 6.5–7.5 mm long, lanceolate, 5-nerved, coriaceous, dark purple, scabrous and short-hairy, entire, awned, the awn 0.5–1.5 mm long; callus glabrous or sparsely hairy; paleas 2/3–4/5 as long as the lemma, glabrous, apex hairy; anthers 0.8–1.1 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 1/2 as long as the grain.

Leaf blade anatomy.—Cross-sections with 7–11 vascular bundles and 5 ribs, sclerenchyma under abaxial epidermis discontinuous, extending to all the vascular bundles, adaxial sclerenchyma present, extending to vascular bundles only exceptionally; bulliform cells absent; adaxial epidermis hairy, the hairs ca. 0.5 mm long.

Geographical distribution.—This species is endemic to the Colombian Cordillera Oriental, at Cañon del Chicamocha and is only known from the type locality at an altitude of 3300 m. The Cañon del Chicamocha is a dry valley without typical paramo vegetation.

Additional specimens examined. **COLOMBIA. Boyacá:** Cañon del Chicamocha, Mun. Chita, Vereda Los Colorados, 3300 m, 27 Jan 1927, *Killip 18479* (COL).

36. Festuca cleefiana E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 1548. 1984. (**Figs. 44, 46, 90C−F**). Type: Colombia. Boyacá, Páramo de la Rusia, NW-N de Duitama Aislada, 3580 m, 7 Dec 1972, *A.M. Cleef 6826* (holotype: US-2785718!; isotypes: COL!, U!).

Densesly tussocked perennials with intravaginal innovations. Culms 70–130(–150) cm tall, erect, glabrous sometimes finely scabrous; nodes 1 or 2(–3). Leaf sheaths, membranous to coriaceous, grayish-brown, glabrous; auricles absent; ligules (0.5–)1–2(–2.5) mm long, membranous to coriaceous, apex mostly obtuse, short-ciliate; blades 30–50(–60) cm long, 0.6–0.9(–1.1) mm wide, conduplicate, abaxially glabrous, green, apex obtuse. Panicles 10–20(–25) × 3–10(–15) cm, flexuous, branched, erect, oblong; branches finely scabrous. Spikelets 8–11 mm long, oblong, florets 4–6(–7); rachilla long, densely pilose; glumes (3.5–)4–7.5(–8) mm long, narrowly lanceolate, coriaceous, purple or purplish-green, upper 1/4 scabrous, apex acute; lower glumes (3.5–)4–6(–6.5) mm long, 1-nerved; upper glumes (5.5–)6–7.5(–8) mm long, 3-nerved; lemmas 6–7.5(–8) mm long, lanceolate, membranous to coriaceous, 5-nerved, purplish-green, scabrous to densely hairy, apex short two-dentate, awned, the awn 0.5–2.5 mm long; paleas as long as the lemma, papillose, upper 1/3 hairy; lodicules oblong-lanceolate, acuminate; anthers (2–)2.5–3 mm long; ovary apex glabrous. Caryopses oblong-lanceolate; hilum 3/4 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with 7–9(–11) vascular bundles and 5–9 ribs; sclerenchyma under abaxial epidermis continuous or discontinuous, extending to all the vascular bundles; adaxial epidermis present, extending to all or every other vascular bundle; bulliform cells absent; adaxial epidermis densely hairy, the hairs 0.02–0.07 mm long.

Observations.—Festuca cleefiana is an easily recognizable species, forming relatively large tufts with flexuous, ramified panicles and spikelets with typically long glumes.

Distribution and habitat.— Festuca cleefiana is endemic to Colombian Cordillera Oriental (Cundinamarca, Boyacá, Santander). It is a typical species of the grass paramo occurring between 3300–4000 m. This species is known from the communities of *Festuca dolichophylla* & *Paspalum bonplandianum* (Rangel & Sturm 1995), *Sphagno magellanici-Chusquetum tesellatae* (Rangel & Sturm 1995), *Hypericum juniperinum* (Cleef 1981).

Additional specimens examined. **COLOMBIA. Cundinamarca:** Mun. Bogotá, valley between Usme and Nazareth, 4º13´N, 74º11´W, 3480 m, 16 Jul 1998, *D. Stančík 272* (PRC); Mun.

Figure 45. *Festuca chita.* **A.** Stylized growth form. **B.** Habit. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Leaf blade cross-section. A–F**,** *Etter 661* (COL).

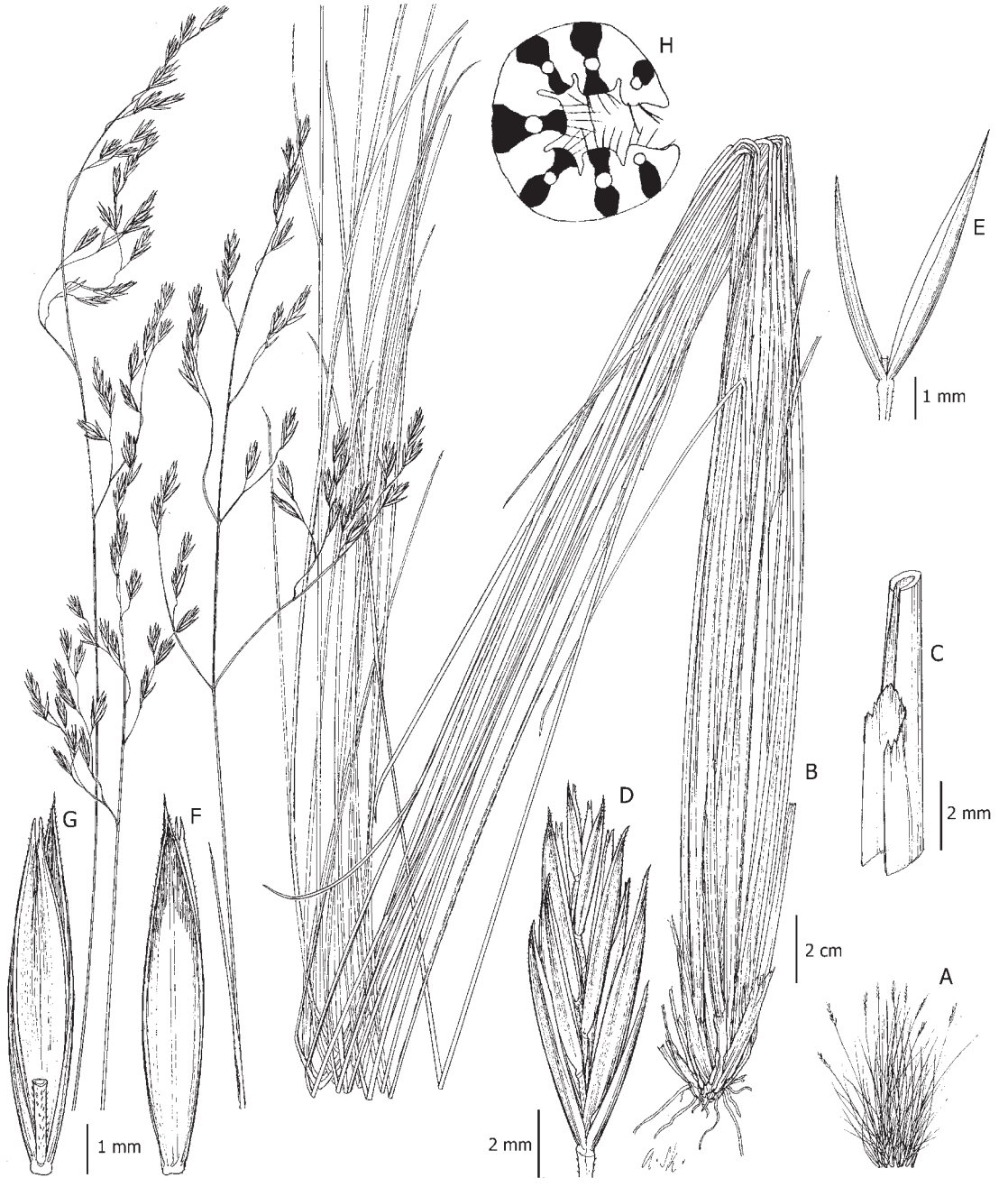


Figure 46. *Festuca cleefiana.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 1421* (PRC).

Villapinzón, Paramo La Calera, 5º12´N, 73º33´W, 3500 m, 22 Jul 1978, *D. Stančík 409, 466, 467* (COL, PRC). **Boyacá:** Mun. Aquitania, Páramo El Guarne, 3500 m, 8 Feb 1999, *D. Stančík 2160*, *2188, 2189* (COL, FMB, COL); Mun. Aquitania, road to Sisvaca, km 6, 2900 m, 10 Feb 1999, *D. Stančík 1920* (COL, FMB, PRC); *D. Stančík 2257* (COL, FMB, PRC); km 2, 3350 m, 14 Jan 1999, *D. Stančík 1950* (PRC); 3240 m, 14 Jan 1999, *D. Stančík 1964* (COL, FMB, PRC); 3450 m, 14 Jan 1999, *D. Stančík 1935* (COL, FMB, PRC); Mun. Aquitania, Páramo Sarna, 3400 m,

20 Jan 1999, *D. Stančík 2000* (COL, PRC); Mun. Arcabuco, Santuario Iguaque, Laguna Iguaque, 3600 m, 14 Oct 1998, *D. Stančík 924, 926, 945* (COL, FMB, PRC); Lagun Ojo de Agua, 3650 m, 14 Oct 1998, *D. Stančík 927* (COL, FMB, PRC); Mun. Arcabuco, SW slope of Cerro Volcán, 3000 m, 20 Nov 1998, *D. Stančík 1407* (COL, FMB, PRC); Mun. Belén, Páramo de Güina, 3250 m, 6 Feb 1999, *D. Stančík 2130, 2136* (COL, PRC); 3300 m, 6 Feb 1999, *D. Stančík 2137, 2138* (PRC); Mun. Duitama, Páramo de La Rusia, 5º54´27˝N, 73º4´44˝W, *D. Stančík 1004* (COL); 3750 m, 12 Feb 1999, *D. Stančík 2367, 2372, 2373* (COL, PRC); 3580 m, 3540 m, *Hernández 1311* (COL); Páramo Pan de Azucar, 3400 m, 30 Nov 1998, *D. Stančík 1421*, *1422* (COL, FMB, PRC); 3350 m, 30 Nov 1998, *D. Stančík 1423* (COL, FMB, PRC); 3400 m, 30 Nov 1998, *D. Stančík 1482* (COL, FMB, PRC, US); Mun. El Cocuy, Parque Nacional El Cocuy, Las Cabanas Kanwara, 4070 m, 30 Dec 1998, *D. Stančík 1827, 1865* (COL, FMB, PRC); 4350 m, 30 Dec 1998, *D. Stančík 1828, 1830* (COL, FMB, PRC); pass between Cocuy and Chita, 4000 m, 3 Feb 1985, *Wood 5141* (COL, K); Mun. Chinavita, Cerro Mamapacha, 2900 m, 11 Dec 1998, *D. Stančík 1602, 1635, 1640* (COL, FMB, PRC); 2850 m, 11 Dec 1998, *D. Stančík 1629* (COL, PRC); 11 Dec 1998, *D. Stančík 1576, 1577, 1628* (COL, FMB, PRC); 11 Dec 1998, *D. Stančík 1580* (COL, PRC); Mun. Mongui, Laguna La Colorada, 3550 m, 21 Jan 1999, *D. Stančík 2020* (COL, FMB, PRC); 3650 m, 21 Jan 1999, *D. Stančík 2045* (COL, FMB, PRC); Mun. Paipa, Cuchilla El Páramo, 3200 m, 4 Dec 1998, *D. Stančík 1503*, *1532, 1555, 1556* (PRC); Mun. Santa Rosa de Viterbo, Alto Lamadero, 3200 m, 30 Nov 1998, *D. Stančík 1438, 1457, 1463, 1465* (COL, PRC); Mun. Siachoque, Páramo Siachoque, 05º30´N, 73º8´W, 3650 m, 24 Jan 1999, *D. Stančík 2051, 2050, 2054* (COL, FMB, PRC); Mun. Socota, Páramo Pisva, lagoon Chorro Negro, 3500 m, 11 Feb 1999, *D. Stančík 2346, 2350* (COL, FMB, PRC); Alto de Cardon, 3540 m, 11 Feb 1999, *D. Stančík 2314* (COL, FMB, PRC); Alto de Calarca, 3500 m, 11 Feb 1999, *D. Stančík 2313, 2332* (COL, FMB, PRC); Mun. Sotaquirá, Páramo Chontales, 3050 m, 15 Dec 1998, *D. Stančík 1688, 1689, 1690* (COL, FMB, PRC); 14 Nov 1998, *D. Stančík* 1339 (COL, FMB, PRC); Mun. Pesca Páramo Cortadero, vereda Puerta Chiquita, 3500–3700 m, 15 Oct 1981, *Bejarano 44* (COL); Páramo de Belén, 3500 m, 15 Nov 1999, *Rangel et al. 3515 (*COL); Mun. Toca, Páramo Cortadero, 5º30´N, 73º15´W, 3450 m, 14 Nov 1998, *D. Stančík 1339* (COL, FMB, PRC); 3350 m, 14 Nov 1998, *D. Stančík 1366* (COL, FMB, PRC); 3600 m, 14 Nov 1998, *D. Stančík 1373* (COL, FMB, PRC); Mun. Labranzagrande, Páramo Franco, 3300 m, 9 Feb 1999, *D. Stančík 2224, 2230, 2232, 2236, 2240* (COL, FMB, PRC); Mun. Labranzagrande, Valle de Río Cushiana, 5 km from Toquilla, 2950 m, 9 Feb 1999, *D. Stančík 2249* (COL, FMB, PRC). **Santander:** Mun. Concepción, vereda Juradito, Páramo de Gallina, 3500 m, 24 Feb 1999, *D. Stančík 2495, 2502, 2503, 2505,* (COL, FMB, PRC); 24 Feb 1999, *D. Stančík* 2489 (PRC).

37. Festuca cocuyana Stančík, Darwiniana 41 (1–4): 133, f. 12a–e. 2003. (**Figs. 39, 47, 91A−D**). Type: Colombia. Boyacá, Mun. Cocuy & Güicán, Parque Nacional El Cocuy, Alto de las Cuevas. Grass paramo with *Calamagrostis effusa*, *Espeletia* sp., *Acaulimlva* sp., etc., 3850 m, 30 Dec 1999, *D. Stančík 1886* (holotype: PRC!; isotypes: COL!, FMB!).

Tussocked perennials with intravaginal innovations. Culms 20–50 cm tall, erect, glabrous; nodes 1, basal. Leaf sheaths membranous to coriaceous, stramineous, glabrous, finely striate; auricles absent; ligules 0.6–1 mm long, membranous to coriaceous, apex truncate; blades 15–20 cm long, 0.8–1.5 (–2) mm wide, conduplicate or flat, abaxially glabrous. Panicles 8–12 cm long, 0.8–1.5 mm wide, contracted, narrow, elongate. Spikelets 10–13 mm long, lanceolate, florets 2 or 3; rachilla pubescent; glumes 7.5–10.5 mm long, almost as long as the spikelet, lanceolate, membranous, scabrous along midnerve, apex acute; lower glumes 7.5–8 mm long, 1-nerved; upper glumes 7.5–10.5 mm long, 3-nerved; lemmas 8–10 mm long, lanceolate, 5-nerved, membranous, awnless or short-awned, the awn ca. 0.5 mm long; callus glabrous or sparsely hairy; paleas 3/4 as long as the lemma, papillose, distally scabrous; lodicules 1–1.4 mm long, lanceolate, two-dentate; anthers 0.8–1.1 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 3/4 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with (8–)10–11 vascular bundles and 5–7 ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous; sclerenchyma girders absent; bulliform cells absent; adaxial epidermis with scattered hairs, the hairs ca. 0.02 mm long.

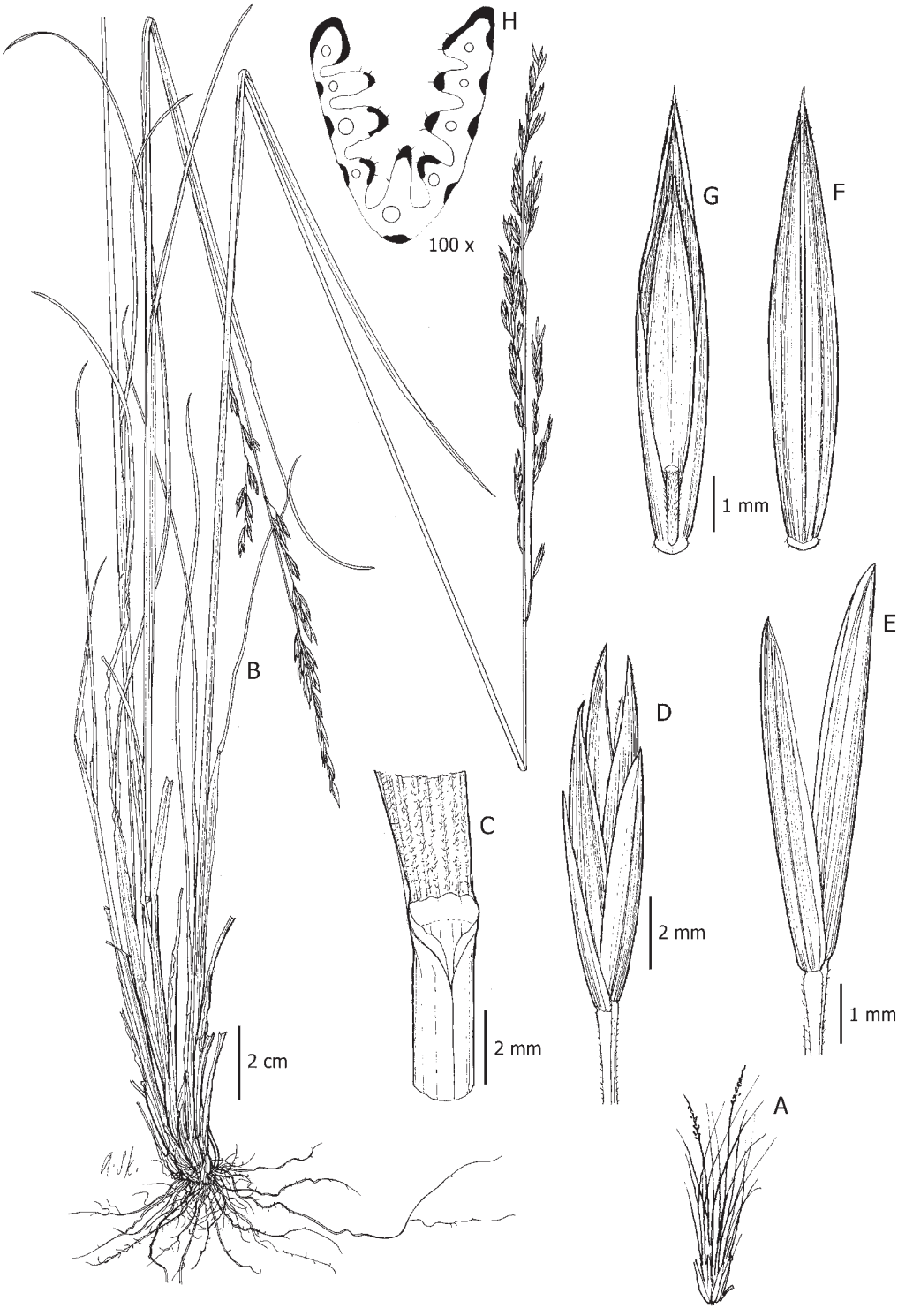


Figure 47. *Festuca cocuyana.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 1886* (PRC).

Observations.—Festuca cocuyana is morphologically similar to *F. sanctae-martae,* an endemic species of Sierra Nevada de Santa Marta. *Festuca cocuyana* differs from *F. sanctae-martae* by having shorter culms (20–50 verses 60–80 cm), shorter leaf blades (15–20 verses 25–35 cm), and shorter lower glumes (7.5–8 verses 8.5–9.5 mm).

Distribution and habitat.— It is endemic to the Sierra Nevada del Cocuy in the Colombian Cordillera Oriental. It occurs between 3800–4300 m, in grass paramo dominated by *Calamagrostis effusa* and *Espeletia* spp., and on rocky slopes in the superparamo.

Additional specimens examined. **COLOMBIA. Arauca:** Sierra Nevada del Cocuy, cabeceras de la Quebrada El Playón, Patio Bolos 2.5 km, al NW de la Laguna La Plaza, hoya S. José, 4300 m, 10 Mar 1973, *Cleef 9078* (COL); S of the Lagoon La Plaza, 4300 m, 31 Dec 1985, *Wood 5260* (COL, FMB, K).

38. Festuca cundinamarcae E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 1548. 1984. (**Figs. 48, 49, 91E & F, 92A & B**). Type: Colombia. Cundinamarca, Macizo de Bogotá, Cerro Diego Largo, paramo, 3540 m, 14 Jan 1940, *J. Cuatrecasas 7966* (holotype: S!; isotypes: COL!, U!, US!).

Tussocked perennials with intravaginal innovations. Culms 60–100(–120) cm tall, erect, scabrous; nodes 1 on distal half. Leaf sheaths coriaceous, stramineous, glabrous; ligules 0.1–0.3 mm long, coriaceous, apex truncate, short-ciliate; blades 30–50 cm long, 0.7–1(–1.2) mm wide, conduplicate, rigid, abaxially glabrous, dark green, apex obtuse or mucronate. Panicles 10–20 × 0.5–1.5 cm, contracted, narrow; branches scabrous. Spikelets 9–13 mm long, oblong-lanceolate, florets 5–7(–8); rachilla sparsely short-pilose; glumes 3–6 mm long, lanceolate, membranous to coriaceous, green, scabrous distally, apex acute; lower glumes 3–4.5 mm long, 1-nerved; upper glumes (4.5–)5–6 mm long, 3-nerved; lemmas (5.5–)6–7(–7.5) mm long, lanceolate, 5-nerved, membranous to coriaceous, glabrous, upper 1/3 scabrous, apex entire, usually awned, the awn up to 1 mm long; paleas as long as the lemma, papillose, upper 1/3 hairy; lodicules ca. 1.1 mm long, lanceolate, acuminate; anthers 2–3 mm long; ovary apex glabrous. *Caryopses* oblong-lanceolate; hilum 2/3 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with 9–15 vascular bundles and 7–13 ribs; sclerenchyma under abaxial epidermis discontinuous, extending to all or every other the vascular bundles, adaxial sclerenchyma present, often extending to the vascular bundles forming girders; bulliform cells absent; adaxial epidermis densely hairy, the hairs 0.09–0.2 mm long.

Distribution and habitat.—Festuca cundinamarcae is endemic to Colombia, where it is known only from the Cordillera Oriental (Cundinamarca, Boyacá, Meta). It is a common species of grass paramos growing between 2700–3700 m. This species occurs in communities such as: *Pentacalio nitidae-tessellatae* (Sánchez & Rangel 1990), *Calamagrostietum planifoli-effusae* (Vargas & Zuloaga 1985), *Espeletietum argenteae-Calamagrostiosum effusum* (Cuatrecasas 1934), *Bartsio santolinifoliae-Calamagrostietum effusae* (Rangel & Ariza 2000).

Additional specimens examined. **COLOMBIA. Boyacá:** Boyacá, 2700 m, 15 Apr 1964, *Saravia 3912* (COL, PRC); Mun. Pesca, Puerta Chiquita, Páramo de Cortadera, 3500–3700 m, 15 Oct 1981, *Bejarano 22* (UPTC); Mun. Aquitania, road Suse–Sisvaca, km 1.5–2, 3050 m, 13 Jan 1999, *D. Stančík 1939*, *1951, 1952* (COL, FMB, PRC); 14 Jan 1999, *D. Stančík 1944* (PRC); Páramo Sarna, 3350 m, 20 Jan 1999, *D. Stančík 1987, 1988* (COL, FMB, PRC); 3400 m, 20 Jan 1999, *D. Stančík 2005* (COL, FMB, PRC); 3200 m, 20 Jan 1999, *D. Stančík 1985, 1986* (COL, FMB, PRC); Mun. Aquitania, Páramo Suse, 3350 m, 14 Jan 1999, *D. Stančík 1929* (COL, PRC); 14 Jan 1999, *D. Stančík 1945* (PRC); 14 Jan 1999, *D. Stančík 1922* (COL, FMB, PRC); Mun. Belén, Páramo Güina, 3250 m, 6 Feb 1999, *D. Stančík 2109, 2115, 2116, 2117, 2120* (COL, PRC); 6 Feb 1999, *D. Stančík 2114, 2136* (COL, FMB, PRC); Mun. Mongui, Laguna La Colorada, 3300 m, 21 Jan 1999, *D. Stančík 2019* (COL, FMB, PRC); Mun. Toca, Páramo Cortadero, 05º30´N, 73º15´W, 2700 m, 14 Nov 1998, *D. Stančík 1402* (COL, FMB, PRC); 3200 m, 14 Nov 1998, *D. Stančík 1347, 1360, 1363, 1396* (COL, FMB, PRC); 4 Dec 1998, *D. Stančík 1513* (COL, FMB, PRC); Mun. Samaca, Páramo Rabonal, 2000 m, 1 Nov 1998, *D. Stančík 1286* (COL, FMB, PRC); Mun. Toquilla, Valle of Río Cushiana, 2950 m, 9 Feb 1999, *D. Stančík 2250* (COL, FMB, PRC); Mun. Tutasa, Páramo de Carnicerías, 3300 m, 26 Feb 1999, *D. Stančík 2597, 2599, 2612* (PRC); Mun. Paipa, cuchilla El Páramo, 3250 m, 3 Dec 1998,

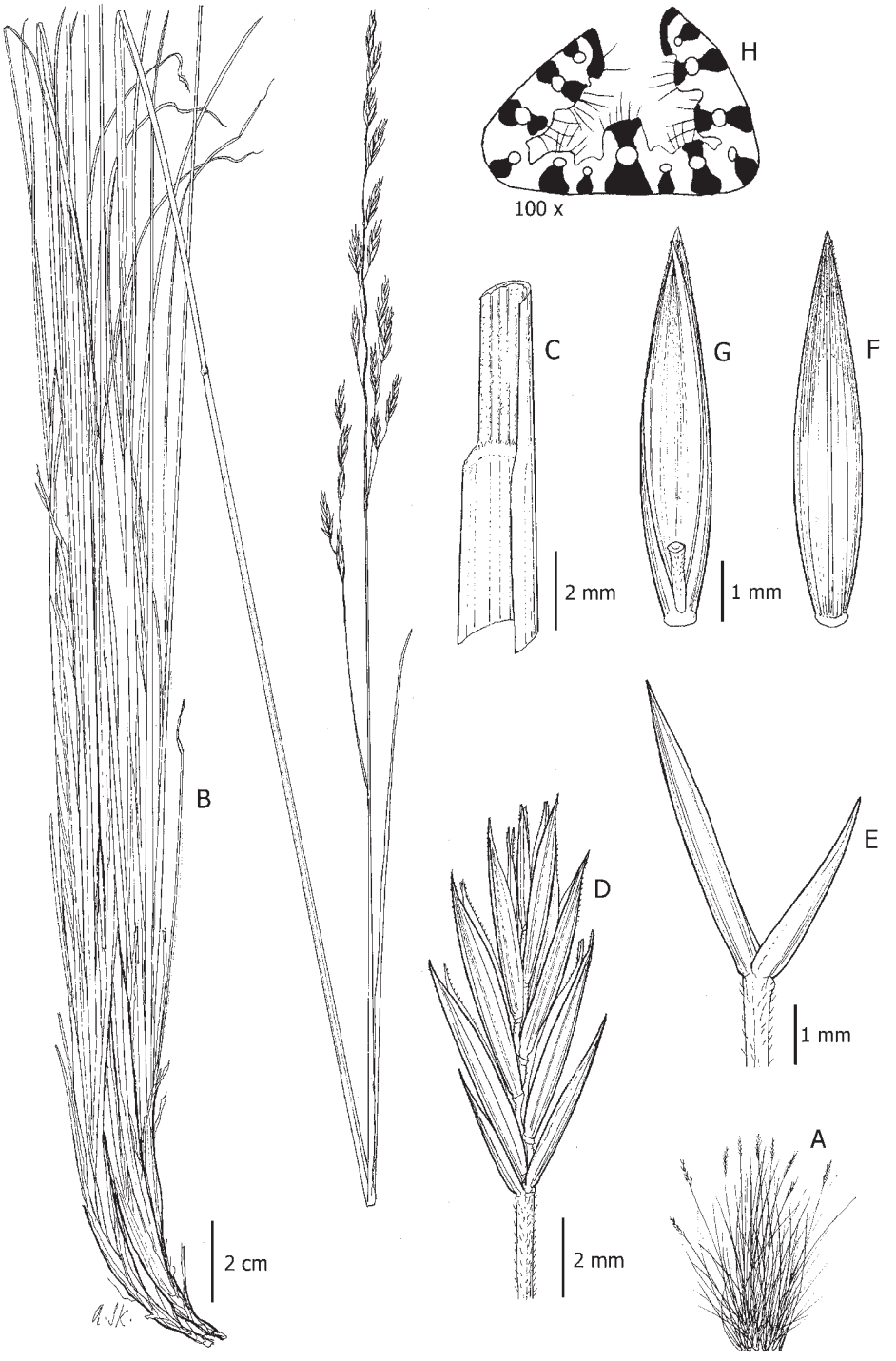


Figure 48. *Festuca cundinamarcae.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 3539* (PRC).

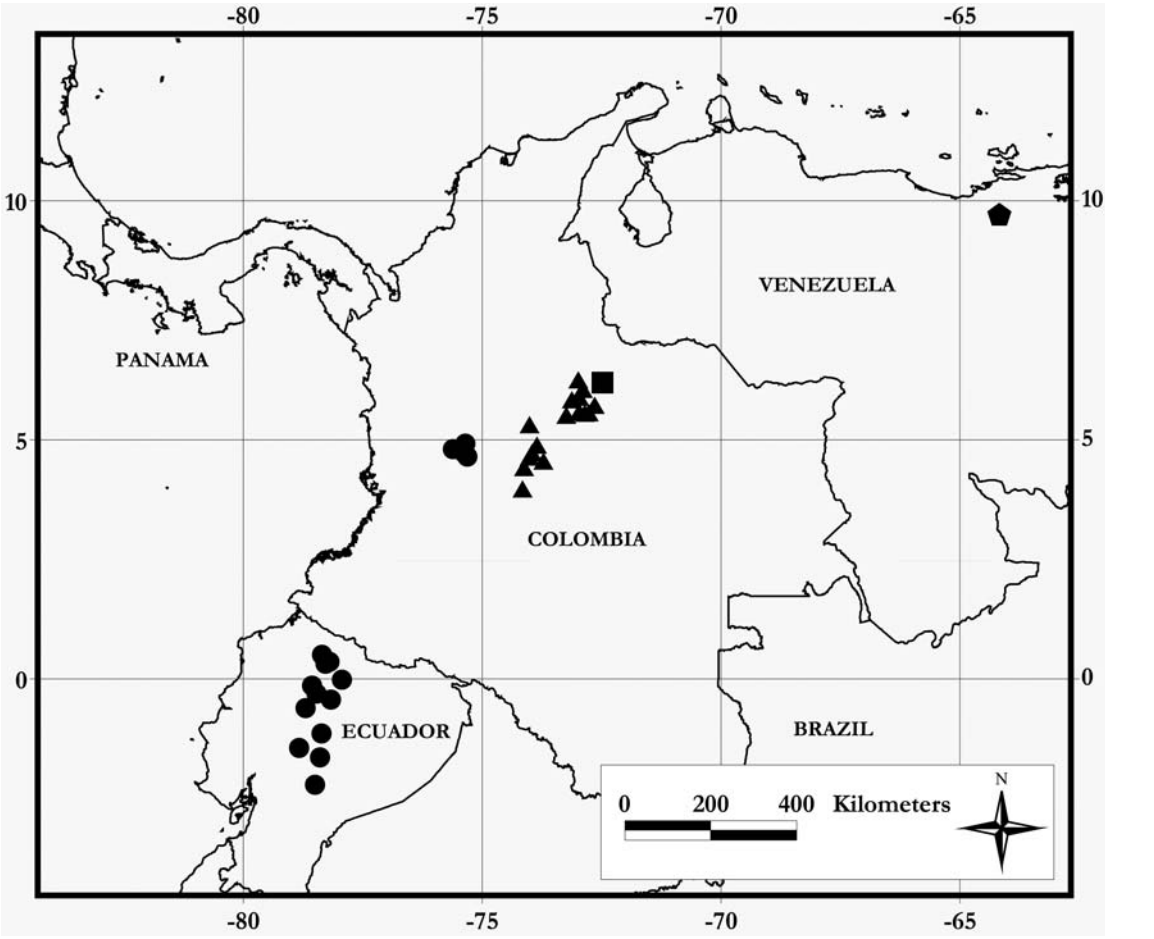


Figure 49. Distribution of *Festuca glumosa* (●), F. *cundinamarcae* (▲), *F. chita* (■), and *F.turimiquirensis* (⬟).

D. Stančík 1523 (COL, FMB, PRC); 4 Dec 1998, *D. Stančík 1511* (COL, PRC); Mun. Susacón, km 20, margin of river Susacón, 3150 m, 23 Feb 1999, *D. Stančík 2472* (PRC); 23 Feb 1999, *D. Stančík 2471, 2473* (COL, FMB, PRC). **Cundinamarca:** Cordillera de Bogotá, 2900 m, Nov 1856, *Triana s.n.* (US); Bogotá, Páramo de Monserrate, vereda El Verjon, 3000–3200 m, 29 Jul 1988, *Garzón 617* (COL); 3160 m, 15 Feb 1980, *Zuluoga 107* (COL); 3000–3300 m, 16 Apr 1944, *Killip et al. 38050* (COL); 3125m, 24 May 1968, *Valderrano 34* (UPTC); 3125m, 26 Apr 1968, *Sturm 33* (UPTC); Mun. Bogotá, Alto de la Viga, 1 Feb 2000, *D. Stančík 3539* (COL, PRC); Páramo de Cruz Verde, 3400–3500 m, 15 Sep 1940, *J. Cuatrecasas 10446* (COL, US); 04º34´N, 74º01´W, 3500–3700 m, 17 Jun 1995, *S. Laegaard & Mayorga 17536* (AAU, COL); Sumapaz–Santa Rosa, 3600 m, 15 Jul 1984, *Wood 4539* (COL, FMB); Hoya de Quebrada Sitiáles, 1.5 km NW de Laguna La Guitarra, 26 Jan 1972, *Cleef 1090* (COL, U); Páramo Chingaza, sector Río La Playa, Valle de Fraillejon, 3250 m, 14 Nov 1992, *Guerrero 152* (COL); near La Calera, 3500 m, 1983, *Wood 3523* (AAU, COL, K); Páramo de Palácio, La Sibéria, 3400 m, 30 Feb 1961, *Rodríguez 4130* (COL); Páramo between Bogotá and Choachí, 3320 m, 7 Jan 1974, *G. Davidse et al. 5545* (COL, US); Páramo entre Cogua y San Cayetano, cercania de la Laguna Seca, 3700 m, 12 Feb 1972, *Cleef 6285* (COL); Páramo de Guasca, 3200–3300 m, 2 Jun 1940, *J. Cuatrecasas* 9475 (COL, US). **Meta:** Páramo Sumapaz, Hoya Sitiáles, laguna La Primavera, 3580 m, 25 Jan 1972, *Cleef 982A* (COL).

39. Festuca densipaniculata E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69: 1551. 1984. (**Figs. 50, 52, 92C–F**). Type: Ecuador.

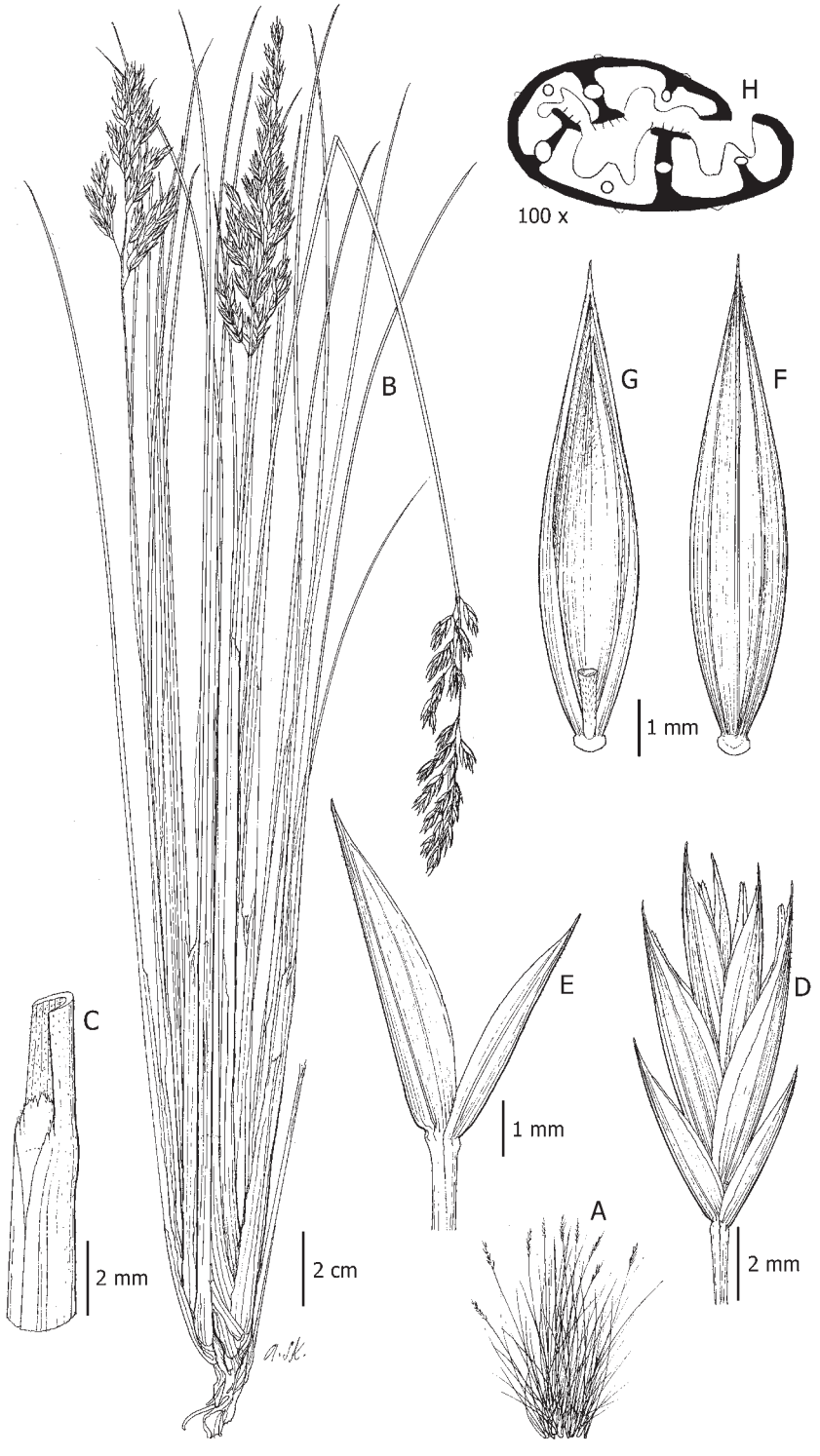


Figure 50. *Festuca densipaniculata.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Asplund 8397* (S).

Chimborazo, southern slope of Mt. Chimborazo, sandy ground, 4600 m, 18 Mar 1939, *E. Asplund 8397* (holotype: S!).

Tussocked perennials with intravaginal innovations. Culms 20–50 cm tall, erect, finely scabrous; nodes 1, basal. Leaf sheaths coriaceous, stramineous, glabrous or scabrous; ligules 0.8–1.5(–1.7) mm long, membranous, apex truncate, short-ciliate; blades 17–25 cm, long, 0.8–1.2 mm wide, conduplicate, abaxially scabrous, glaucous, apex pointed. Panicles 5–10 × 1.5–2 cm, contracted, dense, lanceolate to oblong; branches finely scabrous throughout. Spikelets 8–9(–10) mm long, elliptic to oblong, florets 3 or 4; rachilla densely hairy; glumes 4–6 mm long, membranous to coriaceous, green and somewhat glaucous, apex acute; lower glumes 4–5 mm long, lanceolate to oblong-lanceolate, 3-nerved, glabrous or upper 1/3 scabrous; upper glumes (4.5–)5–6 mm long, oblong to oblong-lanceolate, 5-nerved, glabrous or upper 1/2 scabrous; lemmas (6.5–)7–8.5 mm long, lanceolate, 5–7- nerved, membranous, green or sometimes purplish, glaucous, upper 1/2 or entire surface scabrous, awned, the awn 0.7–1 mm long; callus glabrous; paleas as long as the lemma, lanceolate, membranous, upper 1/3 and along keels scabrous to hairy; lodicules 1.4–2 mm long, oblong; anthers (2.3–)2.7–2.8 mm long; ovary apex glabrous. Caryopses lanceolate to oblong-lanceolate; hilum 1/2 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with (7–)11–15 vascular bundles and 5–7 ribs above; sclerenchyma under abaxial epidermis continuous, adaxial sclerenchyma present, extending to every other vascular bundle forming girders; abaxial epidermis with a dense covering of prickles, adaxial epidermis with frequent hairs, the hairs 0.2–0.4 mm long.

Observations.—The type specimen of *F. densipaniculata* was originally annotated by Alexeev as "*Festuca densiflora*" but he published it as *F. densipaniculata* because of the earlier homonym, *F. densiflora* Tovar. There are only two known collections of this species. Leaf anatomical characteristics suggest that *F. subulifolia* and *F. asplundii* may be closely related. Otherwise, the status of this species is not readily apparent and molecular studies will be needed for elucidation of its affinities.

Distribution and habitat.—Festuca densipaniculata is known only from grass paramos of central Ecuador between 4000–4600 m.

Additional specimens examined. **ECUADOR. Chimborazo:** S slope of Mt. Chimborazo, sandy ground, 4600 m, *E. Asplund 8396* (S-paratype). **Napo:** Antisana, 22 Jul 1997, *Sklenář & Kostečková 2738* (PRC).

40. Festuca dinirica Stančík, Novon 14(3): 341–343, f. 1f–j. 2004. (**Figs. 44, 51**). Type: Venezuela. Lara, Mun. Humocaro Alto, Parque Nacional Dinira, 09°35′39″N, 70°07′12″W, grass paramo with shrubby patches with *Rhynchospora* sp., *Chusquea* sp., *Blechnum* sp., *Calamagrostis effusa*, *Espeletia* sp., and *Diplostephium* sp., 3170 m, 30 Nov 2000, *D. Stančík 4287* (holotype: PRC!; isotypes: CAR!, COL!).

Tussocked perennials with intra- and extravaginal innovations. Culms 50–60 cm tall, erect, glabrous; nodes 1, in distal half. Leaf sheaths coriaceous, brown, glabrous, fibrous near base; auricles absent; ligules 0.5–1 mm long, membranous, apex truncate; blades 20–25 cm long, 0.4–0.6 mm in diameter, conduplicate to involute, abaxially glabrous, green. Panicles 10–12 × 0.5–1.5 cm, contracted, erect; branches glabrous. Spikelets 8–10 mm long, lanceolate sometime oblong-lanceolate, florets 3 or 4; rachillas 1–1.2 mm long, sparsely hairy; glumes 3.4–6 mm long, lanceolate, membranous to coriaceous, violet, apex acute; lower glumes 3.4–4 mm long, 1-nerved; upper glumes 5.5–6 mm long, 3-nerved; lemmas 6–7 mm long, lanceolate, 5-nerved, coriaceous, violet, scabrous, awned, the awn 1.5–4 mm long; callus glabrous; paleas as long as the lemma, lanceolate, membranous, scabrous; anthers 2–2.5 mm long; ovary apex glabrouse. Caryopses lanceolate; hilum 4/5 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections usually with 5 vascular bundles and 3–5 ribs above; sclerenchyma under abaxial and adaxial epidermis discontinuous; adaxial epidermis hairy, the hairs ca. 0.09 mm long.

Observations.—The spikelet structure of *F. dinirica* resembles *F. tolucensis*, another frequent species of the Venezuelan paramos. However *F. dinirica* clearly differs from *F. tolucensis* by its smaller culms (40–60 versus 60–80 cm), mixed innovations (versus intravaginal), brown, striate, and fibrous leaf sheaths (versus stramineous and non-fibrous), shorter ligules (0.5–1 mm versus 1.8–3.5 mm), and anatomically with discontinuous

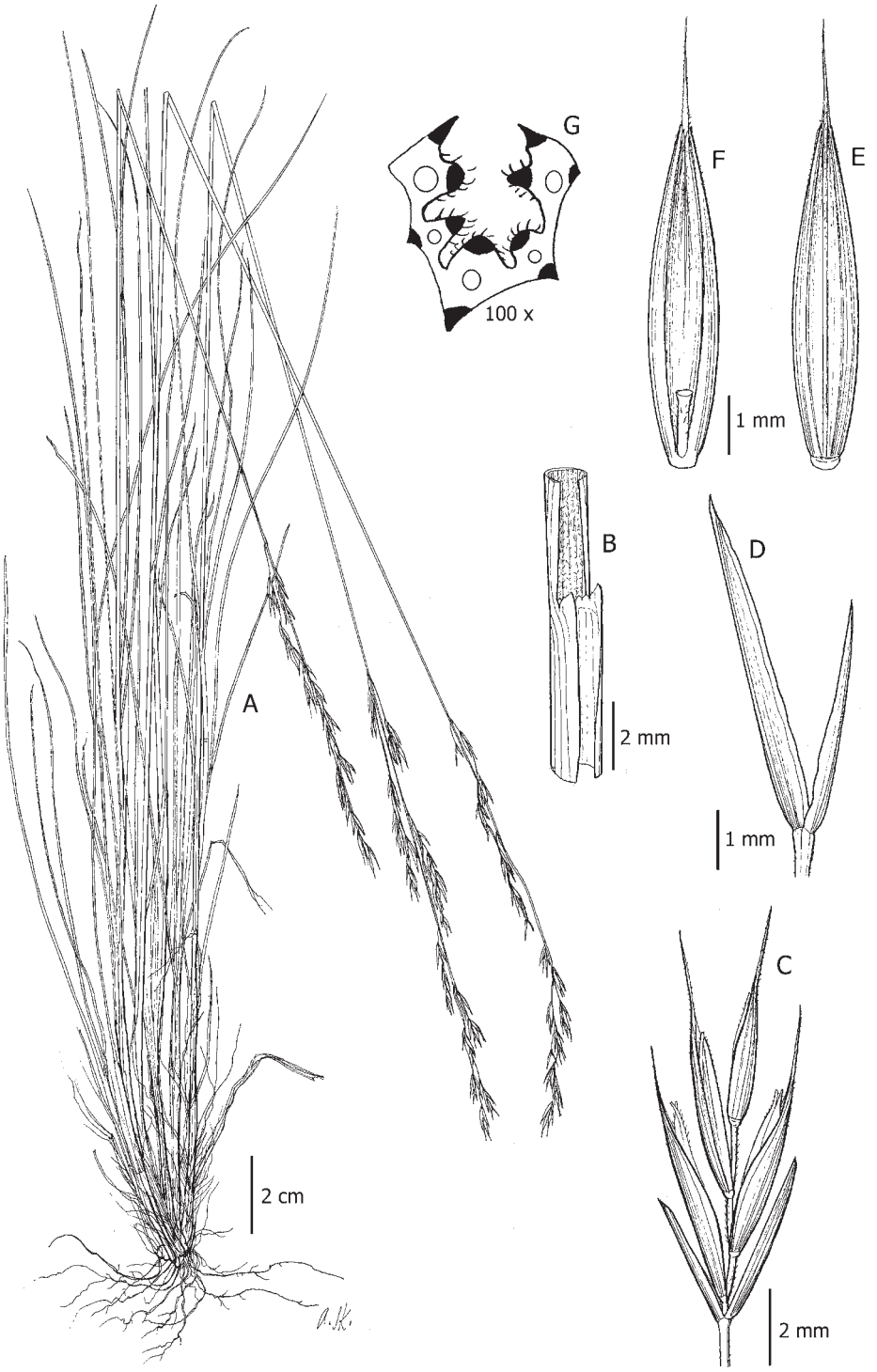


Figure 51. *Festuca dinirica.* **A.** Habit. **B.** Ligule. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Lemma with palea and rachilla. **G.** Leaf blade cross-section. A–G, *Stančík 4288* (PRC).

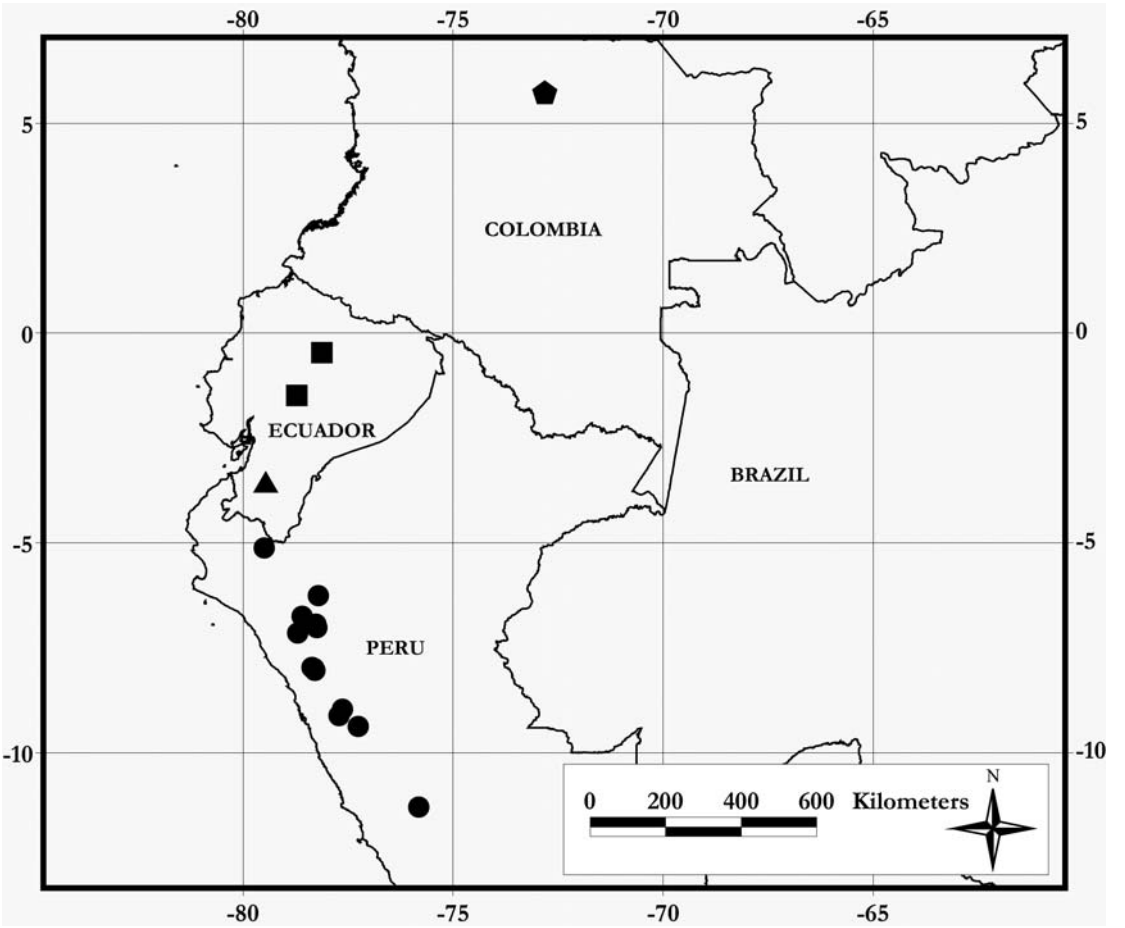


Figure 52. Distribution of *Festuca glyceriantha* (●), *F. holubii* (▲), *F. densipaniculata* (■), and *F. monguensis* (⬟).

abaxial sclerenchyma and all vascular bundles free (versus continuous abaxial sclerenchyma with some girders persent). The characteristics of mixed innovations with brown, striate, fibrous sheaths in *F. dinirica* suggest a close relationship with *F.* sect. *Aulaxyper*. In South America, this section is not very common and is still poorly studied. The Colombian and Ecuadorian species, *F. andicola*, is geographically the nearest species within *F.* sect. *Aulaxyper*.

Distribution and habitat.—Festuca dinirica is endemic to Venezuela (Lara) and occurs at an altitude of about 3200 m where it forms small tussocks in shrubby-grassy paramos and is associated with various species of *Blechnum, Espeletia*, *Hypericum*, *Calamagrostis*, *Chusquea,* and *Rhynchospora*.

Additional specimens examined. **VENEZUELA. Lara:** Mun. Humocaro Alto, Parque Nacional Dinira, 09°35′39″N, 70°07′12″W, 3170 m, 30 Nov 2000, *D. Stančík 4288* (CAR, COL, PRC).

41. Festuca glumosa Hack. ex E.B. Alexeev, Bot. Zhurn. (Moscow & Leningrad) 69(11): 1549. 1984. (**Figs. 49, 53, 93A–D**). Type: Ecuador. In pasq. andinis, 1886, *A. Sodiro 36/4* (holotype:W!)

Festuca ovina subvar. *jamesonii* St.-Yves, Candollea 3: 166. 1927. Type: Ecuador Andes de Quito, 15000 ft, *Jameson 230* (lectotype: G-DC!, designated here).

Densely tussocked perennials with intravaginal innovations. Culms 15–55 cm tall, erect, finely scabrous; nodes 1, basal with 2 leaves. Leaf sheaths membranous to coriaceous, firm, stramineous glabrous, inconspicuously striate; ligules 0.8–1.2 mm long, apex two-dentate, short-ciliate; blades 10–25 cm long, 0.8–1.4 mm wide, involute, abaxially scabrous, glaucous, apex obtuse. Panicles 8–10 × 0.6–1 cm, linear to lanceolate,

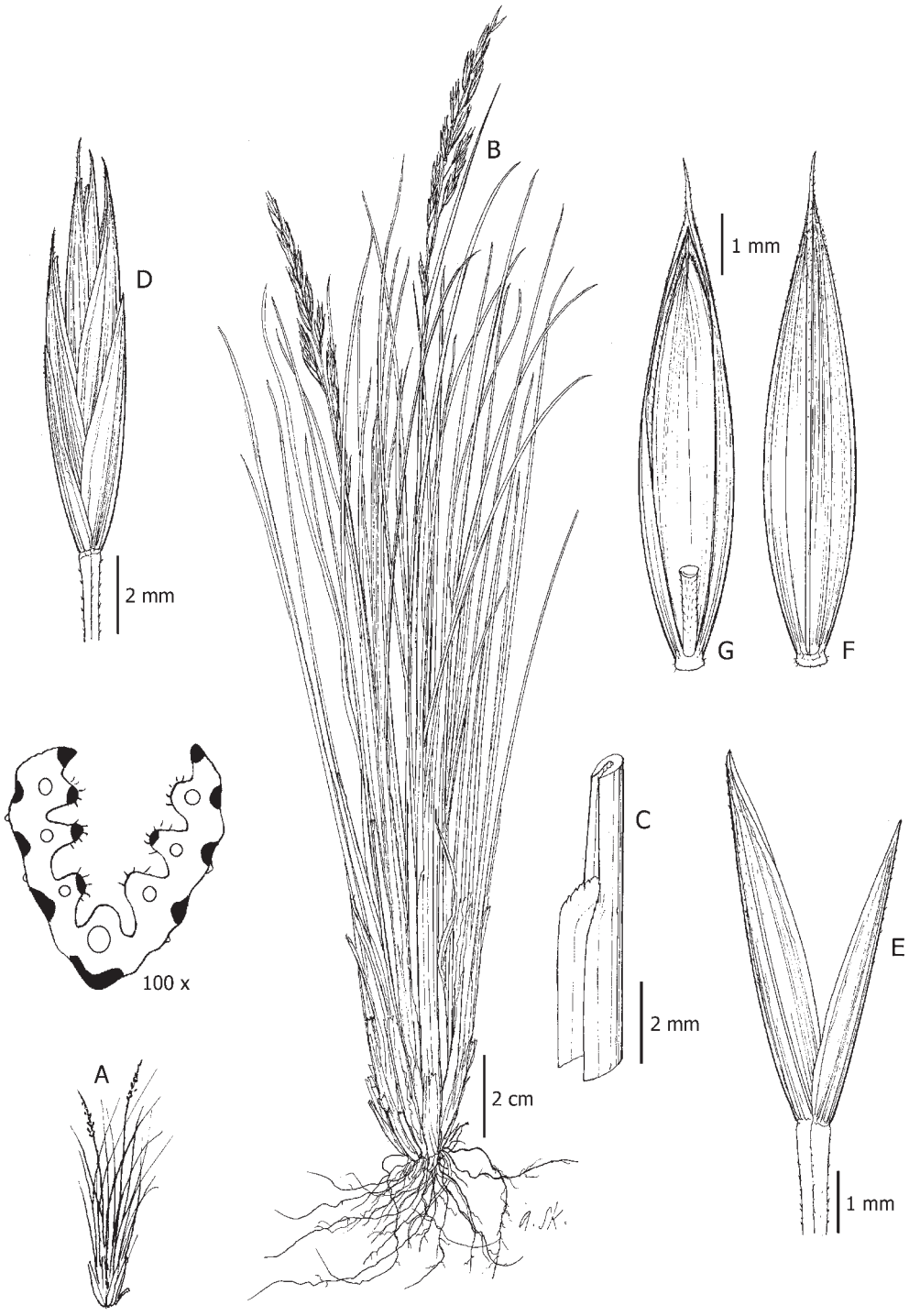


Figure 53. *Festuca glumosa.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 3392* (PRC).

contracted, dense, branches scabrous. Spikelets 8.5–10 mm long, lanceolate, florets 3 or 4; rachilla with scattered hairs; glumes 4.5–6.5 mm long, lanceolate, membranous to coriaceous, keeled, purplish-green, upper 1/3 scabrous along keel, apex acute; lower glumes 4.5–6 mm long, 1-nerved; upper glumes 6–6.5 mm long, 3-nerved; lemmas 7–8 mm long, lanceolate, 5-nerved, membranous, keeled, purplish-green, scabrous distally, awned, the awn 0.5–1.5 mm long; callus with scattered hairs; paleas 4/5 as long as the lemma, lanceolate, membranous, upper 1/3 and keels scabrous to hairy; lodicules lanceolate; anthers 0.8–0.9 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 1/2–3/5 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with 7 (rarely 5) vascular bundles and 5 ribs above; sclerenchyma usually discontinuous under abaxial epidermis and small or absent under adaxial epidermis; adaxial epidermis with scattered hairs, the hairs ca. 0.09 mm long.

Observations.—A specimen of *F. glumosa* labeled as *Sodiro 36/4* was found at QPLS. However, this specimen is not the type specimen since the collection date is Sep 1887 and the locality is "crescit in pasquis on Pichincha". Apparently, Sodiro used a single number to indicate the same species. Morphologically similar species are *F. carchiense* and *F. imbaburensis*. The species may be distinguished by the characters shown in the following tabular comparison.

Characters	***F. glumosa***	***F. carchiense***	***F. imbaburensis***
Leaf width (mm)	0.8–1.4	0.4–0.7	0.5–0.6
Leaf length (cm)	10–25	25–40	9–20
Ligule length (mm)	0.8–1.2	0.5–0.8	0.5–0.7
Panicle length (cm)	8–10	10–20	6–12
Spikelet length (mm)	8.5–10	9–10.5	8–10
Number of florets	3 or 4	3 or 4	2 or 3
Lower glume length (mm)	4.5–6	4–4.5	3–3.5
Upper glume length (mm)	6–6.5	5–6.5	4–4.2
Lemma length (mm)	7–8	7–7.5	5.5–6
Awn length (mm)	0.5–1.5	0.8–1.5	0.5–0.7
Anther length (mm)	0.8–0.9	1.1–1.3	1–1.5

Distribution and habitat.—Festuca glumosa ranges from central Ecuador to the northern Cordillera Central in Colombia and occurs in (dry) grasslands and rocky slopes of superparamos between 4000–4600 m. *Festuca glumosa* is known from the following communities: *Diplostephio eriophori-Loricarietum colombianae* (Salamanca et al. 1991), *Cerastio floccosi-Pentacalietum gelidae* (Salamanca et al. 1991), *Lupino alopecuroidis-Agrostietum araucanae* (Salamanca et al. 1991), *Baccharido caespitosae-Agrostietum araucanae* (Salamanca et al. 1991), and *Aciachne acicularis-Calamagrostis intermedia* (Verweij 1995).

Additional specimens examined. **COLOMBIA. Caldas:** Mun. Manizales, Parque Nacional Los Nevados, between Crater La Oletta and el Ruiz, way to Río Nereidas, 4200–4500 m, 18 Sep 1999, *D. Stančík 3393* (COL, PRC, W); *D. Stančík 3392* (COL, PRC); *D. Stančík 3413* (COL, PRC); 19 Sep 1999, Casa del Cisne, 4180 m, 19 Sep 1999, *D. Stančík 3383* (COL, PRC); way from Río Nereidas, km 5–7, 4000 m, 18 Sep 1999, *D. Stančík 3394* (COL, PRC); Mun. Villamaría, Crater Olleta, 04º54´N, 75º21´W, 4600 m, 27 Jan 1988, *L.G. Clark & X. Londoño 376* (COL, TULV, UPTC, US); Refugio del Ruiz, carratera hacia "El Siléncio", 4310 m, 7 Oct 1978, *Rangel et al. 1732* (COL); Cordillera Central, camino entre Buenos Aires y la Laguna Verde, 4020–4350 m, 9 Oct 1978, *Rangel et al. 1791* (COL); Páramo entre Termales y Nevado Líbano, 4620 m, 8 Dec 1958, *Barclay & Juajíbioy 6313* (COL); **Risaralda:** Mun. Pereira, below Nevado El Cisne, way from Casa del Cisne to Laguna Otún, km 5, 4100 m, 19 Sep 1999, *D. Stančík 3378* (COL, PRC); Volcán de Santa Rosa, vertiente oriental, 4500 m, 20 Feb 1980, *Jaramillo-Mejía et al. 5747* (COL); Entre Laguna El Otún y Páramo de Santa Rosa, 4375 m, 4 Feb 1980, *Jaramillo-Mejía et al. 6149* (COL); below Nevado de Santa Isabel, 4000 m, 20 Sep 1999, *D. Stančík 3373B* (COL, PRC); 4000–4100 m, 20 Sep 1999, *D. Stančík 3374* (COL, PRC), 4300 m, 13 Jul 1980, *Salamanca et al. 40* (US); junto a la Laguna del Beso, 4300 m,

25 Nov 1946, *J. Cuatrecasas 23201* (US); Parque Nacional Los Nevados, vertiente W del Nevado de Quindio, 4450 m, *Salamanca et al. SS143* (U). **Tolima:** Mun. Ibague, Nevado del Tolima, 04º38.5´N, 75º19.1´W, 4250 m, 8 Jun 2000, *D. Stančík 3601, 3602, 3607* (COL, PRC); Mun. Santa Isabel, paso del Otún a la Quebrada Africa, 3900 m, 6 Feb 1980, *Jaramillo-Mejía et al. 6210* (COL); 4200–4300 m, *Díaz–Piedrahita & Jaramillo-Mejía 1821* (COL). **ECUADOR. Chimborazo:** El Altar, N side, 4300 m, *Sklenář & Kostečková 1931* (AAU); Paramo de los Altares, 01º40´S, 78º24´W, 4200 m, 3 Sep 1987, *Ramsay & Smith 410* (K, QCNE); Volcán Chimborazo, lower refuge, 01º28´S, 78º50´W, 4800–4840 m, 11 May 1992, *S. Laegaard 102797* (AAU, QCA, QCNE); *S. Laegaard 102803* (AAU); 05 Mar 1988, *S. Laegaard & S.A. Renvoize 70555* (AAU, K, QCA, QCNE); E slope, 4550 m, *E. Asplund 7926* (S); Cerro Yuibug–Pailacajas, E side, 4100 m, *Sklenář & Sklenáová 2990* (AAU); W side of Cerro Yanaurcu, 4300 m, *Sklenář & Kostečková 1853* (AAU). **Imbabura:** Nevado Cotacachi, SW side, 4400 m, *Sklenář & Kostečková* 4300–4400 m, *S. Laegaard 54518B* (AAU, QCA); Mun. Cayambe, Volcán Cayambe, swamps below the Refugium, 00°00´N, 78°01´W, 4450 m, 20 Oct 2000, *D. Stančík 4149* (PRC, QCA); rocky superparamo, 00°00´31˝S, 78°00´34.4˝W, 4600 m, 20 Oct 2000, *D. Stančík 4129, 4133, 4134, 4166* (AAU, PRC, QCA); *D. Stančík 4122* (PRC, QCA); Mun. Urcuquí, Cerro Yanaurcu, rocks and pajonal, 00°29´N, 78°21˝W, 4300 m, 15 Oct 2000, *D. Stančík 4039* (AAU, PRC, QCA). **Pichincha:** Volcán Cayambe, 14000–14500 ft, *Whymper 1330* (K); NE side, 15000 ft, *Cazalet & Pennington 5749B* (US); *Cazalet & Pennington 5749* (K, NY); road to refuge, 4300–4400 m, 1 Mar 1988, S. *Laegaard 70491* (AAU, K, QCA); SW side, 4600 m, *Sklenář & Kostečková 55-2* (US); Paso de la Vírgen, 4400 m, *S. Laegaard 53869* (AAU, QCA, QCNE); Paramo de Guamani, 4200–4250 m, *S. Laegaard 55718* (AAU, QCA); 4200–4250 m, *S. Laegaard 55696* (AAU); 00º20´S, 78º12´W, 4050 m, 2 Mar 1999, *S. Laegaard et al. 19630* (AAU, QCA, QCNE); NE slope of Rucu Pichincha, 00º10´S, 78º34´W, 4500 m, *Sklenář & Kostečková 1903* (AAU); NE slope, 4300–4500 m, *Sklenář & Kostečková 1933* (AAU); W slope, 4400–4500 m, 6 Mar 1988, *Molau & Eriksen 3298* (AAU, GB, QCA, QCNE); 4500 m, *Sklenář & Kostečková 9-1* (QCNE); 4350 m, *E. Asplund 17334* (S); Guagua Pichincha, 00º12´S, 78º35´W, 4500–4600 m, *S. Laegaard et al. 102760* (AAU); Lloa–Guagua Pichincha road, km 10, 00º13´S, 78º35´W, 4170 m, *S. Laegaard et al. 102725* (AAU); Pichincha, 4700 m, *E. Asplund 8594* (NY, QCA); 4100–4500 m, *A.S. Hitchcock 21058* (NY, US); *Sodiro s.n.* (QPLS); Volcán Antisana, N side, 00º27´S, 78º10´W, 4700 m, *S. Laegaard 102889* (AAU); Nevado Cayambe, SW slope, 4400 m, *Sklenář & Kostečková 1893* (AAU); SW side, 4500–4700 m, *Sklenář & Kostečková 735* (AAU); 4220 m, 11 May 1990, *P.M. Peterson 9086, E.J. Judziewicz & R.M. King* (K, MO, QCA, QCNE, US); 4400 m, 01 Jul 1995, *Sklenář & Kostečková 49-19* (QCNE); 4600 m, 2 Jul 1995, *Sklenář & Kostečková 56-2* (QCNE); E slope of Illiniza Sur, 4300 m, *Sklenář & Kostečková 1863* (AAU); Cerro Saraurcu, W side, 4100–4200 m, *Sklenář & Kostečková 1836* (AAU); Mt. Corazón, E slope, 4500 m, *E. Asplund 17504* (S); Mun. Pifo, Páramo Guamaní, grassy paramo, 00°19´S, 78°12´W, 4300 m, 19 Jun 1999, *D. Stančík 3031*, *3034* (AAU, PRC, QCA); 4000 m, *D. Stančík 3048* (PRC, QCA). **Tungurahua:** Cordillera de Llanganatis, Paramo de Jaramillo, 01º10´S, 78º22´W, 4000–4250 m, *S. Laegaard 53293* (AAU); *S. Laegaard 53307* (AAU, QCA).

42. Festuca glyceriantha Pilg., Bot. Jahrb. Syst. 37: 516. 1906. (**Figs. 52, 54, 93E & F**). Type: Peru. Ancash: Yungay, Yanganuco, 4100 m, 15 Jun 1903, *A. Weberbauer 3275* (holotype: B!; isotypes: BAA-1228 fragm. ex B!, US-2875417!).

Tussocked perennials with intravaginal innovations. Culms (30–)80–120 cm tall, erect, glabrous; nodes 1 or 2, basal. Leaf sheaths coriaceous, dark brown, glabrous, striate, old sheaths fibrous; ligules 0.5–1 mm long, apex acute, ciliate; blades 20–60 cm long, 2–5 mm wide, conduplicate or flat, abaxially glabrous, green or pale-green. Panicles 15–17 × 1.5–2 cm, contracted, lanceolate, discontinuous; branches scabrous. Spikelets 12–15 mm long, lanceolate, florets 4(–5); rachillas 2–2.5 mm long, glabrous, rarely scabrous; glumes 3.5–6.5 mm long, coriaceous, glabrous, violet, margins membranous; lower glumes 3.5–5 mm long, lanceolate, 1-nerved, apex acute; upper glumes (4.5–)5–6.5 mm long, lanceolate, 3-nerved, apex acute; lemmas 6–8.5 mm long, lanceolate, 5-nerved, coriaceous, violet, upper 1/3 with brown stripes, margin membranous, awned, the awn 0.5–2.5 mm long; paleas almost as long as the lemma, membranous, slightly scabrous; anthers 3–3.5 mm long; ovary apex glabrous. Caryopses not seen.

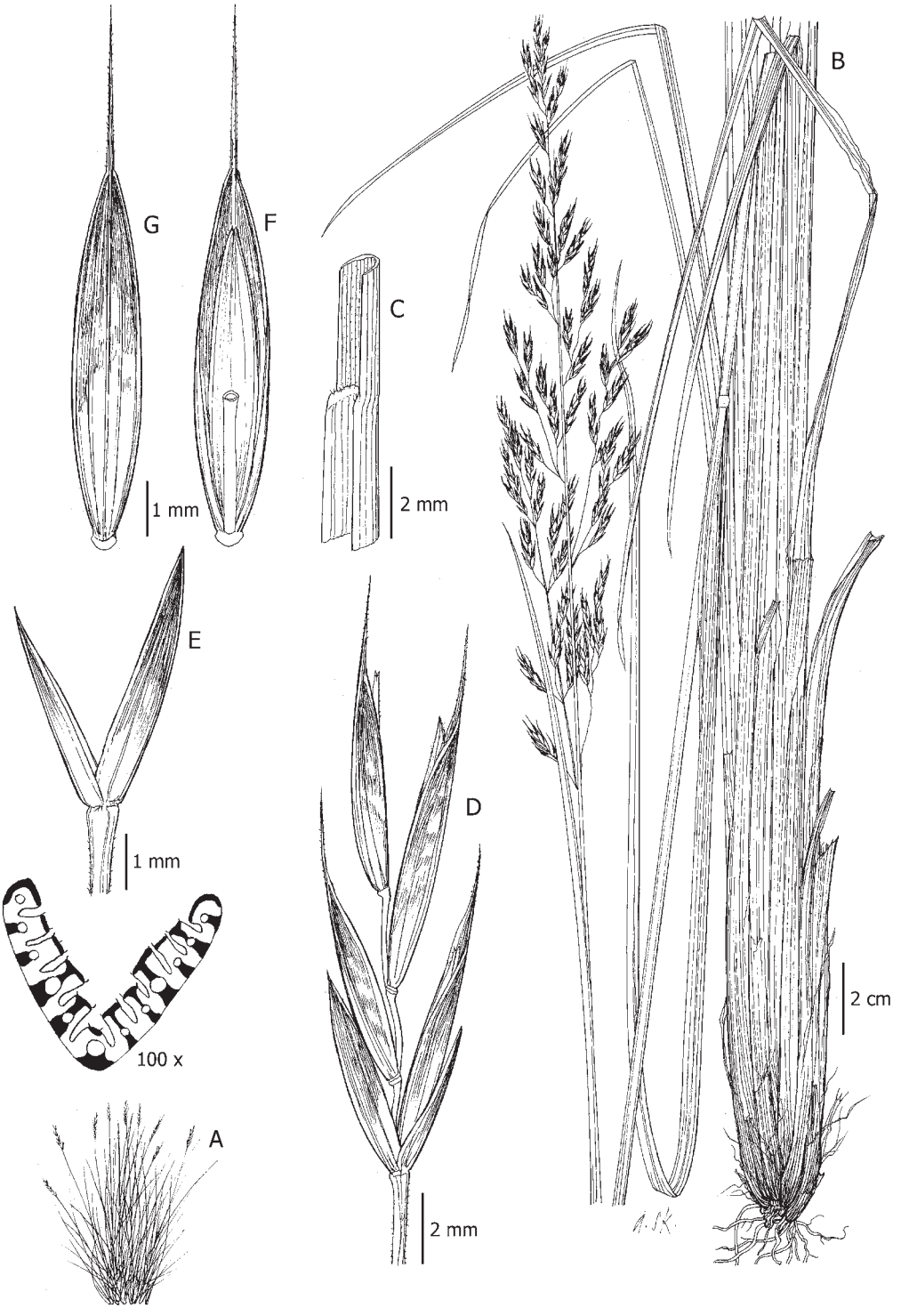


Figure 54. *Festuca glyceriantha.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma with palea and rachilla. **G.** Lemma. **H.** Leaf blade cross-section. A–H, *Vega 2012* (F).

Leaf blade anatomy.—Cross-sections with (7–)11–15 vascular bundles and corresponding ribs above; sclerenchyma under abaxial epidermis discontinuous, extending to the vascular bundles, adaxial sclerenchyma present, extending often to the adaxial epidermis hairy; the hairs short.

Observations.—Festuca glyceriantha is very distinct and easily recognized since it has dark brown, fibrous sheaths (often resembling bulbs) and brown stripes on the upper 1/2 of the lemma.

Distribution and habitat.—Festuca glyceriantha is known from northern and central Peru where it occurs in alpine grass vegetation (jalca) between 3300–4100(–4700) m.

Additional specimens examined. **PERU. Ancash:** Prov. Huaylas, Huascarán Parque Nacional, Quebrada Los Cedros, Alpamayo trail, 4020–4700 m, 3 Nov 1985, *Smith et al. 9939* (MO); 08°50´S, 77°44´W, 4020–4700 m, 3 Nov 1985, *Smith 9942* (F, MO); *Smith et al. 9944* (MO); Paron Vall., E of lake, 08°59´S, 77°38´W, 4200 m, 27 Sep 1985, *Smith 11493* (MO); Prov. Huari, Huascarán Parque Nacional, quebrada Rurichinchay, 09°23´S, 77°16´W, 3840–3870 m, 13 Jun 1986, *Smith et al. 12630* (US); Cordillera Blanca, 28 km SE of San Luis on road towards Huari, 4230 m, 23 Mar 1997, *P.M. Peterson 13875 & N. Refulio Rodríguez* (US, USM); Prov. de Bolognesi, Caillarpacsa, arriba de Chuiquian, monte fluvial, 3900 m, 4 May 1952, *Cerrate 1540* (US). **Cajamarca:** Prov. Celendín, lugar Challuayaco, sobre la carretera a Celendín, E del Paso de Cumullca, 3550 m, 5 Dec 1984, *Vega et al. 3485* (F); Desvio a Huanico, sobre la ruta Cajamarca–Celendín, 3500 m, 4 Oct 1987, *Vega 4371* (F); Sorochuco, arriba del Punre, 06°57´S, 78°16´W, 3340 m, 8 Nov 2001, *Vega 10889* (F, MO); El Sendamal, entre la Encanada y Celendín, 3520 m, 7 Mar 1975, *Vega et al. 1695* (F); Cerca al Centro Turistico Cumbe Mayo, 3460 m, 21 Apr 2001, *Vega 10509* (F, MO); Cajamarca–Celendín road, 07°02´S, 78°14´W, 3450 m, 15 Jul 1983, *Smith et al. 4278* (MO); Prov. Cajamarca, cerro Campanario, entre Cajamarca y Cooperativa Atahualpa, 3500 m, 8 Mar 1993, *Vega 6616* (F); Prov. Cajamarca, Cerro Maqui–Maqui, al N de Cajamarca, ruta Shanta alta, 4120 m, 29 Jan 1994, *Vega et al. 6694* (F); Cerro Campanario, en la SAIS Atahualpa, al NW de Cajamarca, 3500 m, 4 Nov 1994, *Vega et al. 6974, 6975* (F); arboretum de CICAFOR, 3400 m, 16 May 1981, *Vega et al. 2527* (F); Cerro Sexcemayo, al W de Cajamarca, 3430 m, 4 Feb 1991, *Vega 5427* (F); 3500 m, 20 Jun 1991, *Vega et al. 5744* (F); Jalca de Kumullca, entre La Encanada y Celendín, 3600 m, 27 May 1977, *Vega et al. 2012 (*F); Coymolache ruta Cajamarca–Hualgalloc, 3850 m, 7 Jan 1977, *Vega et al. 2061* (F); 16 km W of Central Plaza of Cajamarca up road towards Cumbemayo, 3440 m, 31 Mar 1997, *P.M. Peterson 14011 & N. Refulio Rodríguez* (MO, US, USM); Prov. Hualgayoc, Perlamayo, Tres Lagunas, subiendo hacia Tambillo, 3200–2850 m, 22 Jul 1986, *Vega 4168* (F); arriba de la ciudad de Hualgayoc a 31 km de Bambamarca, 3500 m, 26 Mar 1985, *Vega et al. 3797* (F); Paso de Coymolache, km 81 de la carretera Cajamarca–Bambamarca, al W de Hualgayoc, 3900 m, 13 Jun 1980, *Vega 2263* (F); al W de Hualgayoc, 3 km sobre la carretera a Hualgayoc–Cajamarca, 3600 m, 15 Jun 2001, *Vega 10764* (F, MO); Prov. San Miguel, 64 km N of Cajamarca and 3 km SW of El Cobro, on route 3N towards Bambamarca, 3530 m, 16 Mar 2000, *P.M. Peterson14925 & N. Refulio Rodríguez* (MO, US, USM); Prov. San Pablo, 32 km NW of Cajamarca on road towards San Pablo via Porcon, 3470 m, 14 Mar 2000, *P.M. Peterson14855 & N. Refulio Rodríguez* (MO, US, USM); 2 km SW of Hualgayoc on road towards El Cobro and Cajamarca, 3530 m, 17 Mar 2000, *P.M. Peterson 14936 & N. Refulio Rodríguez* (MO, US, USM); Prov. De Hualgayoc, cerca a Coymolache entre Hualgayoc y Cajamarca, jalca, 3800 m, 16 Aug 1952, *R. Ferreyra 8566* (US). **Junín:** NW part of Junín, Goyllarisquisca, 4000 m, 7 Nov 1923, *A.S. Hitchcock 22328* (US). **La Libertad:** Prov. Santiago de Chuco, 23 km SW of Huamachuco on road towards Alto de Tamboras and Pampas, 3540 m, 29 Mar 1997, *P.M. Peterson 13961 & N. Refulio Rodríguez* (MO, US, USM); Santiago–Shoreyo road, 35 km from Santiago, 08°03´S, 78°18´W, 4120 m, 26 Aug 1982, *Smith 2337* (MO); Los Quinuales (al N de Quiruvilca), ladera, 3775 m, 24 Mar 1994, *Leiva & Leiva 1094* (MO); Carrion, Trujillo–Huamachuco road, 07°56´S, 78°10´W, 3700 m, 13 Feb 1983, *Smith et al. 3312* (MO). Prov. Huamachuco, Munmalca, Hda. Cochabamba, 3200 m, 26 Jun 1958, *López & Sagásteguii 2827* (US). **Piura:** Prov. Huancabamba, Chulucanitas bajo, 3150 m, 5 Mar 1980, *Vega 5271* (F).

43. Festuca holubii Stančík, Folia Geobot. Phytotax. 39(1): 102, f. 1, 6–10. 2004. (**Figs. 52, 55**). Type: Ecuador. Loja, Cerro de Arcos W of road Manu–Zaruma, 03º34´S, 79º28´W, 3250–3600 m, moist paramo, 14 Sep 1999, *S.*

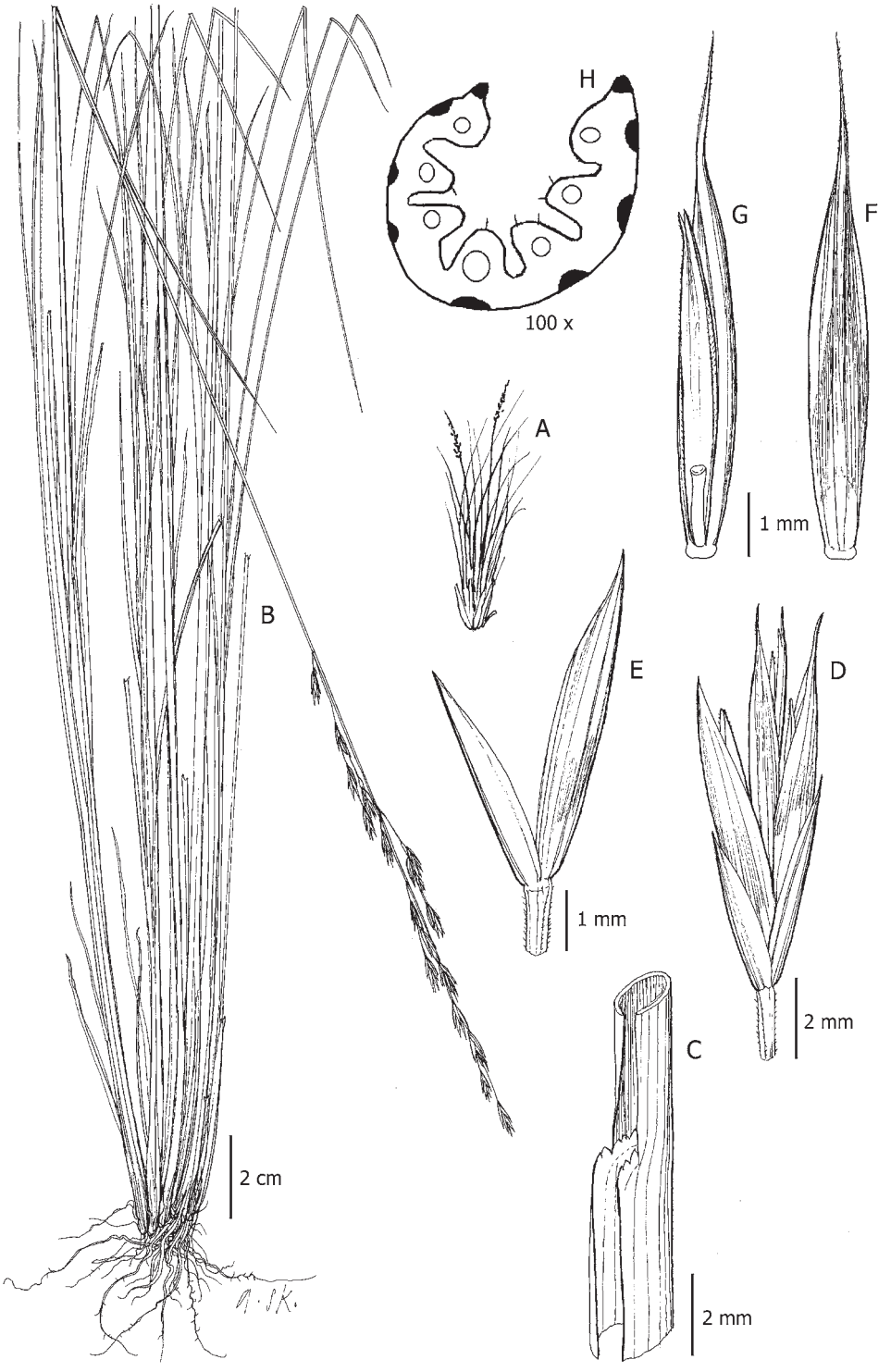


Figure 55. *Festuca holubii.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Laegaard &Aguirre 20611* (PRC).

Laegaard & Aguirre 20611 (holotype: AAU!; isotypes: LOJA!, PRC!, QCA!, QCNE!).

Tussocked perennials with intravaginal innovations. Culms, 50–60 cm tall, erect, finely scabrous; nodes 1, basal. Leaf sheaths membranous, brownish-gray, glabrous, striate; ligules 0.6–0.8 mm long, two-lobed, apex short-ciliate; blades 15–25 cm long, 0.8 mm wide, conduplicate to involute, finely abaxially scabrous, green, apex obtuse. Panicles 8–14 cm long, ca. 0.7 cm wide, contracted, narrow, sparsely branched; branches scabrous on ribs. Spikelets 9–10 mm long, lanceolate, florets 3 or 4; rachilla glabrous or sparsely hairy; glumes 4–5.5 mm long, lanceolate to oblong-lanceolate, membranous to coriaceous, keeled, purplish, glabrous, apex obtuse and scabrous; lower glumes ca. 4 mm long, 1-nerved; upper glumes ca. 5.5 mm long, 3-nerved; lemmas ca. 7 mm long, oblong-lanceolate, 5-nerved, membranous to coriaceous, purplish-green, distally keeled, scabrous, awned, the awn 1–2 mm long; callus glabrous; paleas 5/6 as long as the lemma, lanceolate, membranous, scabrous only on keels; lodicules 0.9–1 mm long, oblong, bilobed; anthers ca. 1.3 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 3/5–3/4 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with 7 vascular bundles and 5 ribs above; sclerenchyma discontinuous, only under abaxial epidermis; adaxial epidermis with numerous hairs, the hairs ca. 0.09 mm long.

Observations.—Festuca holubii is morphologically similar to the Peruvian *F. divergens*. However, the former differs from the latter by having taller culms (50–60 versus 20–35 cm), longer panicles (8–14 versus 6–7 cm), shorter spikelets are (9–10 versus 12–14 mm), and shorter lemmas (ca. 7 versus 10–12 mm).

Distribution and habitat.—Festuca holubii is known only from the type collection in southern Ecuador and it occurs in grass paramos between 3200–3600 m.

44. Festuca huamachucensis Infantes, Revista Ci. (Lima) 54: 107. 1952. (**Figs. 56, 57**). Type: Peru. La Libertad, Huamachua Prov., 7 Aug 1951, *J. Infantes Vera 3538* (holotype: herb. Infantes; isotype: US-2044946!).

Tussocked perennials with intravaginal innovations. Culms 15–55 cm tall, erect, glabrous; nodes 1 or 2, basal. Leaf sheaths membranous, brown, glabrous, striate; ligules 0.5–1 mm long, apex truncate, ciliate; blades 5–20 cm long, 0.6–0.8 mm wide, conduplicate to involute, abaxially glabrous, green, sometimes slightly curved. Panicles 15–17 × 0.5–1 cm, narrow, contracted, with few branches and these only near base; branches sparsely scabrous. Spikelets 8.5–10 mm long, lanceolate, florets 3 or 4, probably cleistogamous; rachillas 0.5–0.7 mm long, glabrous or sparsely scabrous; glumes 4–6.5 mm long, lanceolate, membranous, glabrous, apex acute; lower glumes 4–4.5 mm long, 1-nerved; upper glumes 5.5–6.5 mm long, 3-nerved; lemmas, 7–7.5 mm long, lanceolate, 5-nerved, membranous, glabrous, awned, the awn 4–6 mm long; paleas almost as long as the lemma, membranous; anthers 0.8–0.9 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 2/5 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with 5(–7) vascular bundles, 3–5 ribs above; sclerenchyma under abaxial epidermis discontinuous, forming small fascicles, adaxial sclerenchyma absent or exceptionally forming small fascicles; adaxial epidermis with short scattered hairs.

Distribution and habitat.—Festuca huamachucensis is endemic to northern Peru where it has been found growing on wet alpine grasslands (jalca).

Additional specimens examined. **PERU. Ancash:** Prov. Recuay, Huascarán Parque Nacional, quebrada Queshque, lateral valley toward Río Pachacoto, 09°50S´, 77°18´W, 4500–4600 m, 18 Mar 1986, *Smith et al. 11851* (MO). **Cajamarca:** Prov. Cajamarca, 52 km N of Cajamarca, on Hwy 3N towards Bambamarca, and ca. 1 km W on a small road "Carretera Lagunas Yanacanchilla", 3800–3900 m, 16 Mar 2000, *P.M. Peterson14901 & N. Refulio Rodríguez* (MO, US); Laguna Maqui–Maqui, pajonal de jalca, 3910 m, 4 Oct 1994, *Vega et al. 6955* (F); Cerro Piedras Gachas, entre Yanacocha y Llaucan, 3900 m, 23 Apr 1994, *Vega et al. 6994* (F); cima de cerro con Piedras grandes, 3900 m, 24 Apr 1994, *Vega et al. 7041* (F); cima del Cerro Maqui–Maqui, ladera arenosa, 4150 m, 20 Mar 1994, *Vega et al. 6914* (F); Pampa Larga, al N de la explotacion minera Yanacocha, ladera de jalca graminosa, 3900 m, 14 May 1994, *Vega 7124* (F); Jalca de Cumullca, lado occidental, 3600 m, 31 May 1984, *Vega et al. 3494* (F); ruta a Guagal, km 10, 3600 m, 27 May 1977, *Vega et al. 2018* (F); Ladera de jalca, 3900 m, 14 May 1994, *Vega et al. 7128* (F); Prov. Celendín, desvio Huanico,

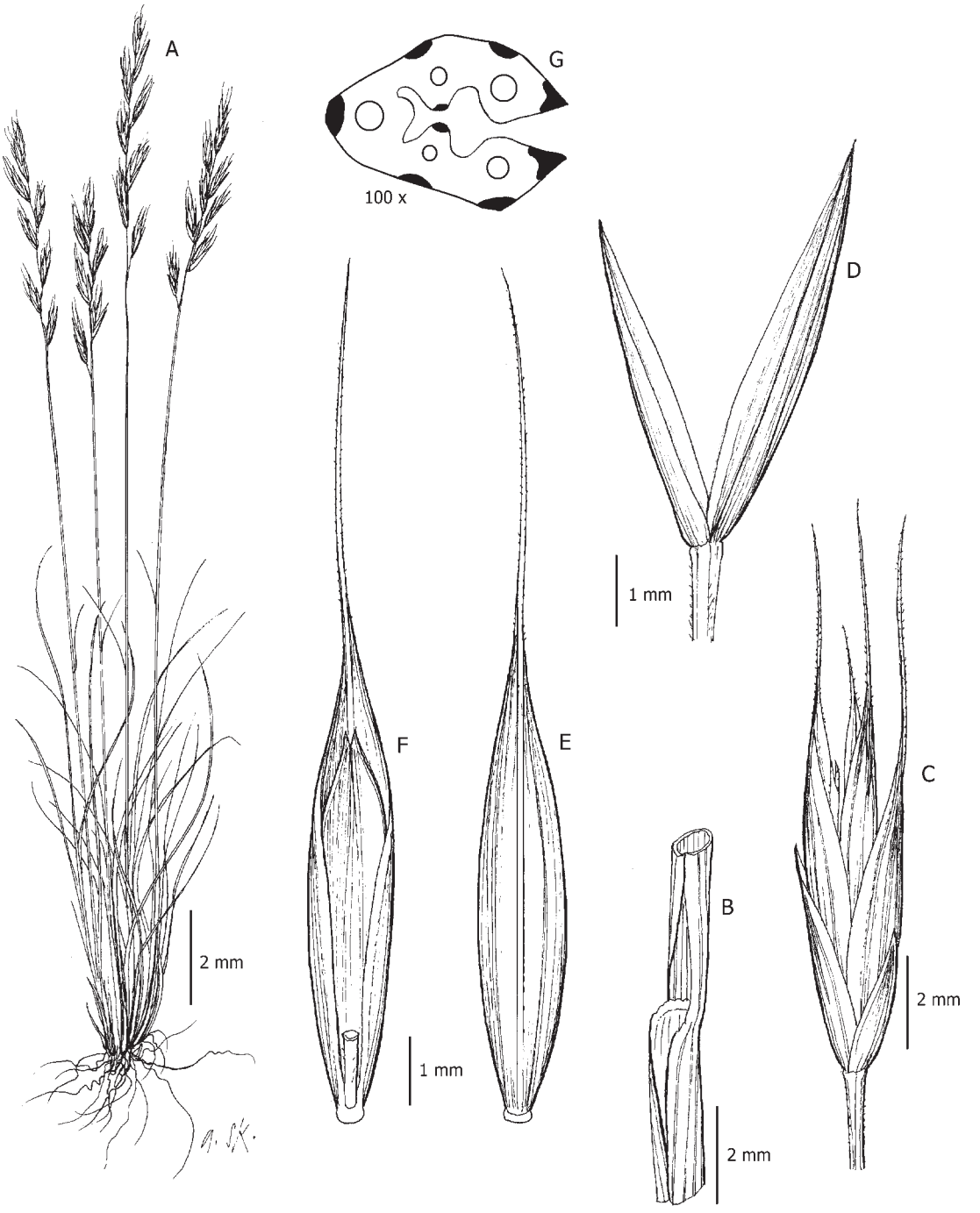


Figure 56. *Festuca huamachucensis*. **A.** Habit. **B.** Ligule. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Lemma with palea and rachilla. **G.** Leaf blade cross-section. A–G, *Vega 6994* (F).

sobre la ruta Cajamarca–Celendín, 3500 m, 4 Oct 1987, *Vega 4378* (F); 07°02′31″S, 78°15′33″W, 3700 m, 26 Aug 2004, *Sklenář & Zapata Cruz 8705* (PRC); Prov. Hualgayoc. Desvio de la carretera Coymolache–Chugur, 3750 m, 30 Apr 1994, *Vega 7111* (F). **La Libertad:** Prov. Santiago de Chuco, 42 km S of Huamachuco on road towards Pampas, 4000 m, 29 Mar 1997, *P.M. Peterson 13951 & N. Refulio Rodríguez* (K, MO, US, USM); Prov. Carrion, al pie del Nevado de Huaylillas, jalca,

07°52´S, 78°01´W, 3840 m, 21 May 2001, *Zapata 16506, 16508* (F).

45. Festuca imbaburensis Stančík, Folia Geobot. Phytotax. 39(1): 100, f. 3, 1–5. 2004. (**Figs. 57, 58, 94A & B**). Type: Ecuador. Imbabura, Mun. Urcuquí, road to Cerro Yanaurcu, 00º28´29˝N, 78º20´04˝W, grass paramo with swampy patches, 4150 m, 15 Oct 2000, *D. Stančík 4098* (holotype: PRC!; isotypes: AAU!, QCA!).

Tussocked perennials with intravaginal innovations. Culms (15–)20–50 cm tall, erect, finely scabrous; nodes 1, basal. Leaf sheaths membranous to coriaceous, stramineous, glabrous; ligules 0.5–0.7 mm long, membranous, apex truncate, short-ciliate; blades 9–20 cm long, 0.5–0.6 mm wide, conduplicate to involute, somewhat rigid, green, glaucous, abaxially glabrous, apex obtuse. Panicles 6–12 × ca. 0.5 cm, contracted, with few scabrous branches, each with a few spikelets. Spikelets 8–10 mm long, lanceolate, florets 2 or 3; rachilla glabrous; glumes 3–4.2 mm long, keeled on back, membranous, dark purple, glabrous or upper 1/4 sparsely papillose, apex obtuse; lower glumes 3–3.5 mm long, oblong, 1-nerved; upper glumes 4–4.2 mm long, ovate, 3-nerved; lemmas 5.5–6(–7) mm long, lanceolate, 5-nerved, membranous to coriaceous, dark purple, upper 1/4 scabrous, awned, the awn 0.5–0.7 mm long; callus glabrous; paleas shorter than the lemma, lanceolate, membranous, upper 1/4 and along keels densely scabrous to pilose; lodicules ovate, markedly bilobed; anthers 1–1.5 mm long; ovary apex glabrous. Caryopses not observed.

Leaf blade anatomy.—Cross-sections with 5–7 vascular bundles and 3–5 ribs above; sclerenchyma under abaxial epidermis discontinuous, in small fascicles, adaxial sclerenchyma absent;

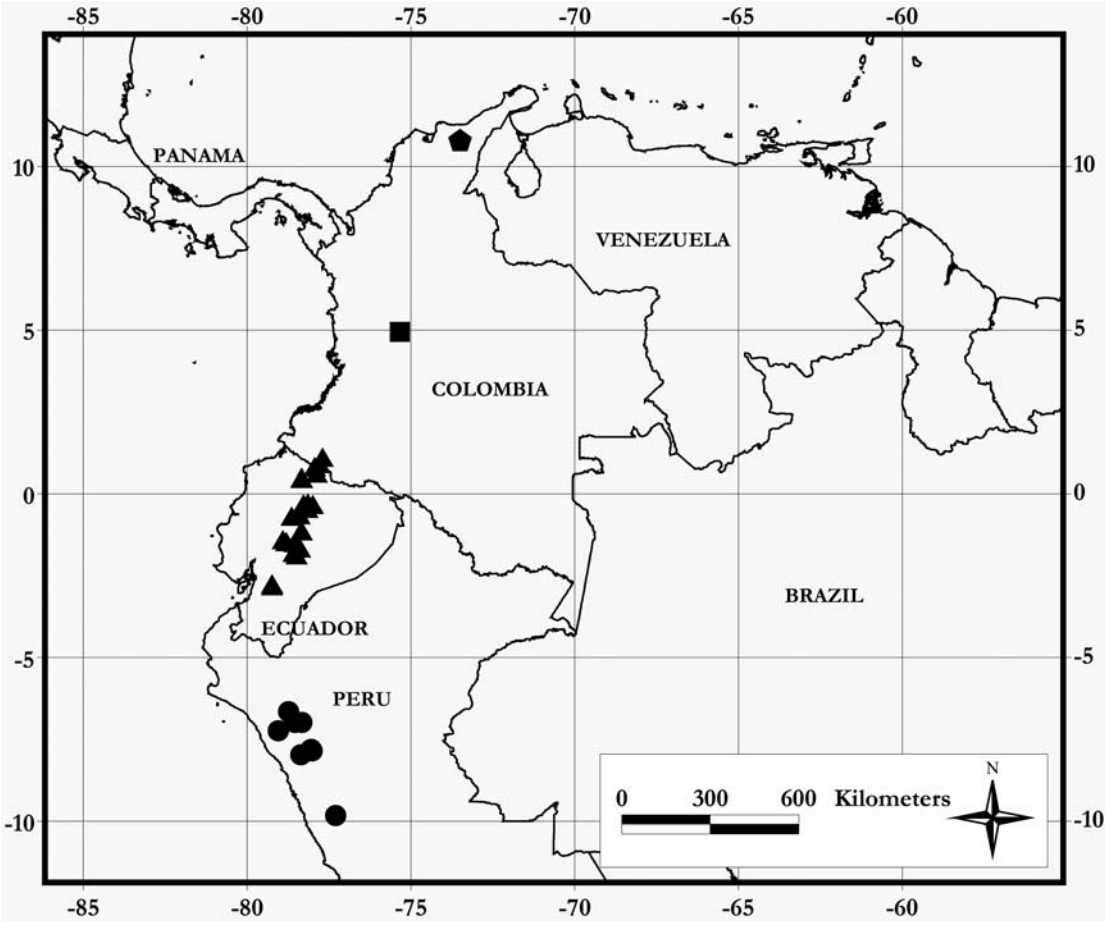


Figure 57. Distribution of *Festuca huamachucensis* (●), *F. imbaburensis* (▲), *F. nereidaensis* (■), and *F. sanctae-martae* (⬟).

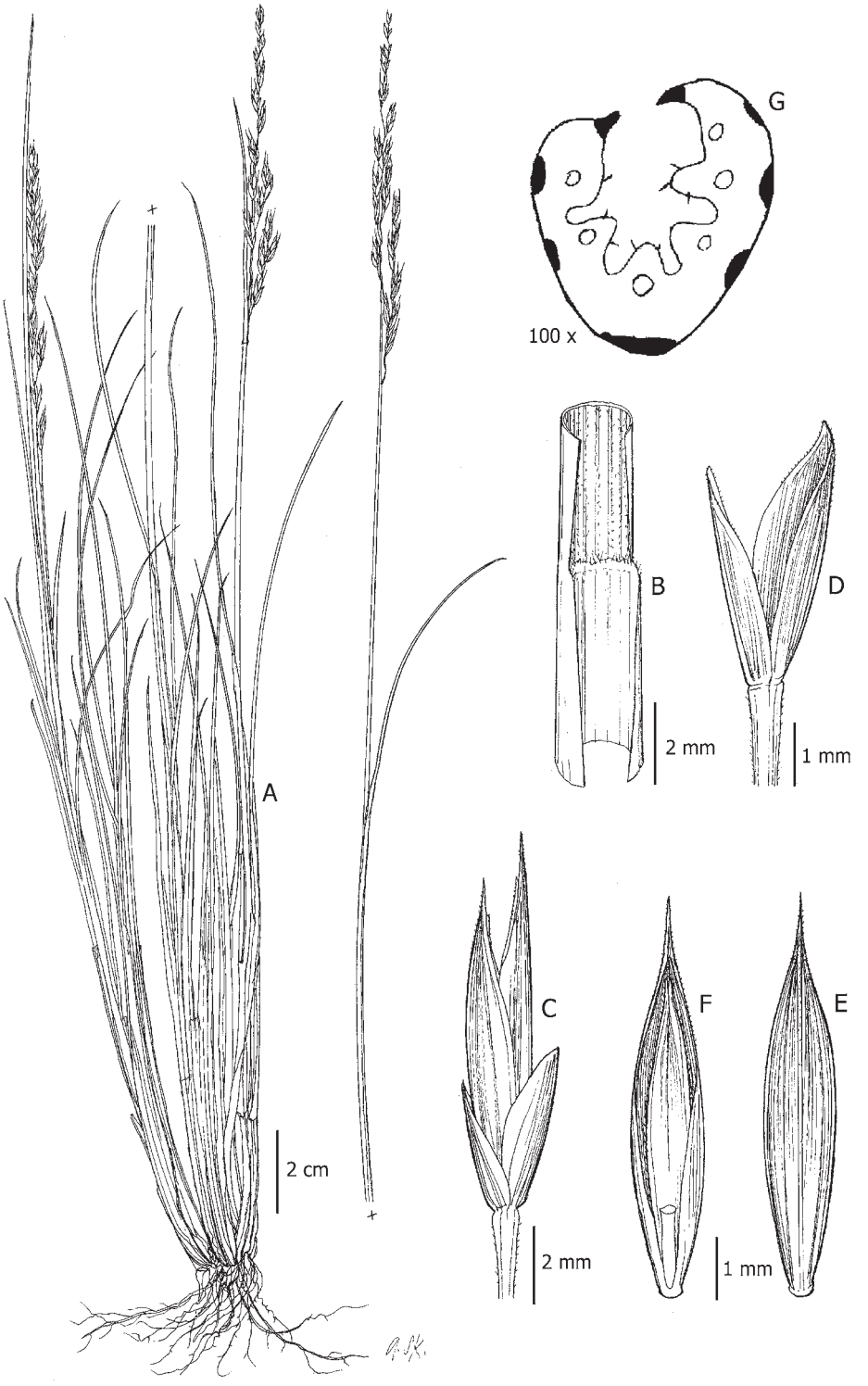


Figure 58. *Festuca imbaburensis.* **A.** Habit. **B.** Ligule. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Lemma with palea and rachilla. **G.** Leaf blade cross-section. A–G, *Stančík 3899* (PRC).

adaxial epidermis with scattered hairs, the hairs 0.09 mm long.

Observations.—*Festuca imbaburensis* is morphologically similar to *F. glumosa* but differs by having glabrous leaf blades (versus scabrous), narrower blades (0.5–0.6 versus 0.8–1.4 mm), shorter ligules (0.5–0.7 versus 0.8–1.2 mm), glabrous rachillas (versus pilose), and shorter lemmas (5.5–6(–7) versus 7–8 mm).

Distribution and habitat.— Festuca imbaburensis ranges from central Ecuador to southern Colombia. It occurs in swampy patches associated with grass paramos and superparamos between 3400–4200 m.

Additional specimens examined. **COLOMBIA. Nariño:** Mun. Cumbal, Volcán Nevado de Cumbal, N-NE slopes, 3700 m, 9 Mar 1999, *D. Stančík 2749* (COL, PRC, US); Mun. Tuquerres, Volcán Azufral, road from vereda San Roque alto to Laguna Verde, km 4, 3700 m, 9 Mar 1999, *D. Stančík 2783* (COL, PRC); road from vereda San Roque alto to Laguna Verde, km 5, 3800 m, 9 Mar 1999, *D. Stančík 2786* (AAU, COL, PRC). **ECUADOR. Azuay:** Parque Nacional Cajas, trail from Molleturo to Paraguillas, 02º49´S, 79º15´W, 4200–4300 m, *S. Laegaard 102666* (AAU); Mun. Cuenca, Parque Nacional Cajas, Cerro Amarrillo, 2°45´S, 79°15´W, 4300–4400 m, 13 Jul 1997, *D. Stančík 2056* (PRC, QCA); Cajas Parque Nacional, E flanks and summit area of Cerro Amarillo, 4451m, lower superparamo with *Loricaria* sp., *Azorella* sp., *Werneria* sp., 79°15´W, 02°45´S, *Sklenář 2596* (PRC, QCA). **Bolívar:** road Los Arenales–Salinas, km 4, 01º24´S, 78º55´W, 4300 m, *S. Laegaard 55368* (AAU). **Carchi:** Paramo del Angel, sector Voladero, 00º38´N, 67º53´W, 3400–3800 m, *Davalos 18* (US); Volcán Los Chiles, 00º49´N, 77º57´W, 3950–3980 m, *S. Laegaard 101692* (AAU, QCA); Mun. Tulcán, volcán Chiles, SW slope, 00°48´N, 77°57´W, 4055m, 14 Jul 1999, *D. Stančík 3228* (AAU, PRC, QCA, US, W); *D. Stančík 3235*, *3267* (AAU, PRC, QCA). **Chimborazo:** El Altar, N side of Volcán, 4200–4400 m, *Sklenář & Kostečková 956* (AAU); 4200 m, *Sklenář & Kostečková 1929* (AAU); *Sklenář & Kostečková 1031* (US); Collanes valley, Paramo de Los Altares, 4000 m, *Ramsay & Smith 343* (QCA, QCNE); Alao–Paramo de Laguna Negra, 4100 m, *Barclay & Juajibioy 8763* (MO, US); E side of Volcán Chimborazo, 4300 m, *Sklenář & Kostečková 2168* (AAU); km 8.5 E of Guardiana Alao above Río Alao, 3350–3550 m, *P.M. Peterson 9197, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (MO, US); E of Licto, 4200 m, 30 Oct 1987, *Ramsay 1035* (K, QCA, QCNE). **Cotopaxi:** road San Miguel (Salcedo)–Puerto Nuevo, 29 km from San Miguel, 3950–4050 m, *B. Øllgaard & Balslev 9921* (AAU, F, MO, NY, S); Paramo de Cotopaxi, *T. de Vries s.n.* (AAU); Parque Nacional Cotopaxi, 4220 m, 21 Jun 1999, *D. Stančík 3098* (AAU, PRC, QCA); Mun. Lasso, Parque Nacional Cotopaxi, NE side of volcano, 00º 39.3´S, 78º25´W, 4220 m, 26 Jun 1999, *D. Stančík 3101* (AAU, PRC, QCA). **Imbabura:** Paramo de Mariano Acosta, km 25 on the road Yahuarcocha–Mariano Acosta, 00º20´S, 78º00´W, 3650–3750 m, *S. Laegaard 101194* (AAU); Mun. Urcuquí, road to Cerro Yanaurcu, S slope, 00°28´56˝N, 78°20´28.5˝W, 4300 m, 15 Oct 2000, *D. Stančík 4081* (AAU, PRC, QCA); *D. Stančík 4090* (AAU, PRC, QCA, US); *D. Stančík 4091* (AAU, PRC, QCA); *D. Stančík 4092B, 4098* (PRC, QCA). **Pichincha:** road Pifo–Pintag, in valley 2.5 hours horseride above Inga Monserat, 00º19´S, 78º17´W, 3950 m, *S. Laegaard 102262* (AAU); along road El Chaup–Pastocalle, 00º41´S, 78º39´W, 3200–3700 m, *S. Laegaard 54548* (MO); road Quito–Páramo Guamaní, 00º17´S, 78º09´W, *B. Øllgaard & Balslev 10073* (AAU, F, NY, MO, S); antenna N of pass, 00º17´S, 78º09´W, 4260xm, *B. Øllgaard & Balslev 10100* (AAU, NY); 00º17´S, 78º11´W, 4250–4400 m, *S. Laegaard et al. 53859* (AAU, QCNE); 4050 m, *S. Laegaard 101373* (AAU, QCA); peak ca. 6 km S of Paso de la Vírgen, 00º21´S, 78º13´W, 4200–4250 m, *S. Laegaard 55698* (AAU); 4100 m, *S. Laegaard 103105* (QCA); 3900 m, *Ramsay et al. 153* (QCA, QCNE); N side of Volcán Antisana, ca. km 12 along road to Hacienda Antisana, 00º27´S, 78º10´W, 4400–4500 m, *S. Laegaard 102871* (AAU); Mun. Pifo, Paramo de Guamaní, 00º 20´S, 78º12´W, 4000 m, 19 Jun 1999, *D. Stančík 3054B* (PRC, QCA); *D. Stančík 3054A* (AAU, PRC, QCA); Superparamo vegetation on the SW side of Cotacachi, 0°21´N, 78°21´W, 4300–4400 m, 12 Aug 2004, *Sklenář 8204* (PRC). **Tungurahua:** along trail from Mesa Tablon to Limpiopungu, S of Laguna Pisayambo, 01º07´S, 78º21´W, 4000–4050 m, *S. Laegaard 19452* (AAU); Llanganatis, by Lake Aucacocha, 3700 m, *Edwards s.n.* (P); Mun. Pillaro, Las Llanganatis, 01°07´55.5˝ S, 78°20´40˝W, 3900 m, 28 Sep 2000, *D. Stančík 3898* (PRC, QCA); *D. Stančík 3899* (AAU, PRC, QCA); 01°09´37.5˝S, 78°14´51˝W, 3500 m, *D. Stančík 3990* (PRC, QCA).

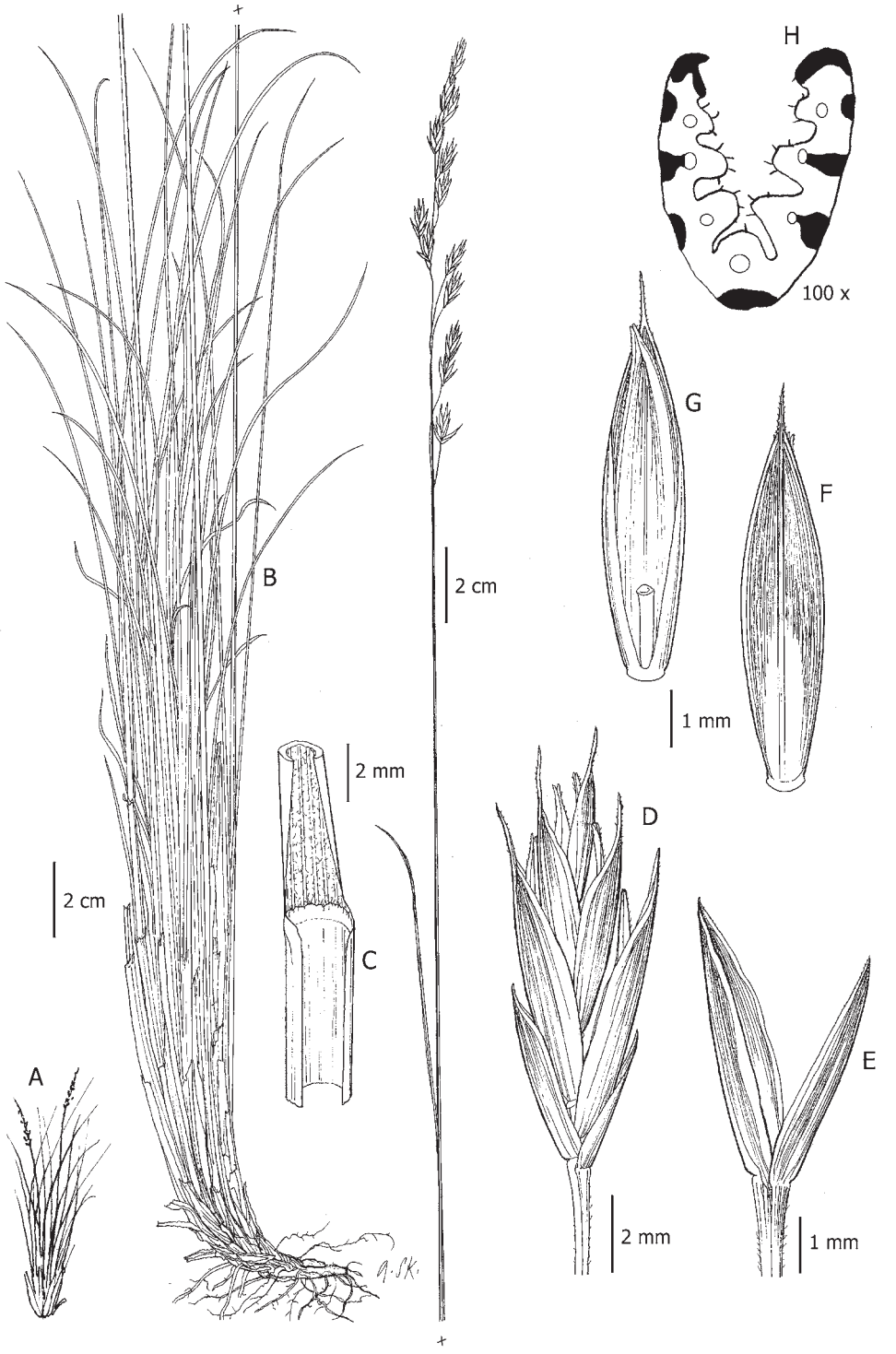


Figure 59. *Festuca monguensis.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík & Galvis2026* (PRC).

46. Festuca monguensis Stančík, Darwiniana 41(1–4): 139, f. 8a–e. 2003. (**Figs. 52, 59, 94C−F**). Type: Colombia. Boyacá, Mun. Mongui, páramo de la Laguna La Colorada, 3550 m, 21 Jan 1999, *D. Stančík & Galvis 2026* (holotype: PRC!; isotype: COL!, FMB!).

Tussocked perennials with intravaginal innovations. Culms ca. 50 cm tall, erect, scabrous; nodes 2 on upper 1/2. Leaf sheaths coriaceous, stramineous, finely striate, glabrous; auricles absent; ligules 0.7–1(–1.5) mm long, coriaceous, apex truncate, short-ciliate; blades 20–25 cm long, 0.6–0.8 mm wide, conduplicate to involute, abaxially scabrous, green, apex obtuse. Panicles 5–15 × 0.5–0.8 cm, contracted, lanceolate, with few branches; branches scabrous. Spikelets 9–11 mm long, lanceolate, florets 3 or 4; rachilla glabrous or with short, scattered hairs; glumes 4–5 mm long, lanceolate, coriaceous, purplish-green, scabrous near apex, margins membranous, apex acute; lower glumes ca. 4 mm, 1-nerved; upper glumes ca. 5 mm long, 3-nerved; lemmas 6–7 mm long, lanceolate, 5-nerved, membranous, purplish-green, papillose, scabrous near apex, awned, the awn 0.5–2.5 mm long; callus glabrous; paleas as long as the lemma, lanceolate, membranous, papillose, hairy along keel and near apex; lodicules 1.3 mm long, oblong, two-dentate; anthers 1.2–1.3 mm long; ovary apex glabrous. Caryopses not seen.

Leaf blade anatomy.—Cross-sections usually with 7 vascular bundles, 5(–7) ribs above; sclerenchyma under abaxial epidermis discontinuous sometime extending to the vascular bundles, sclerenchyma absent adaxially; adaxial epidermis with scattered hairs, the hairs ca. 0.09 mm long.

Observations.—*Festuca monguensis* differs from other species of *F.* sect. *Festuca* by having short panicles on distinctive long culms.

Distribution and habitat.— *Festuca monguensis* is endemic to Colombia and is known only from type locality in Cordillera Oriental (Boyacá). It is known from grass paramo dominated with *Calamagrostis effusa* (Kunth) Steud. between 3400–3600 m.

Additional specimens examined. **COLOMBIA. Boyacá:** Mun. Mongui, páramo de la Laguna La Colorada, 3550 m, 21 Jan 1999, *D. Stančík & Galvis 2025* (COL, PRC); 3450 m, 21 Jan 1999, *D. Stančík & Galvis 2028* (COL, FMB, PRC).

47. Festuca nereidaensis Stančík, Darwiniana 41(1–4): 139, f. 8f–k. 2003. (**Figs. 57, 60, 95A−D**). Type: Colombia. Caldas, Mun. Manizales, Parque Nacional Los Nevados, road from Casa del Cisne to Río Nereidas, km 5, 3800–4000 m, 18 Dec 1999, *D. Stančík 3401B* (holotype: PRC!; isotype: COL!).

Tussocked perennials with intravaginal innovations. Culms 80–100 cm tall, erect, finely scabrous just below panicle; nodes 2 or 3 on upper 1/2. Leaf sheaths membranous to coriaceous, stramineous, glabrous; auricles absent; ligules 0.7–1 mm long, membranous, apex truncate, ciliate; blades 25–35 cm long, 1.2–1.5 mm wide, conduplicate, abaxially glabrous, green, apex acute. Panicles 15–20 × 1–1.5 cm, contracted, lanceolate, branches finely scabrous. Spikelets 11–12 mm long, lanceolate, florets 5; rachilla short, sparsely short-hairy; glumes 6–8 mm long, lanceolate, coriaceous, margins membranous, dark, glabrous, apex acute; lower glumes 6–6.5 mm long, 1-nerved; upper glumes 7–8 mm long, 3-nerved; lemmas 7–7.5 mm long, lanceolate, 5-nerved, coriaceous, finely papillose, awned, apex pointed, the awn 0.5–0.7 mm long; callus glabrous; paleas almost as long as the lemma, lanceolate, membranous, papillose, upper 1/2 scabrous, apex hairy; lodicules 1.3 mm long, lanceolate, two-dentate; anthers 1.3–1.6 mm long; ovary apex glabrous. Caryopses not seen.

Leaf blade anatomy.—Cross-sections with 10–12 vascular bundles and 9 ribs above; sclerenchyma under abaxial epidermis almost continuous, sometimes extending to the vascular bundles, adaxial sclerenchyma present but not extending to the vascular bundles; adaxial epidermis hairy, the hairs ca. 0.45 mm long.

Distribution and habitat.—Festuca nereidaensis is endemic to Colombia and is known only from the type locality of Nevado del Ruiz in Cordillera Central. This species occurs in grass paramo zones between 3800–4000 m.

48. Festuca oroana Stančík, Folia Geobot. Phytotax. 39(1): 104, f. 2, 6–10. 2004. (**Figs. 61, 64, 95E & F**). Type: Ecuador. El Oro, along mule-track Tambillo–Manu, mountain forest, grazed and/or burned, dense tussock, 03º30´S, 79º32´W, 3200–3320 m, 21 Feb 1988, 21 Feb 1988, *S. Laegaard 70309* (holotype: AAU!; isotypes: MO!, PRC!, QCA!, QCNE!).

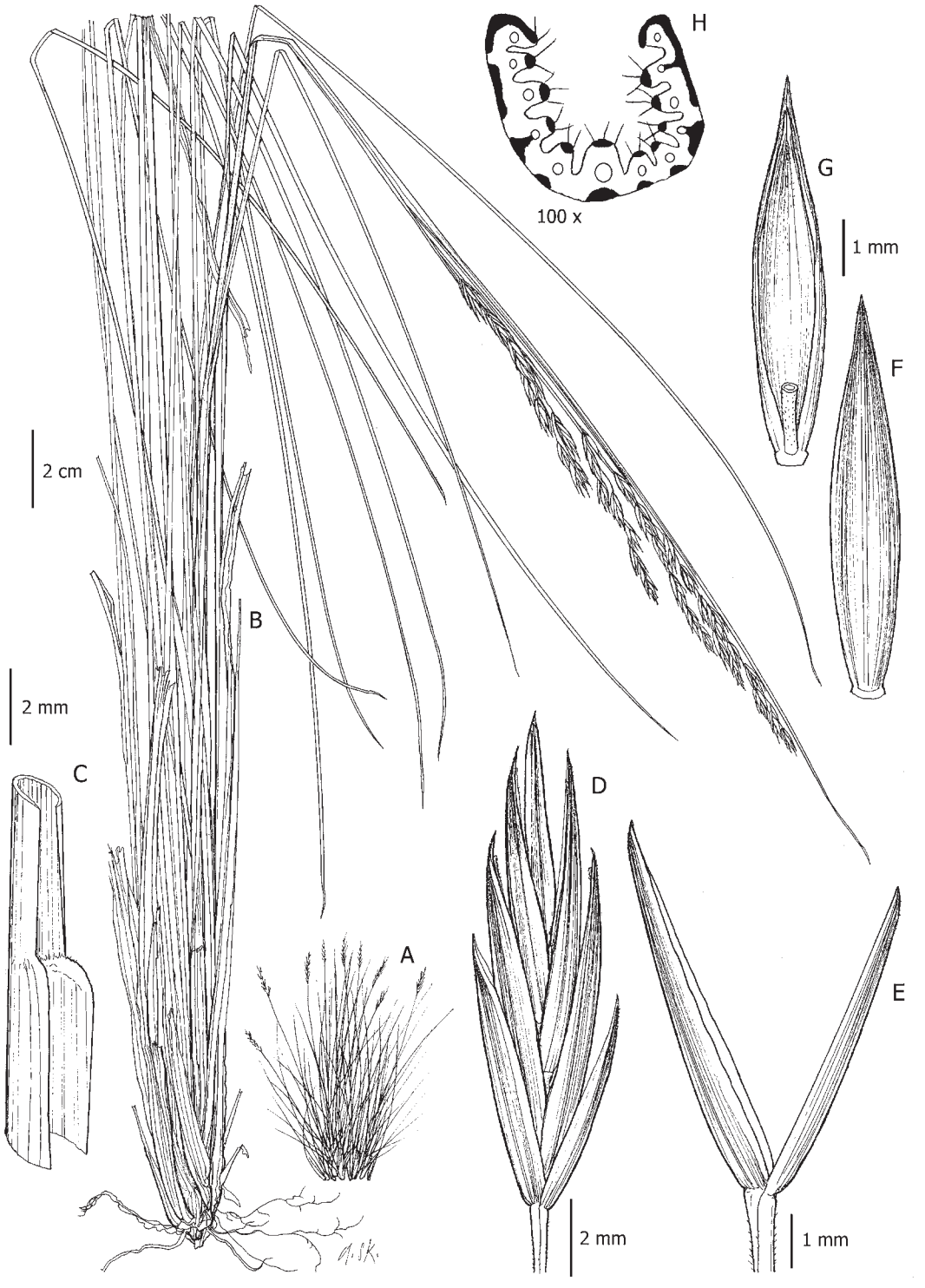


Figure 60. *Festuca nereidaensis.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 3401B* (PRC).

Figure 61. *Festuca oroana.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Laegaard 70309* (PRC).

Tussocked perennials with intravaginal innovations. Culms ca. 100 cm tall, erect, scabrous; nodes 2(–3) on lower 1/2. Leaf sheaths membranous to coriaceous, lightly brownish-gray, finely scabrous, margins free; auricles absent; ligules 0.5–1(–1.5) mm long, membranous, apex truncate, short-ciliate; blades 35–50 cm long, 1.1–1.8(–4) mm wide, conduplicate to flat, abaxially glabrous, green. Panicles ca. 20 cm long, ca. 25 cm wide, pyramidal, spreading, branches and pedicels densely minutely scabrous. Spikelets 9–10 mm long, lanceolate to oblong-lanceolate, florets 4 or 5(–6); rachilla densely hairy, the hairs short; glumes 2.4–3.9 mm long, membranous to coriaceous, green, apex acute; lower glumes 2.4–2.6 mm long, lanceolate, 1-nerved, glabrous; upper glumes 3.6–3.9 mm long, oblong to oblong-lanceolate, 3-nerved; lemmas 5.5–6(–6.5) mm long, lanceolate, 5-nerved, membranous, greenish, papillose or upper 1/3 finely scabrous, awned, the awn 0.5–1 mm long; callus hairy; paleas as long as the lemma, lanceolate, membranous, margins short-hairy, apex glabrous; lodicules oblong-lanceolate; anthers 2.7–2.8 mm long; ovary apex glabrous. Caryopses not seen.

Leaf blade anatomy.—Cross-sections with about 17 vascular bundles and 9 ribs above; sclerenchyma under abaxial epidermis discontinuous, adaxial sclerenchyma extending to the vascular bundles forming girders; adaxial epidermis densely hairy, the hairs, 0.2–0.4 mm long.

Observations.—In South America, there are no species morphologically similar to *F. oroana*. Perhaps *F. fiebrigii* is superficially similar but differs by having cylindrical panicles (versus pyramidal in *F. oroana*), longer glumes and lemmas (lower glume ca. 4 versus 2.4–2.6 mm; upper glumes 5–5.5 versus 3.6–3.9 mm; lemmas 6–7 versus 5.5–6 mm).

Distribution and habitat.—Festuca oroana is known only from type locality in Southern Ecuador. It occurs in Andean mountain forests at an altitude of about 3200 m.

49. Festuca parciflora Swallen, Contr. U.S. Natl. Herb. 29(6): 255. 1949. (**Figs. 62, 64**).

Type: Ecuador. Azuay, paramo, in vicinity of Toreador, between Molleturo and Quinoas, 3810–3930 m, 15 Jun 1943, *J. A. Steyermark 53092* (holotype: US-1911635!).

Tussocked, loosely caespitose or short-rhizomatous perennials with intravaginal innovations. Culms 28–60 cm tall, erect, scabrous or glabrous; nodes 1, basal. Leaf sheaths membranous to coriaceous, brownish-gray, glabrous, inconspicuously striate; ligules 0.8–1 mm long, membranous to coriaceous, apex truncate, short-ciliate; blades 13–23 cm long, 0.4–0.6 mm wide, conduplicate to involute, slightly abaxially scabrous, glaucous, apex obtuse. Panicles 3–15 cm long, ca. 0.5 cm wide, contracted, narrow with few erect branches; branches scabrous on ribs. Spikelets 8.5–9 mm long, lanceolate, florets 2 or 3(–4); rachilla with scattered hairs; glumes 3–5 mm long, keeled in upper part, membranous, purplish-white, upper 1/4 sparsely tuberculate; lower glumes 3–3.5 mm long, lanceolate, 1-nerved; upper glumes 4–5 mm long, ovate, 3-nerved; lemmas 6–7 mm long, lanceolate, 5-nerved, membranous, keeled, purplish-green, upper 1/3 scabrous, awned, the awn 0.5–1.5 mm long; callus with scattered hairs; paleas as long as the lemma, lanceolate, membranous, upper part and along keels densely scabrous to pilose; lodicules lanceolate; anthers 0.8–1.1(–1.4) mm long; ovary apex glabrous. Caryopses lanceolate; hilum 4/5 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with 5 vascular bundles and 3 ribs above; sclerenchyma discontinuous under abaxial epidermis, adaxial sclerenchyma absent; adaxial epidermis with scattered hairs, the hairs 0.09 mm long.

Observations.—This species is morphologically similar to *F. glumosa*, *F. imbaburensis*, *F. carchiense*, and *F. sumapana* but differs by having slender, scabrous leaf blades, smaller spikelets, and smaller floral parts.

Distribution and habitat.—Festuca parciflora is endemic to southern Ecuador (Azuay, Loja) and is known from the grass paramo zone between 3600–4200 m.

KEY TO THE SUBSPECIES OF *FESTUCA PARCIFLORA*

1a. Culms 40–50 cm tall, scabrous; plants tussocked; panicles 7–11(–15) cm tall .... **49a. F. parciflora** subsp. **parciflora**

1b. Culms ca. 25 cm tall, glabrous; plants short-rhizomatous to loosely caespitose; panicles 3–7 cm long.....**49b. F. parciflora** subsp. **loxana**

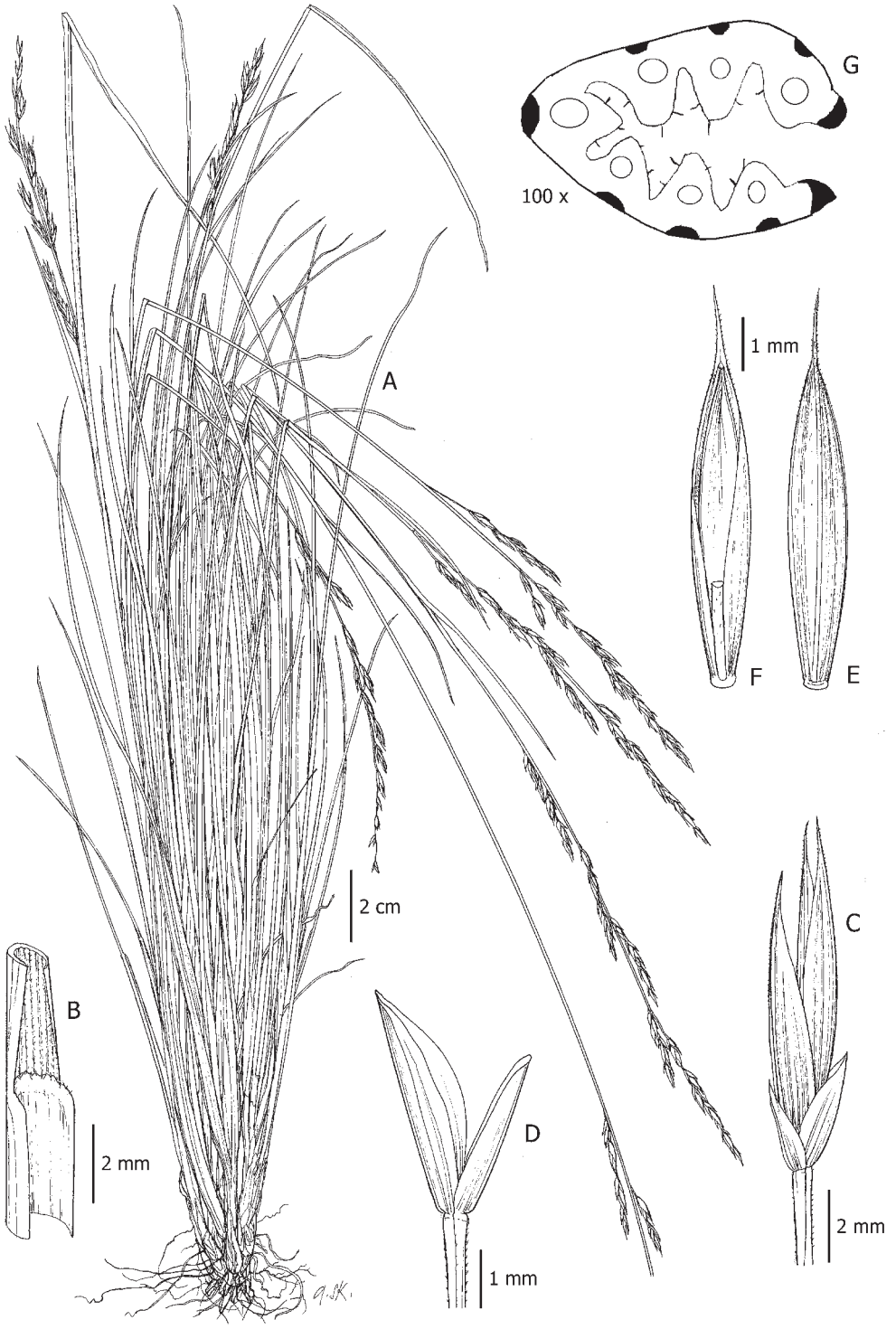


Figure 62. *Festuca parciflora* subsp. *parciflora.* **A.** Habit. **B.** Ligule. **C.** Spikelet. **D.** Glumes. **E.** Lemma. **F.** Lemma with palea and rachilla. **G.** Leaf blade cross-section. A–G *Stančík 3846* (PRC).

49a. Festuca parciflora subsp. **parciflora (Fig. 62)**.

Tussocked perennials. Culms 40–50 cm tall, scabrous; panicles 7–11(–15) cm tall.

Additional specimens examined. **ECUADOR. Azuay:** Parque Nacional Cajas, N side of Laguna Luspa, 02°48´S, 79°15´W, 3850 m, 1 Sep 2000, D. Stančík 3845 (AAU, PRC); *D. Stančík 3846* (AAU, PRC, US, W); Mun. Cuenca, Parque Nacional Cajas, between El Refugio and Lagoon Taglacocha–Tres Cruces, 02°47´S, 79°13´W, 3900–4000 m, 1 Sep 2000, *D. Stančík 3859* (AAU, PRC); N side of Lagoon Taglacocha, 4100–4200 m, 1 Sep 2000, *D. Stančík 3873* (AAU, PRC, US).

49b. Festuca parciflora subsp. **loxana** Stančík, Folia Geobot. Phytotax. 39(1): 107. 2004. Type: Ecuador. Loja, Cerro de Arcos W of road Manu–Zaruma, 03º34´S, 79º28´W, 3250–3600 m, 14 Sep 1999, *S. Laegaard & Aguirre 20608* (holotype: AAU!; isotypes: LOJA!, QCA!).

Rhizomatous or loosely cespitose perennials. Culms ca. 25 cm tall, glabrous. Panicles 3–7 cm tall.

Additional specimens examined. **ECUADOR. Loja:** Surroundings of Laguna Chuquiraga E of Amaluza, 04º37´S, 79º22´W, 3300 m, *S. Laegaard et al. 19285* (AAU).

50. Festuca renvoizei Stančík, Novon 17(1): 100–104. 2007. (**Figs. 63, 64**). Type: Peru. Cajamarca, Las Lagunas, 50 km from Cajamarca on road to Bambamarca, heavily grazed and burned grass paramo with crystalline rock outcrops and numerous lagoons of various size, growing in very wet area beside lagoon, 4000 m, 29 Mar 1988, *S.A. Renvoize & S. Laegaard 5031* (holotype: AAU!; isotypes: CPUN!, K!).

Tussocked perennials with intravaginal innovations. Culms 40–50 cm tall, erect, scabrous; nodes 1, basal. Leaf sheaths membranous, brownish-gray, abaxially glabrous, margins free; auricles absent; ligules 1.2–1.5 mm long, membranous, short-ciliate; blades 20–30 cm long, 0.5–0.7 mm wide, conduplicate to involute, mostly glabrous, green, apex obtuse. Panicles 11–17 cm long, 0.5–0.7 cm wide, contracted, slender; branches scabrous throughout. Spikelets 9–10.5 mm long, lanceolate, florets 2 or 3; rachilla glabrous; glumes 3.5–5.5 mm long, membranous, dark purple, mostly glabrous, apex acute; lower glumes 3.5–4.5 mm long, lanceolate, 1-nerved; upper glumes 5–5.5 mm long, oblong-lanceolate, 3-nerved; lemmas 7–7.5 mm long, lanceolate, 5-nerved, membranous, dark purple, scabrous distally, awned, the awn 0.5–1 mm long; callus glabrous; paleas 4/5 as long as the lemma, membranous, upper 1/3 and along keels hairy; lodicules ca. 0.8 mm long, lanceolate; anthers 1–1.2 mm long; ovary apex glabrous. Caryopses not observed.

Leaf blade anatomy.—Cross-sections with 5–8 vascular bundles, 5 ribs above; sclerenchyma under abaxial epidermis discontinuous and small, adaxially absent; adaxial epidermis with scattered hairs, the hairs ca. 0.1 mm long.

Distribution and habitat.—Festuca renvoizei is known only from Department Cajamarca in northern Peru from grass paramos in very wet areas near lagoons at 4000 m.

Additional specimens examined. **Peru. Cajamarca:** Parte baja del Cerro Shillas Negras y Laguna Totora, 3920 m, 23 Apr 1994, *Vega et al. 7011* (F, CPUN).

51. Festuca sanctae-martae Stančík, Preslia 75(4): 343–345, f. 2. 2004. (**Figs. 57, 65, 96A−D**). Type: Colombia. Magdalena, Sierra Nevada de Santa Marta, SE slope, Hoya del Río Donachuí, Laguna de Calocribe (E of Meollaca), paramo, 3600–3700 m, 30 Sep 1959, *J. Cuatrecasas & Castañeda 24532* (holotype: COL!; isotype: US!).

Tussocked perennials with intravaginal innovations. Culms 60–80 cm tall, erect, glabrous or finely scabrous under panicle; nodes 1, basal and 1 or 2 shorter leaves. Leaf sheaths membranous to coriaceous, stramineous, glabrous, finely striate; auricles absent; ligules 1–1.6 mm long, membranous to coriaceous, apex truncate; blades 25–35 cm long, (0.8–)2–3.5 mm wide, conduplicate or flat, abaxially glabrous. Panicles 10–16 × 1.5–2 cm, contracted, elongate. Spikelets 10–13 mm long, lanceolate, florets 2 or 3; rachilla pubescent; glumes 8.5–10.5 mm long, almost as long as the spikelet, lanceolate, membranous, white to purplish-white, scabrous along midnerve, apex acute; lower glumes 8.5–9.5 mm long, 1-nerved; upper glumes 8.5–10.5 m long, 3-nerved; lemmas 9–10 mm long, lanceolate, 5-nerved, membranous, awnless or short-awned, the awn 0.5–1 mm long; callus

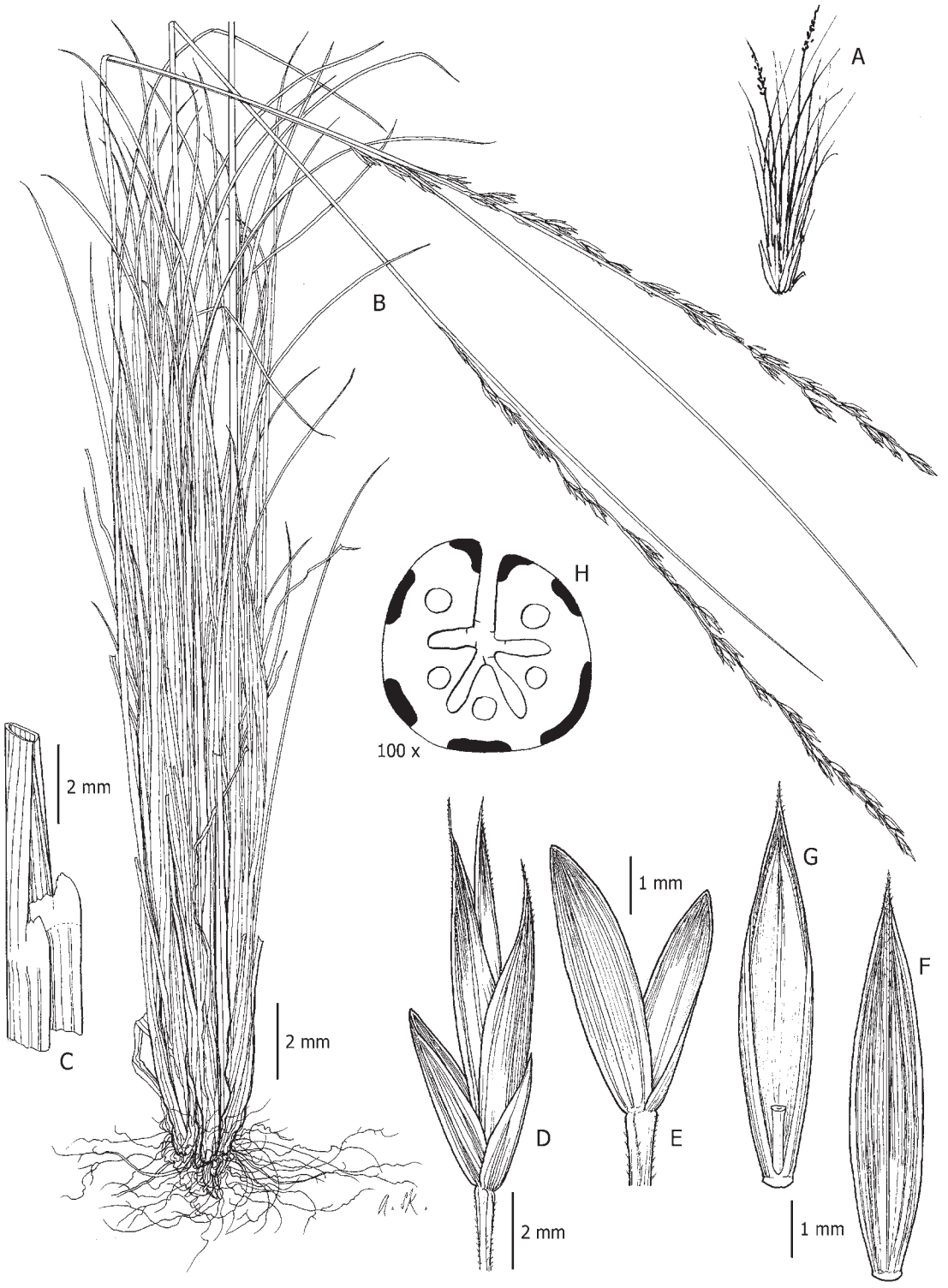


Figure 63. *Festuca renvoizei.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Renvoize & Laegaard 5031* (AAU).

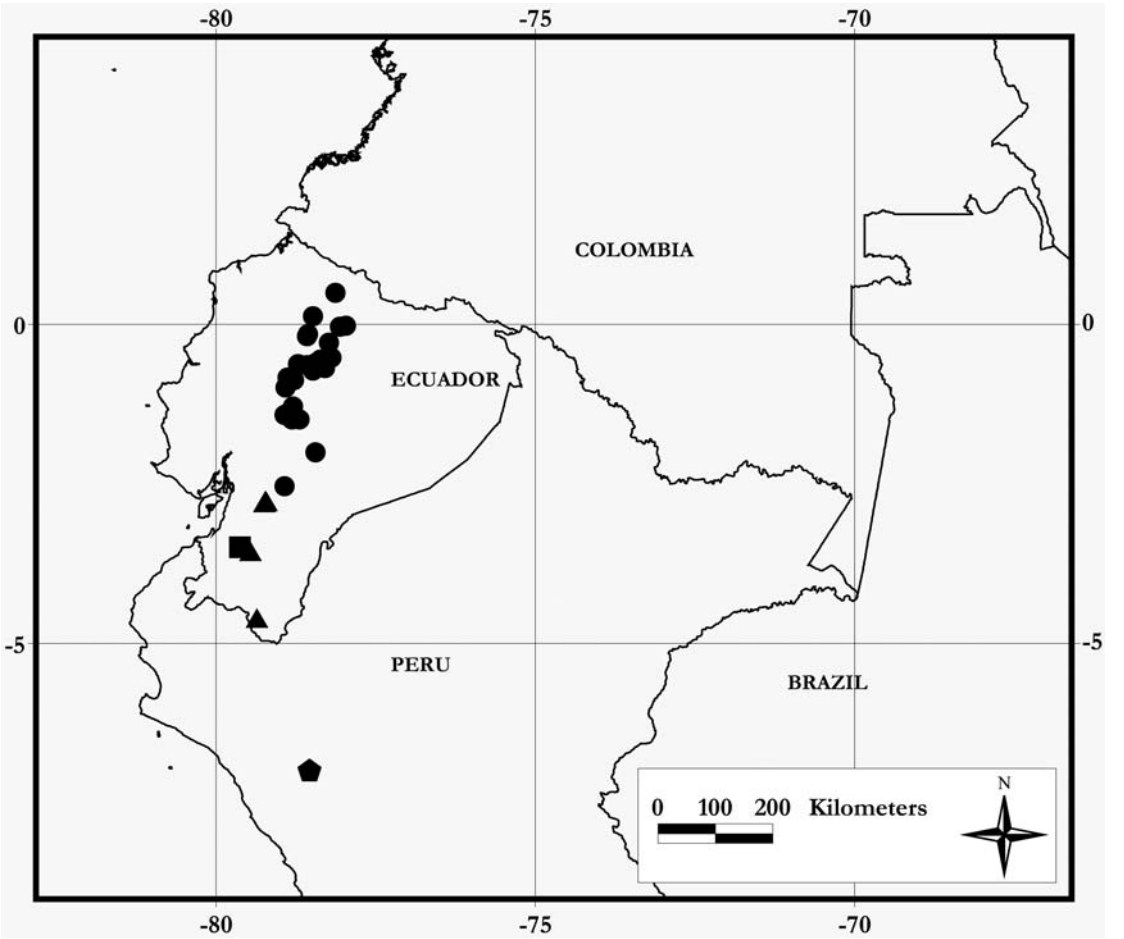


Figure 64. Distribution of *Festuca vaginalis* (●), *F. parciflora* (▲), *F. oroana* (■), and *F. renvoizei* (⬟).

glabrous or sparsely hairy; paleas 3/4 as long as the lemma, papillose, upper 1/3 scabrous; lodicules 1–1.4 mm long, lanceolate; anthers 0.8–1.1 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 3/4 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with (8–)10–11 vascular bundles, with 5–7 ribs above; sclerenchyma under both abaxial and adaxial epidermis, discontinuous, sclerenchyma girders absent; bulliform cells not observed; adaxial epidermis with scattered hairs, the hairs ca. 0.02 mm long.

Observations.—Festuca sanctae-martae is morphologically similar to *F. glumosa* and *F. cocuyana*. *Festuca sanctae-martae* and *F. cocuyana* differ from *F. glumosa* by having conduplicate (versus involute) leaf blades with 8–11 (versus 5–7) vascular bundles, lower glumes 7.5–9.5 mm long (versus 4.5–6 mm), upper glumes 7.5–10.5 mm long (versus 6–6.5 mm), and lemmas 8–10 mm long (versus 7–8 mm). *Festuca cocuyana* differs from *F. sanctae-martae* by having shorter culms (20–50 versus 60–80 cm), shorter leaf blades (15–20 versus 25–35 cm), and shorter lower glumes (7.5–8 versus 8.5–9.5 mm).

Distribution and habitat.—Festuca sanctae-martae is endemic to the Sierra Nevada de Santa Marta in northern Colombia. This species is known from the grass paramos dominated with *Calamagrostis effusa* and shrubby matorral zones between 3600–4300 m.

Additional specimens examined. **COLOMBIA. Magdalena:** Sierra Nevada de Santa Marta, valley descending SW from Picos Reina and Ojeda, around Lagoons Naboba, Mamito, and Mamo, 4200–4300 m, *J. Cuatrecasas & Castañeda 24563* (COL, US).

52. Festuca subulifolia Benth., Pl. Hartw. 262. 1846. (**Figs. 66, 67, 96E–F**). *Festuca tolucensis*

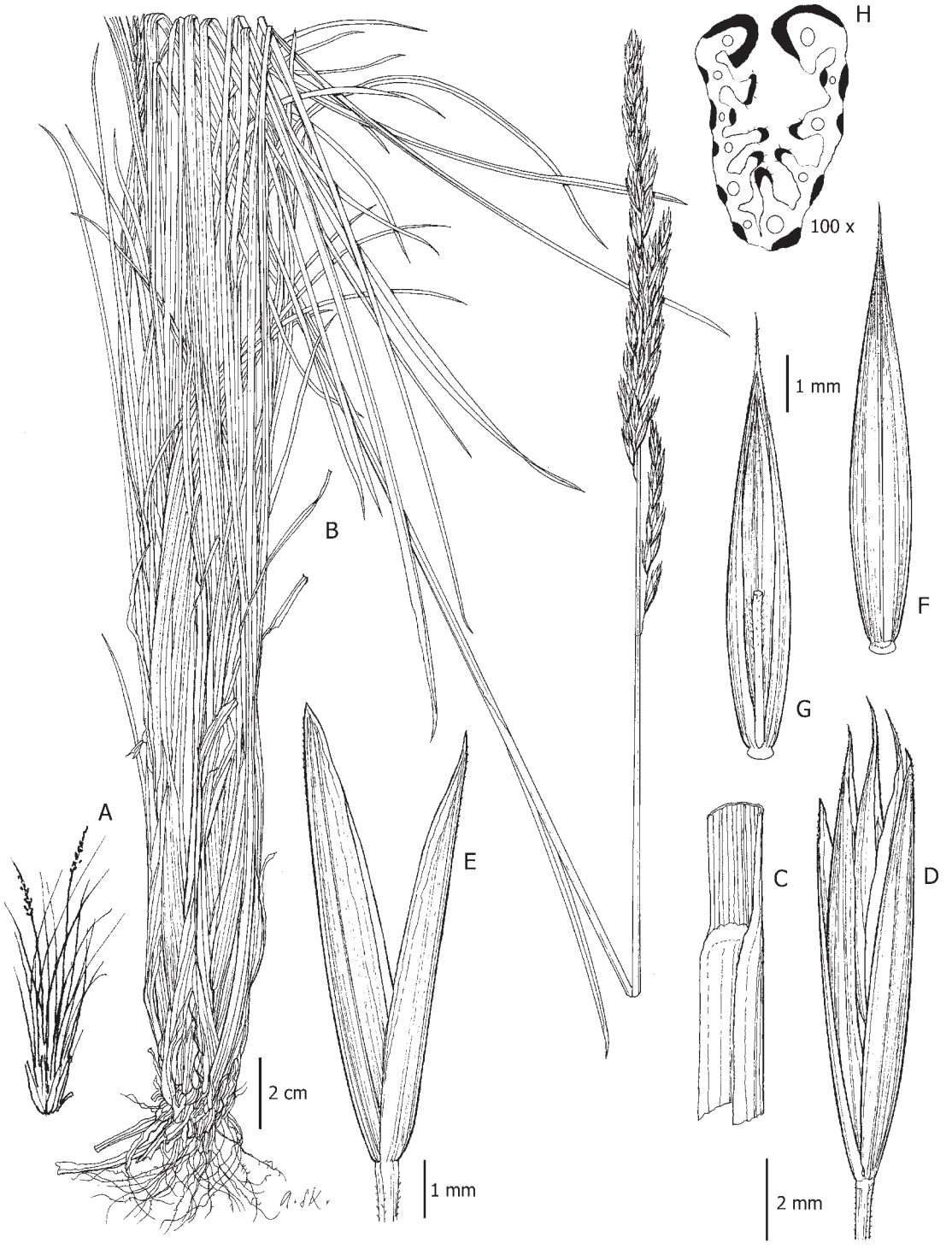


Figure 65. *Festuca sanctae-martae.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Cuatrecasas & Castañeda 24532* (COL).

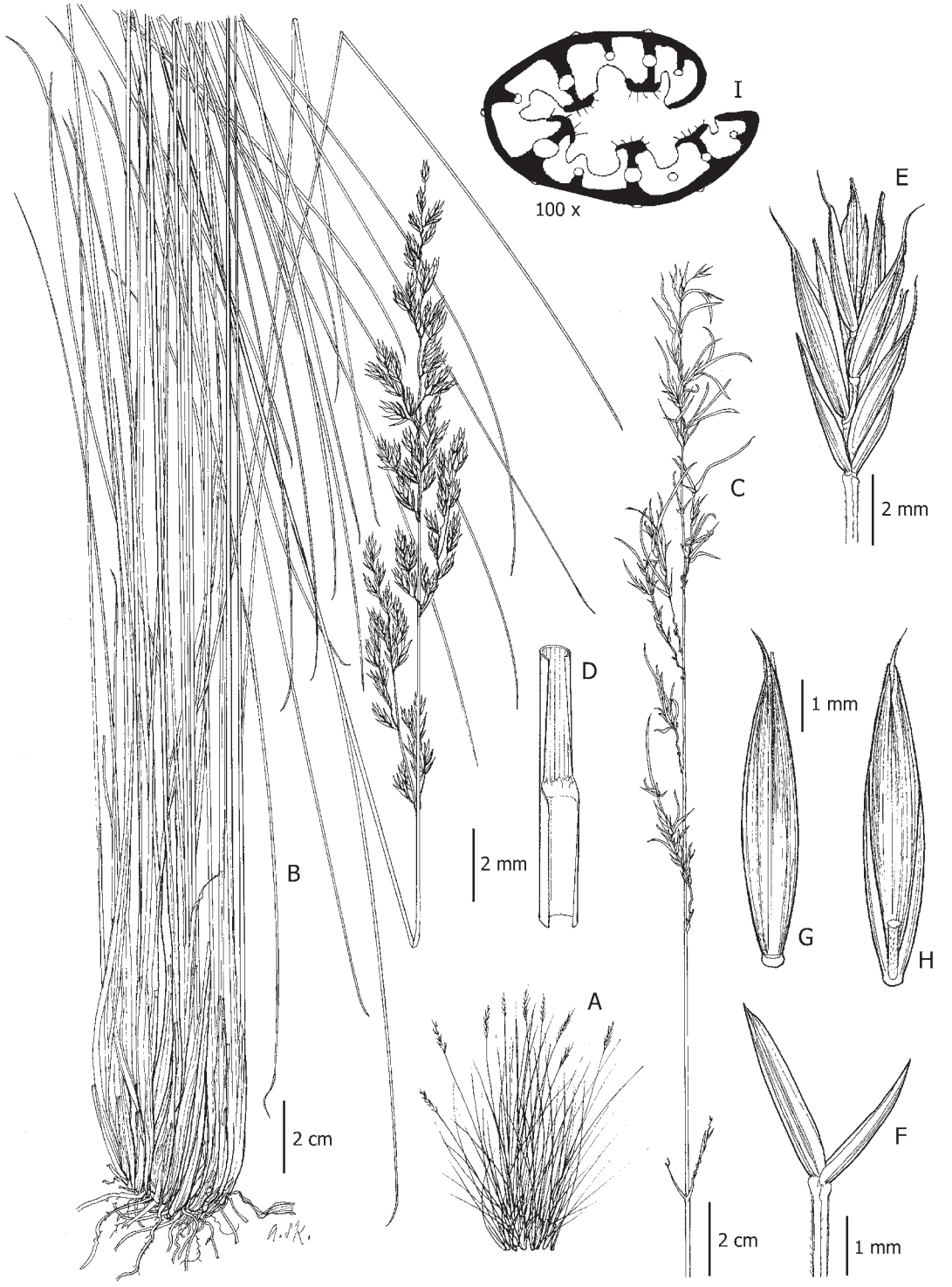


Figure 66. *Festuca subulifolia.* **A.** Stylized growth form. **B.** Habit. **C.** Inflorescence with proliferating spikelets. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Leaf blade cross-section. A–B, D–I, *Stančík 3013* (PRC); C, *Stančík 3336* (PRC).

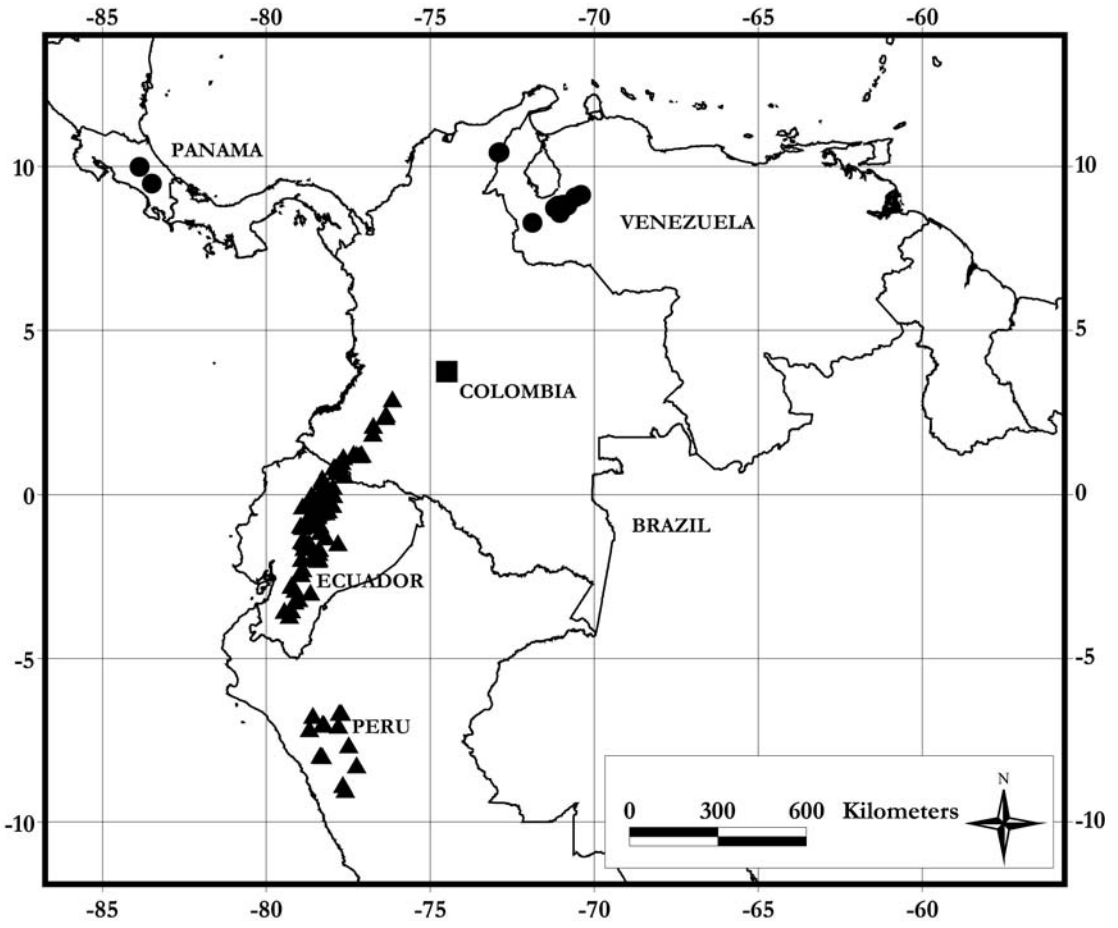


Figure 67. Distribution of *Festuca tolucensis* (●), *F. subulifolia* (▲), and *F. sumapana* (■).

var. *subulifolia* (Benth.) St.-Yves, Candollea 2: 302, 316. 1925. Type: Ecuador. Pichincha, Hacienda de Antisana, *Hartweg 1455* (lectotype: K!, designated by Alexeev, Novosti Sist. Vyss. Rast. 23: 18. 1986; isolectotypes: B!, NY ex K!, P!, W!).

Festuca breviaristata Pilg., Bot. Jahrb. Syst. 25(5): 717–718. 1898. Type: Ecuador. Pichincha, Mount Puntas, 4400 m, Oct–Nov 1971, *A. Stübel 207* (holotype: B!; isotypes: US-2875385 fragm. ex B!, S!).

Festuca cajamarcae Pilg., Bot. Jahrb. Syst. 37: 513. 1906. *Festuca distichovaginata* var. *cajamarcae* (Pilg.) St.-Yves, Candollea 3 :222. 1927. Type: Peru. Cajamarca, Pas Coymolache, 4000–4100 m, May 1904, *A. Weberbauer 3974* (holotype: B!; isotypes: BAA-1171 fragm.!, US-2875389!).

Festuca ferreyrae Tovar, Publ. Mus. Hist. Nat. Javier Prado, Ser. B, Bot. 32: 8. 1984. Type: Peru. Amazonas, Prov. Chachapoyas, Leimebamba, en pajonal, 17 Apr 1964, *R. Ferreyra 15512* (holotype: US-2565588!).

Dense tussocks (25–)50–80 cm tall; innovations intravaginal; culms erect, finely scabrid or glabrous, with one basal node and 2 leaves. Sheaths coriaceous, firm, stramineous (or greyish), glabrous (or finely scabrid); ligule coriaceous-membranous, two-lobed, shortly ciliate, (0.5–)1–2.5 mm long; leaf blades linear, conduplicate, pungent, 10–60 cm long, 0.4–0.8 mm in diameter, rough, green to glaucous. Panicle usually contracted, dense, lanceolate to oblong, some times spreading, ovate, (6–)12–35 long, 1–2(–10) cm wide; branches finely scabrid. Spikelets 6.5–9 mm long, ovate, with 3–5 florets; rachilla covered (densely) by hairs; glumes coriaceous-membranous, acute, green or purplish-green, upper third (or all) scabrous, nerves prominent; lower glume lanceolate, (3–)3.5–4.5(–5.5) mm long,

1-nerved; upper glume oblong, 4–5.5(–6) mm long, 3-nerved; lemmas 5–6.5(–8) mm long, 5-nerved, coriaceous-membranous (on margins), oblong-lanceolate, purplish-green, densely scabrid to rough on all surfaces, shortly two-dentate, with awn 0.5–2.5 mm long; callus glabrous; palea membranous, lanceolate, two-carinate, at least upper third and along keels scabrid to hairy, two-dentate, as long as the lemma (or longer); lodicules obovate, two-dentate, about 1.1 mm long; stamens 3, anthers (2.1–)2.4–2.8(3.2) mm; ovary apex glabrous. Caryopsis oblong-lanceolate; hilum linear, 4/5 of total. Leaf blade cross section typically with 7 vascular bundles and 5 ribs above; sclerenchyma under abaxial epidermis continuos with all or almost all vascular bundles, adaxial sclerenchyma present at 3 vascular bundles and forming girders. (about 30% of studied specimens with 9–13 vascular bundles forming 7–11 ribs and with 3–6 girders); abaxial epidermis densely covered by prickles, hairs more or less dense on adaxial epidermis, 0.1–0.2 mm long.

Leaf blade anatomy.—Cross-sections typically with 7 vascular bundles and 5 ribs above; sclerenchyma under abaxial epidermis continuous extending to (almost) all vascular bundles; adaxial sclerenchyma present and extending to 3 vascular bundles forming girders, ca. 30% of studied specimens with 9–13 vascular bundles forming 7–11 ribs and with 3–6 girders); abaxial epidermis densely covered by prickles, densely hairy on adaxial epidermis, the hairs 0.1–0.2 mm long.

Observations.—*Festuca subulifolia* is morphologically similar to *F. tolucensis*, however *F. subulifolia* differs by having large girders in leaf blade cross sections and shorter truncate ligules. *Festuca subulifolia* is a highly variable species that is often a dominant or co-dominant in the grass paramo zone. The variation in form and size of the panicles and floral parts cannot be taxonomically interpreted easily and it is probably a result of the diversity of natural conditions and of paramo management, i.e., burning and grazing. Characteristics, such as two-dentate lemmas with a relatively long awn and finely scabrous leaf blades, are fairly stable with not much variation. After comparing the types of Peruvian material of *F. cajamarcae* and *F. ferreyrae,* with that of *F. subulifolia,* it was concluded that these types represent slightly different forms of the same species. Therefore the former two names are here treated as synonyms.

Distribution and habitat.—*Festuca subulifolia* is known from Peru, Ecuador, and Colombia. In Colombia *Festuca subulifolia* is known only in southern part of Cordillera Central (Nariño, Cauca). It is often a dominant species of grass paramos between 2900–3700 m. This species is known from various plant communities such as: *Agrostis* cf. *haenkeana* (Cuatrecasas 1934), *Calamagrostio effusae-Calamagrostietum macrophyllae* (Duque & Rangel 1989), *Aciachne acicularis-Calamagrostis intermedia* (Verweij 1995), *Ugno myricoidis-Espeletietum hartwegianae* (Rangel & Ariza 2000), *Espeletio hartwegianae-Calamagrostietum effusae* (Salamanca 1991), and *Calamagrostis effusae-Espeletia hartwegiana* subsp. *centroandina* (Rangel & Franco 1985).

Additional specimens examined. **COLOMBIA. Cauca:** Mun. Popayan, Parque Nacional Puracé, Volcán Puracé, 02º20.07´N, 76º23.65´W, 4200–4300 m, 6 Jul 2000, *D. Stančík 3609* (COL, PRC); Pilimbalá, 02º22.1´N, 76º24.06´W, 3350 m, 6 Jul 2000, *D. Stančík 3608* (COL, PRC), 3450 m, 2 Apr 1939, *Kjell von Sneidern 2144* (K, US); Macizo Colombiáno, Valle de las Papas, alrededores de Valencia, 3500–3700 m, 15 Sep 1981, *Idrobo et al. 3834* (COL, P, US); Hda. Los Andes, 3150 m, 17 Sep 1958, *Barclay 5865* (COL); alrededores de la Laguna de Cusiyaco, 3360 m, 7 Oct 1958, *Barclay & Juajíbioy 5942* (COL, MO); 3360 m, 7 Oct 1958, *Barclay & Juajíbioy 5945* (COL, MO, US); 12 Oct 1958, *Barclay & Juajíbioy 6052* (COL, MO); Páramo del Puracé, E slope, around Laguna San Rafael, 3320 m, 11 Oct 1961, *J. Cuatrecasas & Willard 26292* (COL, US); 3300 m, 27 Dec 1988, *Ortiz 1272* (COL); Laguna San Rafael, 3300 m, 6 Apr 1985, *Wood 4806, 4807* (COL, K); Páramo El Hinchadera, 3700 m, 24 Jul 1943, *J. Cuatrecasas 14694* (US, VALLE); Cabeceras del Río Paéz, Laguna del Paéz, 3450 m, 4 Dec 1944, *J. Cuatrecasas 19059* (US, MO, VALLE); Páramo de Moras, 9 Mar 1999, *D. Stančík 2685* (COL, PRC); 3000–3500 m, Feb 1906, *Pittier 1409* (US); Mt. Pan de Azucar, 3500–3700 m, 16 Jun 1922, *F. Pennell 7057* (US). **Nariño:** El Encano, km 6 in direction to village Colon, 2900 m, 13 Mar 1999, *D. Stančík 2860* (COL, PRC, PSO); 13 Mar 1999, *D. Stančík 2856* (COL, PRC); Mun. Guachucal, vereda Quetanbu, Páramo Infiernillo, 3200 m, 9 Mar 1999, *D. Stančík 2613, 2618* (COL, PRC, PSO); 3100 m, 9 Mar 1999, *D. Stančík 2617, 2619* (COL, PRC, PSO); *D. Stančík 2631* (COL, PRC); Mun. Pasto, páramo Puerto frío, between villages Las Almas and Alisales, 2900 m, 14 Mar 1999, *D. Stančík 2876* (COL, PRC, PSO); Mun. Pasto, Volcán de

Galeras, 3400 m, 16 Mar 1999, *D. Stančík* 2911 (COL, PRC, PSO); 3200 m, 16 Mar 1999, *D. Stančík 2909* (COL, PRC, PSO); 9 Mar 1999, *D. Stančík 2659* (COL, PRC, PSO); 3600 m, 16 Mar 1999, *D. Stančík 2918* (COL, PRC, PSO); 2900 m, 16 Mar 1999, *D. Stančík 2910* (COL, PRC, PSO); 16 Mar 1999, *D. Stančík 2908* (COL, PRC, PSO); Mun. Pasto, Morazurco, vereda San Francisco, 3100 m, 21 Mar 1999, *D. Stančík 2962* (COL, PRC, PSO); 21 Mar 1999, *D. Stančík 2963* (COL, PRC, PSO); Village Piedrancha, Páramo Infernillo, 3200 m, 9 Mar 1999, *D. Stančík 2659* (COL, PRC, PSO); 9 Mar 1999, *D. Stančík 2656, 2657* (COL, PRC, PSO); *D. Stančík 2658* (COL, PRC); Mun. Tuquerres, Volcán Azufral, vereda San Roque Alto, 3600 m, 9 Mar 1999, *D. Stančík 2764* (COL, PRC, PSO); *D. Stančík 2766* (COL, PRC); 9 Mar 1999, *D. Stančík 2802* (COL, PRC, PSO); 9 Mar 1999, *D. Stančík 2789* (COL, PRC); E slope, 01°07´N, 77º40´W, 3100–3300 m, 15 Jun 1995, *J. Luteyn et al. 12834* (COL, MO); 12 May 1989, *J. Luteyn et al. 12842* (COL); Páramo Bordoncillo, 3250 m, 5 Mar 1963, *Espinal 1035* (COL, PSO, US); Chiles, cerca de población Chiles, 3200 m, 30 Oct 1955, *Fernández-Pérez 2931* (COL); Páramo de Uillinsayaco, between Pasto y Sibundoy, 15 Jul 1957, *Barclay 4529* (COL, MO); Volcán Galeras, 2900 m, 30 Oct 1980, *Benavides 2660* (PSO); 3500 m, 21 Mar 1986, *Benavides 6554* (PSO); 3400 m, 25 Aug 1964, *Mora-Osejo 3195* (PSO); 3600 m, 5 Feb 1965, *Mora-Osejo 3503* (PSO); Cumbal, 4000 m, 19 Mar 1941, *Kjell von Sneider 362* (US); 19 Mar 1941, *Kjell von Sneider 435* (US); 3700 m, 24 Mar 1941, *Kjell von Sneider 415* (US); Mun. Pasto, Santuario Volcano Galeras, 2900–3600 m, 16 Mar 1999, *D. Stančík 2914, 2917* (COL, PRC); Mun. Cumbal, Nevado del Cumbal, N-NE slope, from vereda Las Vuertas, 3700 m, 5 Sep 1999, *D. Stančík 2748* (COL, PRC). **ECUADOR. Azuay:** Paramo SW of Cuenca, 02°55´S, 79°08´W, 3500 m, 1 Sep 1984, *S. Laegaard 52837* (AAU, K, QCA, QCNE); Road Gualaceo–Sucua, 03°00´S, 78°40´W, 3450 m, 23 Oct 1984, *S. Laegaard 53213* (AAU, QCA); along new road Cuenca–Saraguro, km 14 N of sideroad to Nabon, 03°12´S, 79°02´W, 3420 m, *S. Laegaard 102376* (AAU); 03°07´S, 79°19´W, 3250–3350 m, 22 Mar 1992, *S. Laegaard 101856* (QCA, QCNE); Parque Nacional Cajas, road to Molleturo, km 38.4, 02°46´S, 79°14´W, 4110–4350 m, *P.M, Jorgensen et al. 2099* (MO, PRC); *P.M. Jorgensen 2074* (MO, PRC); Laguna Torreadora, 02°46´50˝S, 79°13´40˝W, 4100–4150 m, 2 Aug 1999, *Palice 6, 7, 8* (PRC); N side of Lagoon Taglococha, 02°47´S, 79°15´W, 4100–4200 m, 1 Sep 2000, *D. Stančík 3847, 3848, 3850, 3872* (PRC, QCA); slopes near Laguna Luspa and Laguna Canutillos, 3700 m, 21 Apr 1990, *P.M. Peterson 8865, C.R. Annable & M.E. Poston* (K, MO). Totorococha–Mazan Valley, 02°53´S, 79°10´W, 3900 m, *Ramsay & Smith 510* (K, QCA, QCNE), vicinity of Toreador, 3810–3930 m, *J. Steyermark 53146* (F, NY, US); *J. Steyermark 53182* (US); Paramo de Tinajillas, ca. 10 km S of Cumbe, 3300 m, *Harling 11255* (GB); km 13.7 S of Cumbe, 3470 m, *P.M. Peterson 8876, C.R. Annable & M.E. Poston* (US); Paramo de Patococha, entre Gualaceo y Limon, 3450–3500 m, *Barclay & Juajibioy 8641* (MO, US); 03°00´S, 78°38´W, 3400 m, *S. Laegaard et al. 103067 (*AAU, QCA, QCNE); km 45.4 W of Indanza on road to Cuenca, 3300 m, *P.M. Peterson 8932, C.R. Annable & M.E. Poston* (K, MO, QCA, QCNE, US); between el Refugio y Lagoon Taglacocha, 02°47´S, 79°13´W, 3900–4000 m, 1 Sep 2000, *D. Stančík 3862, 3863, 3864, 3865,* (PRC, QCA); Lagoon Luspa, S side, 02°48´S, 79°15´W, 3850 m, 1 Sep 2000, *D. Stančík 3837* (PRC, QCA); Mun. Nabon, road Loja–Cuenca, Cerro Ungahipucera, 03°12´S, 79°02´W, 3300–3450 m, 30 Aug 2000, *D. Stančík 3804, 3805, 3811, 3815* (PRC, QCA); **Bolívar:** pass on road Guaranda–Riobamba, NE of road, 01°35´S, 78°50´W, 4050–4150 m, 10 Jun 1990, *S. Laegaard 71739, 71741* (AAU, QCNE); km 27, 01°38´S, 78°51´W, 3900–4100 m*, S. Laegaard 55001* (AAU, QCA); highway Ambato–Guaranda km 55.4, 4050 m, *P. M. Peterson 8983 & C.R. Annable* (MO, QCA, QCNE, US); km 60.4, 4090 m, *P.M. Peterson 8985 & C.R. Annable* (K, MO, QCA, QCNE, US). **Cañar:** at the antennas of Culebrillas, ca. 17 km from Panamerican Hwy., 02°26´S, 78°57´W, 4000 m, 4 Feb 2000, *S. Laegaard 21016* (AAU, LOJA); road Cañar–Chunchi, 02°24´S, 78°59´W, 3200 m, *S. Laegaard 53834* (AAU, QCA, QCNE); nudo de Cordillera Oriental and Occidental, 3240 m, *Barclay & Juajibioy 8325* (COL, US); km 11.4 NW of Tambo, S facing slope, 3220 m, *P.M. Peterson 8846, C. R. Annable & M.E. Poston* (QCNE). **Carchi:** Paramo del Angel, sector Los Voladores, 00°41´N, 77°53´W, 3700–3750 m, *S. Laegaard 101264A* (AAU, QCA); NE of El Angel, 3700–3900 m, *S. Laegaard 53125* (AAU, QCA, QCNE); 3600 m, *Harlington 4067* (S); 3400–3800 m, *Davalos 21, 28* (US); 3200–3800 m, *S. Laegaard 55771* (AAU, QCA); 00°41´N,

78°54´W, *Holm-Nielsen 5427* (AAU, COL, F, MO, S); 00°50´N, 77°55´W, 3800 m, *Grignon 84189* (AAU); 3750–3850 m, *Holm-Nielsen 5383* (F); 3800 m, *Acosta-Solís 10538* (US); km 13 on road Las Juntas–El Angel, 00°43´N, 77°50´W, 3380 m, *S. Laegaard 101726B* (AAU, QCA, QCNE); 3300 m, *E. Asplund 7055* (S); 3900 m, *E. Asplund 17022* (S); km 4 W of Tufiño, Monte Redondo area, 3475m, *J. Luteyn & Luteyn 5713* (AAU, MO, NY, US); NE of road El Angel towards Tulcan, 3240 m, *P.M. Peterson 9122, E.J. Judziewicz & R.M. King* (K, MO, QCA, QCNE, US); 13 May 1990, *P.M. Peterson 9127, E.J. Judziewicz & R.M. King* (K, MO, QCA, QCNE, US); 3320 m, *P.M. Peterson 9140, E.J. Judziewicz & R.M. King* (K, MO, QCA, US); Nudo de Boliche–Voladero, 3900 m, *Penland & Summers 889* (F); Road Tulcan–El Carmelo, 3300 m, *Harling & Andersson 12538* (GB); Páramo del Angel, 30 Dec 1931, *Benoist 4636* (P); Mun. Tulcán, volcán Chiles, around Laguna Verde, 00°48´N, 77°56´W, 4000 m, 14 Jul 1999, *D. Stančík 3240* (PRC, QCA). **Chimborazo:** Parque Nacional Sangay–comunidad Alao–Llactapamba, 01°58´S, 78°28´W, 3500 m, *Ceron et al. 11813* (MO, QCNE); Altar, A peak–Valley of Collanes, 13000 ft, *Whymper 1638* (K); Collanes valley, 01°40´S, 78°24´W, 4200 m, *Ramsay & Smith 422* (K); Panamerica Highway Riobamba–Ambato, 01°30´S, 78°42´W, 3500 m, *S. Laegaard 55401* (AAU, QCA); W of pass Alao–Huamboya, 01°48´S, 78°25´W, 3750–3800 m, *S. Laegaard 55417* (AAU, QCA); E of Guardiana Alao, km 8.5 via Huamboya, 3350–3550 m, *P.M. Peterson 9189, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (MO, US); Paramo de Chacheaco, E de Chunchi, 3800 m, *Barclay & Juajibioy 8264* (MO, US); Daldal Valley E of Licto, km 10, 01°48´S, 78°32´W, 3850 m, *Ramsay et al. 1057* (QCA); Mt. Chimborazo, E slope, 4250 m, *E. Asplund 8402* (NY, QCA, S), 3650 m, *E. Asplund 7880* (F, S); road to Pallatanga, km 10 E of Lago Colta, 3725 m, *P.M. Peterson 9215, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (QCA, QCNE, US); along Whymper road, ca. 10 km S of Cruce de los Arenales, 01°30´S, 78°52´W, 4100 m, *S. Laegaard 19148* (AAU, LOJA, QCNE); Chimborazo–Reserva faunistica, 01°30´S, 78°49´W, 4150 m, *Ceron et al. 19819* (QAP); Pungala–comunidad Alao, 01°52´S, 78°30´W, *Ceron 28957* (QAP); along Río Alao, 01°52´S, 78°30´W, 3200–3400 m, *S. Laegaard 55304* (AAU, QCA); Paramo de Urbina, 3600 m, *Acosta-Solís 21195, 21208, 21216* (US); 3600–4500 m, *A.S. Hitchcock 21944, 21951* (US); 3700 m, *E. Asplund 7803* (S); 3600 m, *A.S. Hitchcock 22030* (NY, US); road El Pocuy–El Arenal, 3800 m, *Acosta-Solís 166989* (US); Chimborazo, 4100–4400 m, *Rauh & Hirsch E321, E331* (US); W slope of Chimborazo, 01°30´S, 77°50´W, 4000 m, *Ramsay & Smith 1016* (K); E side, 3480 m, *Barclay & Juajibioy 8819* (COL, MO, US); lado A, 3500 m, *Barclay & Juajíbioy 8162* (COL, MO, US); Bosque Andino de Cubillin, 3300–3400 m, *Acosta-Solís 7554* (US); paramo along the road to Guaranda, 4150 m, *E. Asplund 8191* (S); road Pallatanga–Cajabanba, km 47 from Pallatanga, 3750–3800 m, *B. Øllgaard & Balslev 8926* (AAU, MO, NY); *B. Øllgaard & Balslev 8962* (F); road to lago Colta, km 9 NE of San Juan, 3600 m, 21 May 1990, *P.M. Peterson 9245, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (K, MO, QCA, QCNE, US); Entre Culebrillas y Yanayacu, 3300–3450 m, *Acosta-Solís 7614, 7623* (F, S, US); Mun. Guaranda, W side of the volcán Chimborazo, 01°28´S, 78°52´W, 4100 m, 5 Jul 1999, *D. Stančík 3162, 3164*, *3169, 3189, 3190, 3193* (PRC, QCA); NNW side of volcán, above vereda Río Colorado, 4150 m, 2 Jul 1999, *D. Stančík 3176* (PRC, QCA); Mun. Riobamba, Volcán Chimborazo, sector Cruce de los Arenales, 01°28´14.6˝S, 78°54´06˝W, 4300 m, 20 Sep 2000, *D. Stančík 3705B, 3707, 3708, 3709, 3714, 3715, 3716*, *3717* (PRC, QCA. **Cotopaxi:** Parque Nacional Cotopaxi, falda NNW, 4000 m, *Ehrenburg 1, 27, 36* (QCA); E of Loma Ingapirca, 00°40´S, 78°30´W, 4000 m, 6 Nov 1982, *Balslev et al. 3435, 3438* (QCA); *Balslev et al. 3437* (MO, QCA, US); falda N de Cotopaxi, 4000 m, *Balslev et al. 3675, 3733, 3734, 3738* (QCA); Cerro Sinfana, 00°40´S, 78°28´W, 15 Dec 1990, *Ceron 12609* (QAP); railway station Cotopaxi, 3500 m, *E. Asplund 16807* (S); 3400 m, *E. Asplund 6471* (F, MO, S, US); 3500 m, *E. Asplund 18286* (S); 3350 m, 13 Apr 1990, *P.M. Peterson 8721* (K, MO, QCA, QCNE, US); 3550 m, *E. Asplund 6369* (F, S); quebrada de Agualongo, 00°40´S, 78°30´W, 3000 m, 10 Jan 1994, *Ceron 18088* (QAP); Laguna Limpiopungo, 3800 m, 14 Apr 1990, *P.M. Peterson 8744, C.R. Annable & M.E. Poston* (K, MO, QCA, QCNE, US); along road of pine-plantation, 00°37´S, 78°27´W, 3435 m, 10 May 1984, *S. Laegaard 52107* (AAU, QCA, QCNE); 00°38´S, 78°33´W, 3400 m, *S. Laegaard 69261* (AAU); 00°40´S, 78°30´W, 3900 m, *Muñoz 207* (QCA); quebrada de Agualongo, 3400 m, 2 Feb 1992, *Montesdeoca 280, 282, 284, 295, 339,*

348, 585 (AAU); 00°40´S, 78°30´W, 4550 m, *Argüello 348* (QCA); 4300 m, *Argüello 354, 357* (QCA); *T. de Vries s.n.* (AAU); Hacienda Pauzacha S of Volcán Cotopaxi, 00°44´S, 78°29´W, 3650 m, 2 Dec 1985, *S. Laegaard 55734* (AAU, QCA); Cotopaxi, 3550 m, *E. Asplund 6370* (AAU, F, MO, S, US); 3600 m, *E. Asplund 6349* (AAU, F, MO, S, US); 3600 m, *E. Asplund 6348* (AAU, F, S); road Zumbahua–Pujili, km 33, 00°53´S, 78°48´W, 3850–3900 m, 4 Apr 1992, *S. Laegaard 102103* (AAU, QCA); 00°53´S, 78°48´W, 3850–3900 m, *S. Laegaard 102100* (AAU); Angamarca road, km 5 from junction to road Latacunga–La Mana, 01°00´S, 78°55´W, 4000–4100 m, *S. Laegaard 102134B* (AAU); between Limpio Punja y Rumiñahui, 00°38´S, 78°28´W, 3900–4200 m, *S. Laegaard 55748* (AAU); E of Pilalo, km 19, 3600 m, 15 Apr 1990, *P.M. Peterson 8759, C.R. Annable & M.E. Poston* (K, MO, QCA, QCNE, US); km 21.5, 3820 m, *P.M. Peterson 8770, C.R. Annable & M.E. Poston* (MO, QCA, QCNE, US); SW of El Chaupi, km 6.6 on road to base of Illinizas, 3800 m, 1 May 1990, *P.M. Peterson 8951 & C.R. Annable* (K, MO, QCA, QCNE, US); Cantón Latacunga–Volcán Rutzalagua, 00°57´S, 78°33´W, 2900–3500 m, 14 Feb 1994, *Ceron et al. 25697* (QAP); Paramo de Apagua entre Zumbagua y Pilalo, 4200 m, *Barclay & Juajibioy 8085* (MO, US); Salcedo–Napo road, 00°55´S, 78°28´W, 3800–3850 m, *J. Luteyn 13452* (MO, NY, QCA, QCNE, US); Pilalo–Latacunga road, 00°57´S, 78°58´W, 3400 m, *Holm-Nielsen 1485* (AAU, NY, US); road Quevedo–Latacunga, Zumbagua, 3700 m, *Harling et al. 8924* (GB); Mulatos paramo, lagunas, 13000 ft, *Prescott 656* (NY); Panamerican Hwy., km 6 A Lasso, quebrada vegetation ENE Pastocalle, 3400 m, *Sparre 15828* (S); Mun. Chaupi, NE slope of volcán Illiniza Norte, 00°38´S, 78°43´W, 4000–4050 m, 12 Oct 2000, *D. Stančík 4026, 4027, 4030, 4032* (PRC, QCA); Mun. Lasso, Parque Nacional Cotopaxi, NE side of volcano, 00°37.8´S, 78°24.26´W, 3850 m, 21 Jun 1999, *D. Stančík 3119, 3146, 3147, 3149, 3150, 3151, 3152, 3153, 3155, 3884, 4026* (PRC, QCA); around Museum, 3500 m, *D. Stančík 3158* (PRC, QCA); Parque Nacional Cotopaxi entrance, 00°39´S, 78°31´W, 3530 m, 28 Sep 2000, *D. Stančík 3888, 3889* (PRC, QCA); SE slope of Cotopaxi, 00°37´S, 78°24.5´W, 3800–3900 m, 28 Sep 2000, *D. Stančík 3882* (PRC, QCA). **Imbabura:** Paramo Mariáno Acosta, road Yahuarcocha–Mariáno Acosta, km 20, 00º20´S, 78º00´W, 3650–3750 m, 9 Feb 1992, *S. Laegaard 101181, 101164B* (AAU, QCA); Laguna Grande de Mojanda, 00º08´S, 78º17´W, 3850 m, *S. Laegaard 55635* (AAU); Volcán Cayambe, S side, 78º10´W, 00º15´N, 4300 m, *Sklenář & Kostečková 1881* (AAU); vicinity of Mojanda, 15 km N of Malchinguin, S of Otavalo, 4000–4500 m, 11 Oct 1974, *Gentry 12685* (MO); Volcán Cotacachi, 00º22´N, 78º20´W, 4200–4300 m, *S. Laegaard 54506* (AAU); Laguna Cuicocha, 3100–3300 m, *Peñafiel et al. 527, 667, 720* (MO, QCNE); 3100–3400 m, *Peñafiel et al. 402* (MO, QAP, QCNE); 3300–3350 m, *Peñafiel 1067* (QAP); Proantag, estrivaciones occidental de la Cordillera Oriental, 3500–3800 m, *Acosta-Solís 19196* (US); Hacienda Yura Cruz, 10 km N of Ibarra, 00º22´N, 78º05´W, 3700–3800 m, *Holm-Nielsen 6462* (AAU, NY, MO, S); quebrada Rumipamba, 3700–4000 m, *Ceron 29480* (QAP); Cayambe–Laguna San Marcos, 11200 ft, *Cazalet & Pennington 5434* (K, NY, US); Cerro Imbabura, faldas occidentales, 2800–4000 m, *Acosta-Solís 17670* (US); Mun. Urcuquí, road to Cerro Yanaurcu, 00°28´13˝N, 78°18´45˝W, 4100 m, 15 Oct 2000, *D. Stančík 4089, 4101* (PRC, QCA); Mun. Cayambe, volcán Cayambe, 00°00´4˝N, 78°01´40.4˝W, 4200 m, 20 Oct 2000, *D. Stančík 4163, 4164* (PRC, QCA); Mun. Otavalo, road from Otavalo to Laguna Mojanda, 00°07´57˝N, 78°16´27˝W, 3800 m, 19 Oct 2000, *D. Stančík 4115* (PRC, QCA); Mun. Urcuquí, road to Cerro Yanaurcu, 00°28´N, 78°17.5´W, 3900 m, 15 Oct 2000, *D. Stančík 4096, 4164* (PRC, QCA). **Loja:** Road to Fierra Urcu, ca. 10 km from main road Loa–Saraguro, 03º33´S, 79º15´W, *S. Laegaard et al. 18868* (AAU, LOJA, QCA, QCNE); 03º43´S, 79º19´W, 3650 m, S. Laegaard *& Sklenář 20282A* (AAU, LOJA); 03º´S, 79º19´W, 3520 m, *Sklenář & S. Laegaard 7092 (*AAU); Cerro de Arcos, W of road Manu–Zaruma, 03º34´S, 79º28´W, 3500–3600 m, *S. Laegaard et al. 20613* (AAU, LOJA); Mun. Saraguro, road to Fierra Urcu, 03°42´40˝S, 79°18´12˝W, 3400–3450 m, 24 Aug 2000, *D. Stančík 3769, 3770, 3772, 3773, 3774* (PRC, QCA). **Morona – Santiago:** Hda. Huargualla–Hda. San Eduardo, way to Parque Nacional Sangay, 02°0.25´S, 78°27´W, 3700 m, 30 Jul 1999, *D. Stančík 3326, 3327* (PRC, QCA); Parque Nacional Sangay, Plazabamba, 02°0.64´S, 78°26´W, 3600 m, 20 Jul 1999, *D. Stančík 3337* (PRC, QCA); confluence of Quebrada Plazabamba Chico with Q. Plazanbamba, 02°0.48´S, 78°25.4´W, 3000 m, 21 Jul 1999, *D. Stančík 3344* (PRC, QCA); ridge

above Q. Plazabamba Chico, 3600 m, 20 Jul 1999, *D. Stančík 3351* (PRC, QCA); Plaza Culebrillas, 01°58´S, 78°25´W, swampy plate with grassy vegetation and shrubby patches, 3500–3600 m, 22 Jul 1999, *D. Stančík 3355* (PRC, QCA); Plaza Culebrillas, 01°58´S, 78°25´W, 3500–3600 m, 22 Jul 1999, *D. Stančík 3353, 3354, 3360, 3363, 3367* (PRC, QCA). **Napo:** Road Salcedo–Napo, ca. 6 km NE of km 45, 3900 m, *S. Laegaard 53373* (AAU, QCA, QCNE); Paramo de Miranda, 00º34´N, 77º39´W, 3700–3900 m, 23 May 1985, S. Laegaard 54409 (AAU, QCA, QCNE); 3900–4100 m, *S. Laegaard 54416* (AAU, QCA, QCNE); Cerro Antisana, SW slope, 4200 m, *Black 32* (AAU); below Laguna Micacocha, paramo de Loma Gorda, 3850 m, *Holm-Nielsen 20789* (AAU); W side of Volcán Puntos, 00º12´S, 78º10´W, 4150–4200 m, *S. Laegaard 54731* (AAU); Los Llanganati, entre Ainchilibi y Río Portrero al E de Romo Páramo, 2500–3620 m, *Barclay & Juajíbioy 9160* (COL, US); 3600–3700 m, *Barclay & Juajíbioy 9142* (COL, MO, US). **Pichincha:** Volcán Pichincha, via occidental, 2800–3830 m, *Barford & Blicher-Mathiesen 41546* (AAU, QCA, QCNE); 3500–5000 m, *Gentry 12378* (MO, QCA); Guagua Pichincha, 4000 m, *Harlington 4552* (S); 3500–4500 m, *Ceron 28250* (QAP); N slope, ca. 5 km WSW of Cotocollao, 00º08´S, 78º33´W, *Sparre 13709* (S); *Sodiro s.n.* (QPLS); Pichincha–Cerro Ventanillas, 00º09´S, 78º32´W, 3850 m, *S. Laegaard 51060* (AAU, QCA, QCNE); Lloa–Guagua Pichincha, km 10, 4170 m, *S. Laegaard et al. 102733* (AAU, QCA, QCNE); *Sodiro s.n.* (QPLS); *Jameson 70* (K); Hacienda Montecielo on S slope, 3400–3800 m, *Sparre 17408* (S); Jameson s.n. (K); 3400 m, *E. Asplund 6134* (S); 8500 ft, *Spruce 5509* (K, P, US, W); *Sodiro s.n.* (US); 3700 m, *Balslev 23600* (AAU); N slope, ca. 5 km WSW Cotocollao, 3600–3750 m, *Sparre 13709* (AAU); Volcán Pasachoa, 00º27´S, 78º30´W, 3700–3900 m, *S. Laegaard 55279* (AAU, COL, F, GB, K, LOJA, MO, NY, QCA, QCNE, VEN, W); 3700–3900 m, *S. Laegaard 55279* (COL, MO); 00º27´S, 78º30´W, 3900 m, *S. Laegaard 55276* (AAU, QCA); 00º27´S, 78º30´W, 3600 m, *S. Laegaard 55286* (AAU); 3000–3500 m, *Ceron & Alarcon 12260* (MO, PRC, QAP, QCNE); 3500–4300 m, *Ceron & Alarcon 4805* (QCNE); 00º27´S, 78º28´W, 2850–3900 m, *Paredes 41* (QCA); 3800 m, *Penland & Summers 969* (F); Páramo Papallacta, 3900 m, *Maf 57* (AAU); Guamaní, 01º19´S, 78º12´W, 3600–3800 m, *E. Asplund 8718* (QCA, S); 3200 m, *Mille s.n.* (QPLS); *Mille 284* (US); *E. Asplund 9634* (S); *E. Asplund 8724* (MO, NY, QCA, S, US); 3900 m, *E. Asplund 17176* (S); 4000 m, *Vargas et al. 2083* (AAU, MO, QCNE); *Ramsay 426* (K); 4200 m, *Quintana 2* (QCA); 00º15´S, 78º12´W, 3800 m, 7 Oct 1987, *Ramsay & Smith 742* (K, QCA, QCNE); 3800 m, *Harling et al. 10477* (GB); Andibus Quitensis, *Jameson s.n.* (K, S); vicinity of Quito, 3200 m, *E. Asplund 6140* (S); Quito–Andes, *Jameson 91* (K, W); 3500 m, *E. Asplund 6138* (F, S); Volcán Antisana, falda W, 4200 m, *Ehrenburg 191* (QCA); 4150 m, *Grubb et al. 656* (NY, K); W side, 00º28´S, 78º12´W, 4200 m, *Balslev et al. 4070* (QCA); Hacianda de Antisana, *Hartweg 1455* (K, NY, US); between campamento IMAP and Laguna Micacocha, 00º33´S, 78º12´W, 3850–3950 m, *S. Laegaard 101577* (AAU); between Mt. Antisana and Mt. Sincholagua, *E. Asplund 8647* (NY, QCA, S); *E. Asplund 8645* (S); *E. Asplund 8644* (QCA, S); road from Otavalo to Laguna Mojanda, 3810 m, *J.F. Smith 1997* (AAU, F, MO, NY, QCNE, US); *J.F. Smith 1999* (NY, QCA, QCNE); *D. Stančík 4103* (PRC); 00º08´S, 78º16´W, 3725–3750 m, *S. Laegaard 52373* (AAU, QCA); Laguna Negra, 00º08´S, 78º16´W, 3800 m, *S. Laegaard 54351* (AAU, QCA, QCNE); Illiniza Sur, E slope, 00º40´S, 48º42´W, 4200 m, *Sklenář & Kostečková 14-9* (US); Illiniza Norte, 4000–4100 m, *Sparre 15781* (S); Mount Atacazo, 4700 m, *Harteman 67* (US); 00º02´N, 78º37´W, 4250 m, *S. Laegaard 53871* (AAU, QCA, QCNE); 00º20´S, 78º38´W, 3750–3800 m, *S. Laegaard 55672* (AAU, QCA), SW slope, km 19 from San Juan, 00º21´S, 78º39´W, 2900 m, *Holm-Nielsen 25163* (AAU); 00º20´S, 78º36´W, 3600 m, *Espinosa 81* (QCA); road Chillogalo–San Juan, 00º18´S, 78º39´W, 3100–3260 m, 8 Sep 1945, *Jaramillo & Zak 623* (AAU, MO, PRC, QCA); Sincholagua, *E. Asplund 8639* (QCA, S); Pululahua–San Bartolo al E de Moraspungo, 00º01´S, 78º29´W, 3050 m, 13 Dec 1990, *Ceron & Montesdoca 12010* (QAP); Mont Ungui, 3400 m, *Firmin 137* (F, US, W); El Corazón, 11000 ft, *Prescott 834, 839, 848* (NY); 4100 m, *E. Asplund 17522* (S); E side of Corazón, 13–14,000 ft, Feb 1880, *Whymper 1322* (K); Pogonales de Pichincha, 13 May 1930, *Benoist 2515* (P); Mun. Pifo, Páramo de Guamaní, 00°19´S, 78°15´W, 3700 m, 19 Jun 1999, *D. Stančík 3013* (PRC, QCA, W); Mun. Amaguaña, E slope of volcán Pasachoa, 00°27´56˝S, 78°28´40˝W, 4150 m, 14 Sep 2000, *D. Stančík 3671, 3677, 3687, 3688, 3690, 3691, 3692, 3704* (PRC, QCA). **Sucumbios:** SW de

Playon de San Francisco, Páramo Mirador, 3400–3600 m, 15 May 1990, *P.M. Peterson 9155, E.J. Judziewicz & R.M. King* (MO, QCA, QCNE, US). **Tungurahua:** Cordillera de Llanganatis, Lake Yanacocha, 3600 m, *E. Asplund 9967* (QCA); El Tambo near Lake Yanacocha, 3650 m, *E. Asplund 9964* (S); Parque Nacional Llanganatis, vía Salcedo–Tena; 3600 m, 17 Apr 1998, *Vargas et al. 2583* (MO, QCNE); Lake Aucacocha, 3700 m, Aug 1969, *Edwards 70* (K); Las Tolas–5 km SE of Laguna Pisayambo, 01º07´S, 78º21´W, 3700 m, 12 Jan 1999, *S. Laegaard & Grignon 19395* (AAU, LOJA, QCA); road Ambato–Guaranda, 01º25´S, 78º51´W, 4070 m, *Brandbyge 42133* (AAU, QCA); Comunidad Rumipata, 00º22´S, 78º55´W, 4000 m, *Brandbyge 42586* (MO, AAU); Cerro Sangay, 4000 m, *Stübel 257* (S); Mun. Pillaro, Las Llanganatis, around Aucacocha lagoon, 01°9´S, 78°20´W, 3800 m, 28 Sep 2000, *D. Stančík 3901, 3902* (PRC, QCA); Las llanganatis–Pisayambo, 01°07´S, 78°20´W, 3600 m, 28 Sep 2000, *D. Stančík 3900* (PRC, QCA). **PERU. Amazonas:** Prov. Chachapoyas, encima de Leimebamba, pajonal, 3400–3500 m, 17 Mar 1964*, R. Ferreyra 15518* (US); upper slope and summit of Cerro Campanario, 3600–3900 m, 3 Aug 1962, *J. Wurdack 1571* (US). **Ancash:** Prov. Huaylas, Huascarán Parque Nacional, quebrada Alpamayo at foot of snowfree peak above Lago Jancarirish, 08°53´S, 77°41´W, 4350–4500 m, 3 Sep 1985, *Smith et al. 9783* (MO); Prov. Recuay, Huascarán Parque Nacional, Río Pachacoto drainage between mineral springs and Pumashimi, 09°53´S, 77°17´W, 4200–4300 m, 16 Mar 1986, *Smith et al. 11799* (MO); Prov. Yungay, Huascarán Parque Nacional, Llanganuco sector, quebrada Demanda, trail to Chacraraju base camp and Brogue glacier, 09°02´S, 77°36´W, 4100–4400 m, 4 Dec 1985, *Smith et al. 10253* (MO); Huascarán Parque Nacional, Llanganuco sector, quebrada Ancosh, 09°03´S, 77°35´W, 4500 m, 4 Feb 1985, *Smith et al. 10229* (MO). **Cajamarca:** Prov. Cajamarca, dist. Cajamarca, entre Cajamarca y Cumbe Mayo, km 14, Al arboretum Cumbe Mayo de Cicafor, 3400 m, 18 Apr 1981, *Vega et al. 2464* (F); Cajamarca–Bambamarca road, in puna, 07°00´S, 78°33´W, 3800 m, 17 Feb 1983, *Smith 3482* (MO); Bajando el Paso El Gavilán hacia San Juan, el E de la carretera Cajamarca–Pacasmayo, 3000 m, 18 May 1986, *Vega 4043* (F); a la altura del Paso El GavilánGavilán, 3200 m, 18 Apr 1976, *Vega 1385* (F); Jalca de Kumullca, entre La Encanada y Celendín, 3600 m, 27 May 1977, *Vega et al. 2011* (F); Sorochuco, Carretera Michiquillay–El Punre, 07°00´S, 78°18´W, 3570 m, 9 Aug 2001, *Vega et al. 10904* (F); 9 Sep 2001, *Vega et al. 10906* (F); humid jalca vegetation with tussock grasses, 07°02´S, 78°15´W, 26 Aug 2004, *Sklenář & Zapata Cruz 8630* (PRC); Cumbe Mayo, 21 km al W de Cajamarca, ladera con arbustos dispersos, 3100 m, 4 Nov 1977, *Vega 1969* (F); Coymolache ruta Cajamarca–Hualgalloc, 3850 m, 7 Jan 1977, *Vega et al. 2052* (F); Pampa Larga, al N de la explotacion minera Yanacocha, ladera graminosa de jalca, 3900 m, 14 May 1994, *Vega 7136* (F); Prov. Hualgayoc, desvio de la carretera Coymolache–Chugur, jalca graminosa, 3700 m, 28 Apr 1994, *Vega et al. 7062* (F); Prov. Hualgayoc, Coymolache, 06°46´S, 78°38´W, 4000 m, 15 Jun 2001, *Vega et al. 10795* (F, MO); Prov. Hualgayoc, El Tingo, desvio a Chugur, 3350 m, 22 Jul 1986, *Vega 4145* (F). **Cuzco**. Paso de Tres Cruces, Cerro de Cusilluyoc, 3800–3900 m, 5 Mar 1925, *Pennell 13845* (NY); Sacsahuaman, rocky stream-bank, 3500–3600 m, 24 Apr 1925, *Pennell 13552* (NY); Prov. Espinar, Hda Cuyo, 4200–4500 m, 24 Mar 1956, *Vargas 11176* (US). **La Libertad.** Prov. Bolívar, ascenso ao Nevado de Cajamarquilla, 07°08´S, 77°42´W, 3000 m, *Vega 11181* (F, MO); entre el desvio a Uchumarca y Santa Luisa, 07°04´S, 77°49´W, 3700 m, *Vega 11190* (F, MO); Prov. Otuzco, Trujillo–Huamachuco road, 10–15 km before Shorey, 07°59´S, 78°22´W, 3300 m, 13 Feb 1983, *Smith et al. 3278* (MO); Prov. Pataz, grassland in Manachaqui valley, ca. 10 km NE of Pataz, 07°40´S, 77°30´W, 3600 m, 22 Mar 1988, *B. León & Young 1679* (MO); Manachaqui valley, ca. 10 km NE of Pataz, 77°30´W, 07°40´S, 3600 m, 28 Feb 1988, *B. León & Young 1101* (MO); Prov. Santiago de Chuco, al oeste del cementerio de Quiruvilca, 3870 m, 21 May 2001, *Leiva & Leiva 2525* (MO); Paso de Alaska. Carretera a Tayabamba, 3900 m, 24 Jun 1974, *López & Sagásteguii 8180* (MO, US). **San Martin.** Prov. Huallaga, distr. Saposoa, entre la Artesa y Rangra Pata, 3600–3800 m, 23 Aug 2001, *Quipuscoa & Vilchez 2611* (F, MO); Prov. Mariscal Cáceres, Pampa de Cuy, NW sector Río Abiseo Parque Nacional, 07°40´S, 77°30´W, 3550 m, 3 Jun 1988, *B. León & Young 1364* (MO); Chochos valley, NW corner of Río Abiseo Parque Nacional, 3425 m, 31 May 1986, *Young & Watson 3484* (MO).

Note. Ocassionally there are proliferating plants with clearly transformed spikelets and sexual organs. Panicles are compact with short deformed branches;

spikelets are unisexual, transformed into vegetative shoots, only exceptionally with some spikelets carrying rudiments of sexual organs; and some florets are without anthers and ovaries. These plants can be distinguished from *F. asplundii* by having narrower leaf blades (0.4–0.8 versus 1–1.4 mm wide) and viviparous panicles that are abnormally developed (versus normally developed in *F. asplundii*).

Viviparous specimens examined. **COLOMBIA. Nariño:** Mun. Tuquerres, Volcán Azufral, road from vereda San Roque Alto to Laguna Verde, km 6, 3850 m, 9 Mar 1999, *D. Stančík 2790* (COL, PRC, PSO). **ECUADOR. Morona–Santiago:** Parque Nacional Sangay, Plazabamba, 02°00.64´S, 78; 26´W, 3600 m, 19 Jul 1999, *D. Stančík 3335, 3336* (PRC, QCA). **Pastaza:** E of pass Alao–Huamboya, 01°48´S, 78°25´W, 3700–3900 m, *S. Laegaard 55452* (AAU, PRC, QCA). **Tungurahua:** Llanganatis, Las Tolas, 5 km SE of Laguna Pisayambo, 01°07´S, 78°21´W, 3700 m, 12 Jan 1999, *S. Laegaard 19395* (AAU, LOJA, QCA); S of Laguna Verde at Cerro Hermoso, 01°14´S, 78°18´W, 3850 m, 11 Nov 1980, *Holm-Nielsen & Jaramillo 28415* (AAU, QCA).

53. Festuca sumapana Stančík**,** Darwiniana 41(1–4): 144, f. 7l-p. 2003. (**Figs. 67, 68**). Type: Colombia. Meta, Páramo de Sumapaz, Cerro Nevado del Sumapaz, 4130 m, 16 Jan 1973, *Cleef 7930* (holotype: COL!; isotypes: U!, US!).

Tussocked perennials with intravaginal innovations. Culms 15–20 cm tall, erect, glabrous; nodes 1, basal and 1 leaf. Leaf sheaths membranous, grayish-stramineous, glabrous; auricles absent; ligules 0.3–0.5 mm long, membranous, apex two-lobate; blades 8–12 cm long, 0.5–0.7 mm wide, involute, abaxially scabrous, green, apex obtuse. Panicles 5–7 × 0.4–0.6 cm, lanceolate, contracted; branches scabrous. Spikelets 9.5–11 mm long, lanceolate, florets 3 or 4; rachilla glabrous; glumes 4–6 mm long, lanceolate, keeled, membranous, purplish-green, scabrous dorsally, apex acute; lower glumes 4–5 mm long, 1-nerved; upper glumes 5.5–6 mm long, 3-nerved; lemmas 6.5–7 mm long, lanceolate, 5-nerved, keeled, membranous, purplish-green, papillose, awned, the awn 0.5–1.5 mm long; callus glabrous; paleas as long as the lemma, lanceolate, membranous, margins scabrous; lodicules lanceolate; anthers 0.6–0.8 mm long; ovary apex glabrous. Caryopses not seen.

Leaf blade anatomy.—Cross-sections usually with 5 vascular bundles, 3 ribs above; sclerenchyma under abaxial epidermis discontinuous, adaxially absent; adaxial epidermis with scattered hairs, the hairs ca. 0.07 mm long.

Observations.—*Festuca sumapana* is morphologically similar to *F. glumosa* but differs in having shorter ligules (0.3–0.5 versus 0.8–1.2 mm), narrower leaf blades (0.5–0.7 versus 0.8–1.4 mm), and shorter lower glumes (4–5 versus 4.5–6 mm).

Distribution and habitat.—*Festuca sumapana* is endemic to Colombia where it is known only from the type locality, Páramo de Sumapaz (Cundinamarca). It occurs at an altitude about 4000 m in the superparamo zone.

54. Festuca tolucensis Kunth, Nov. Gen. Sp. (quarto ed.) 1: 153. 1816. (**Figs. 67, 69, 97A–C**). Type: Cresit in montosis, scopulosis, apricis regni Mexicani, inter Islahuaca et Toluca, 1380 hexap., Sep, *Humboldt & Bonpland s.n.* (holotype: B!; isotypes: B!, BM, P!).

Festuca aequipaleata E. Fourn., Biol. Cent.-Amer., Bot. 3(20): 581. 1885. *Festuca aequipaleata* E. Fourn., Mexic. Pl. 2: 125. 1886, *isonym*. Type: Mexico. Orizaba, 14,000 ft, *Liebmann 6108* (lectotype: C!, designated by Alexeev, Novosti Sist. Vyš. Rast. 21: 47. 1984; isolectotypes: C!, K!).

Festuca liebmannii E. Fourn., Mexic. Pl. 2: 124. 1886. Type: Mexico. *Liebmann 517* (holotype: P; isotype: US!).

Festuca multiculmis Steud., Syn. Pl. Glumac. 1: 310. 1854. Type: Mexico. Mt. Toluca, *Heller 306* (holotype: P!).

Tussocked perennials with intravaginal innovations. Culms 60–80 cm tall, erect, finely scabrous; nodes 1, basal. Leaf sheaths membranous-coriaceous, stramineous to grayish, glabrous; auricles absent; ligules 1.8–3.5 mm long, membranous, apex acute; blades 20–30 cm long, 0.5–0.7 mm wide, involute, green to olive-green, abaxially scabrous, apex acute. Panicles 20–25 × 0.5–1.5 cm, lanceolate, contracted, branches finely scabrous. Spikelets 7–12(–15) mm long, lanceolate sometimes oblong-lanceolate, florets 3 or 4(–6); rachilla densely hairy; glumes 6–9.5 mm long, lanceolate, coriaceous, green, markedly scabrous, apex acute; lower glumes (2–)6–8.5 mm long, 1-nerved; upper glumes (4–)6.5–9.5 mm long, 3-nerved; lemmas 6–9.5(–10.5) mm long, lanceolate, 5-nerved, coriaceous, green, scabrous on all surfaces,

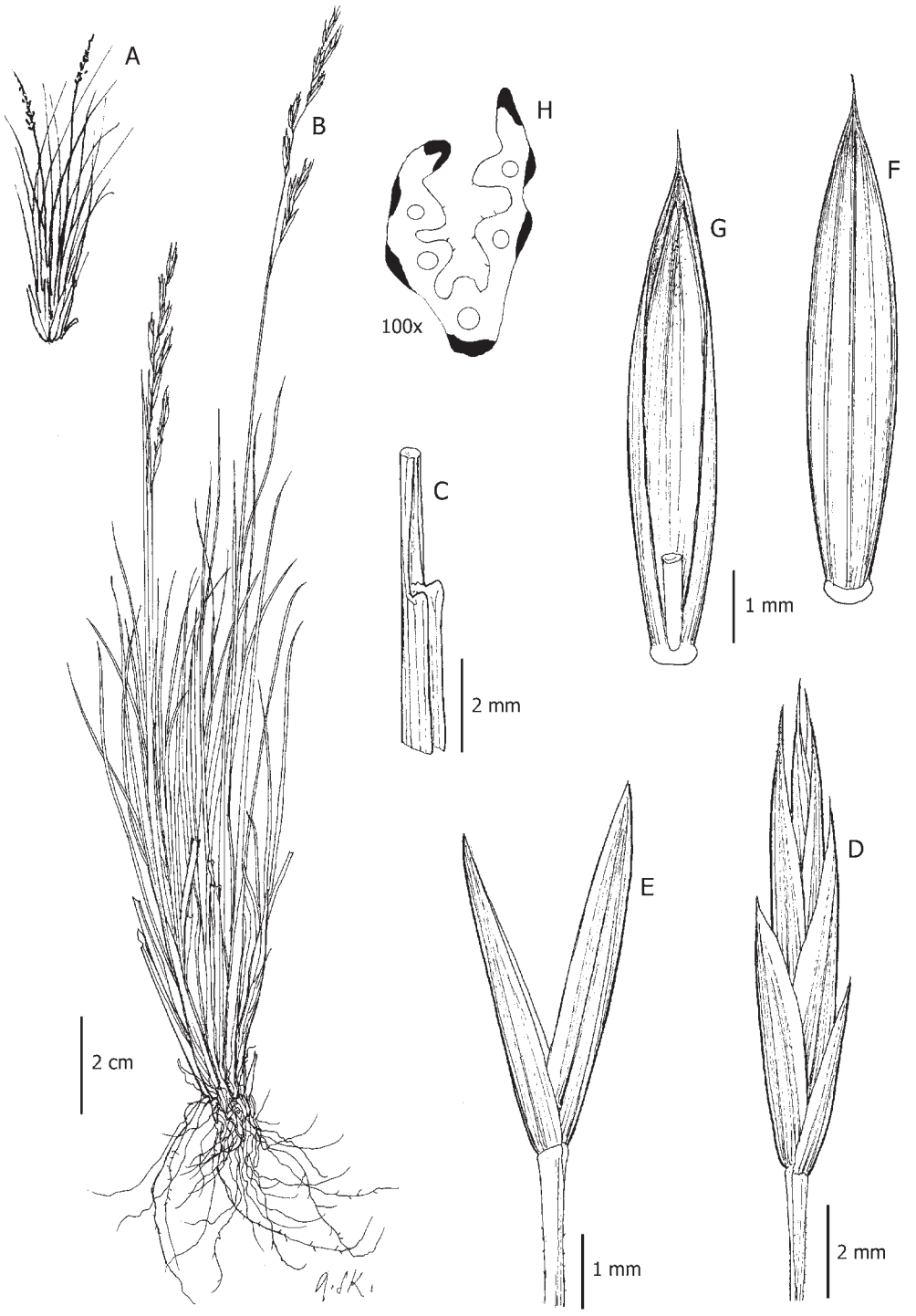


Figure 68. *Festuca sumapana.* **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Cleef 7930* (COL).

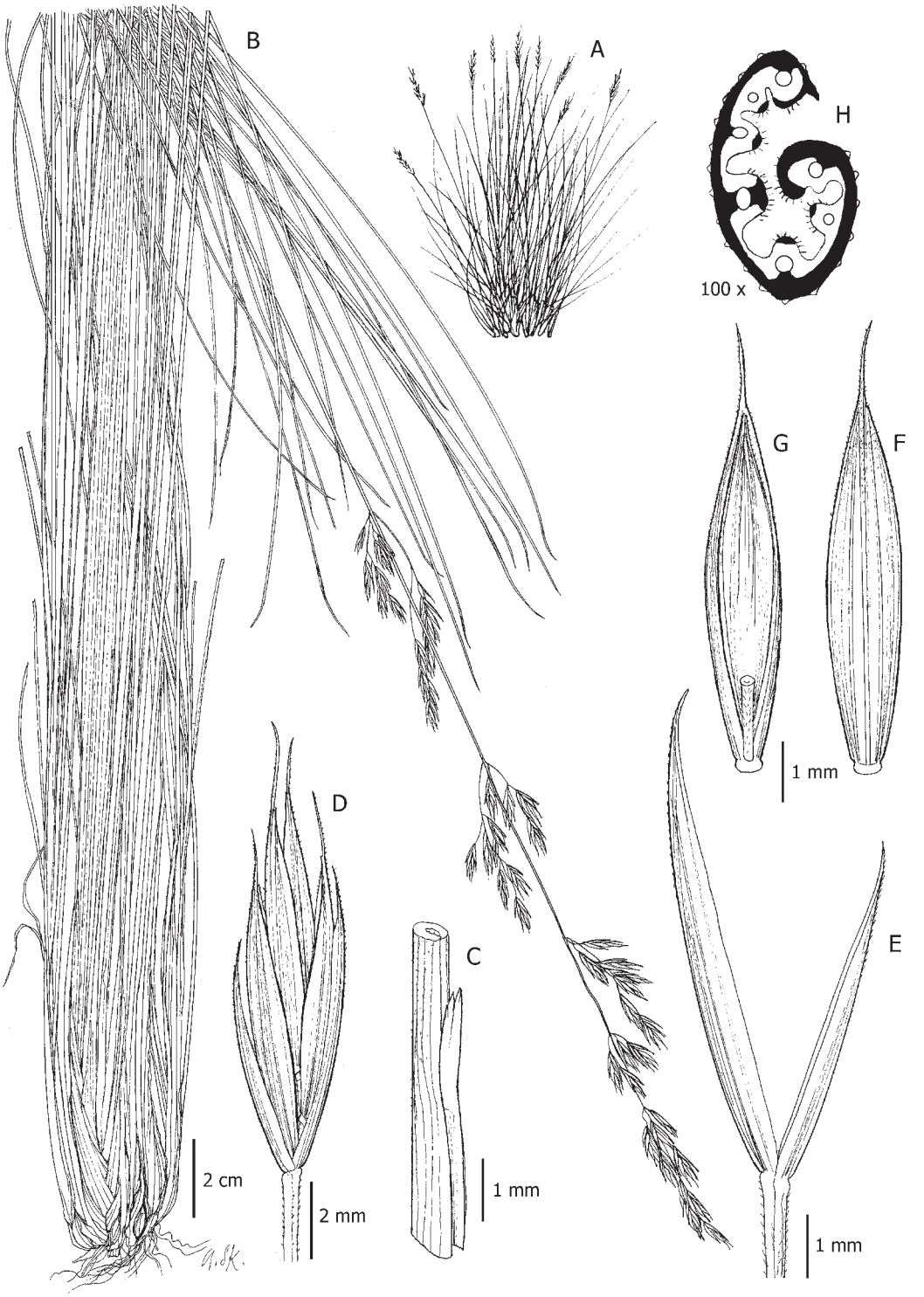


Figure 69. *Festuca tolucensis* subsp. *tolucensis*. **A.** Stylized growth form. **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 4279* (PRC).

awned, the awn 1–1.5 mm long; callus glabrous; paleas almost as long as the lemma, lanceolate, membranous, scabrous, short-hairy; anthers 2.5–3 mm long; ovary apex glabrous. Caryopses lanceolate; hilum 5/6 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections typically with 5–9 vascular bundles and 3–5 ribs above; sclerenchyma under abaxial epidermis continuous, extending to somevascular bundles, adaxial sclerenchyma present in 3–5 ribs, isolated; abaxial epidermis with a dense covering of prickles; adaxial epidermis hairy, the hairs 0.03–0.05 mm long.

Observations.—*Festuca tolucensis* is morphologically similar to *F. subulifolia* and both species form tussocks of fine-leaved plants. Besides differeing in leaf cross-section, *F. tolucensis* has spikelets 7–12(–15) mm long (versus 6.5–9 in *F. subulifolia*), lower glumes 6.5–9.5 (versus 3.5–5.5) mm long, and upper glumes 6.5–9.5 (versus 4–6) mm long.

Distribution and habitat.—*Festuca tolucensis* has a wide distribution and ranges from Mexico to Venezuela. In Colombia, *Festuca tolucensis* is only known from the Serranía de Perijá. We recognize three subspecies as differentiated in the tabular comparison and key below. It is a dominant species found in dry rocky slopes or swampy margins of lagoons in grass paramos between 3000–4000 m.

F. tolucensis subsp.	**Distribution**	**Glume length** (mm)		**Lemma**	**Spikelets**		**Vascular bundles**	
		Lower	**Upper**	**Length** (mm)	**No. florets**	**Length** (mm)	**No.**	**Girders**
tolucensis	MEX-VEN	(4–)5–6	(5–)6–8	6.5–7.5	4–5	7–10	7–9	1–3(–5)
perijae	COL, VEN	5.5–6.5	6.5–7.5	6–7	2 or 3	9–10	5	0
culata	VEN	2–2.5	4–5	6–7	4 or 5	10–11	5	1

KEY TO THE SUBSPECIES OF *FESTUCA TOLUCENSIS*

1a. Lower glumes 2–2.5 mm long; upper glumes 4–5 mm long .... **54c. F. tolucensis** subsp. **culata**

1b. Lower glumes (4–)5–6.5 mm long; upper glumes (5–)6–8 mm long.... 2

2a. Small tussocks (less than 40 cm tall), leaves with 5 vascular bundles, spikelets with 2 or 3 florets; 9–10 mm long ..... **54b. F. tolucensis** subsp. **perijae**

2b. Tussocks more than 40 cm tall, leaves with 7–9 vascular bundles, spikelets with 4–5 florets; 7–10 mm long..... **54a. F. tolucensis** subsp. **tolucensis**

54a. Festuca tolucensis subsp. **tolucensis (Fig. 69)**.

Additional specimens examined. **COSTA RICA. San José:** Iraza, 1300 m, 14 Jun 1932, *Storek 2889* (MO); Cantón de Pérez Zeledón, Parque Nacional Chirripo, Cordillera de Talamanca, Río Talari, cerca del cruce al Cerro Ventisqueros, 3600–3450 m, 27 Jan 1996, *Morales 5194* (MO); Cantón de Pérez Zeledón, Parque Nacional Chirripo, cuenca Terraba–Sierpe Chirripo, base Crestones, 09°27.5´N, 83°30.5´W, 3460 m, 12 Jul 1996, *Alfaro 1029* (MO); Cantón de Pérez Zeledón, Parque Nacional Chirripo, cuenca Terraba–Sierpe, Sandero a Valle Los Leones, 09°26´N, 83°30.5´W, 3100–3400 m, 18 Jul 1998, *Alfaro 1771* (MO). **MEXICO. D.F.:** Ajusco, Sep 1928, *Lyonnet 260* (NY); Lomas, Oct 1932, *Lyonnet 2973* (MO). Volcán Toluca, 4150 m, 18 Oct 1953, *Sohns & Matuda 991* (NY); W side in volcanic ash, competing with *Sedum minimum*, 3940 m, 9 Nov 1955, *J. Clausen 34* (NY); crater, above timberline, dwarf alpine plants, 14000 ft, 17 Aug 1972, *Dziekanowski & Bolingbroke 1911* (MO, NY); 1846, *Heller 62, 306* (P, W); 4150 m, 18 Oct 1953, *Sohn & Matuda 991* (P). Iztaccihuatl, side of Mt. at La Joya, 3990 m, 7 Jun 1960, *J. Beaman 3482* (NY); Monte de Río Frío, km 49, road from Mexico City to Puebla, 4000 m, 31 Jul 1929, *Mexia 2684* (NY); Mt. Popocatepetl, 3400 m, 8 Jun 1910, *A.S. Hitchcock 496* (C, MO, NY, W); Tlaxcala vertiente N del Volcano La Malinche, zacatonal de *Festuca* y *Calamagrostis*, 3920 m, 16 Sep 1986, *González et al. 206* (F, MO); Mun. de Amecameca, bosque de

pino, 3900 m, 30 Nov 1980, *Juan & Alva 101* (MO). **Chiapas:** Summit of Volcano Tacana, Mun. Union Juaréz, scattered dwarfed *Pinus* sp., 2200 m, 30 Jul 1972, *D. Breedlove 26723* (NY); Volcán Tacana, near summit sandy, gravelly soil above timberline, 4090 m, 8 Dec 1959, *J. Beaman 3216* (NY); Mt. Tacana, 2000–4038 m, VIII 1938, *Matuda 2337, 2360* (NY). **Jalisco:** Nevado de Colima, side of mountain below Puerto de Colima, sandy soil in sparsely vegetated meadow, 4000 m, 26 Aug 1958, *J. Beaman 2363* (NY); S of Ciudad Guzman (Zapotlan), near summit, in rockslide, gravel, around rocks, 4000 m, 7 Feb 1956, *Gregory & Eiten 301* (MO, NY, P); Mt. Nevada, 14300 ft, 23−24 Sep 1910, *A.S. Hitchcock 7165* (NY). **Michoacán:** Tancitaro region, Mt. Tancitaro, 10000–11000 ft, 25 Jul 1941, *Leavenworth & Hoogstraal 1218* (MO, NY). **Puebla:** Arroyo Paso Buey, NW side of volcano Pico de Orizaba and 7 km NW of the summit, 0.5 km SE of Miguel Hidalgo, 97°18´30˝W, 19°04´30˝N, 3300 m, 9 Jul 1986, *M. Nee & Soule 33022* (MO, NY); Faldas del Pico Orizaba, 3300 m, 17 Oct 1971, *Hernández et al. 1336* (F, MO). **Veracruz:** Mun. Perote, km 1–2 above Escobillo on the NW slopes of Cofre de Perote 3300 m, 21 Jan 1984, *Taylor et al. 170* (F, MO, NY); Pico Orizaba, NE side of Mt., 3980 m, 16 Aug 1958, *J. Beaman 2284* (NY); Mt. Orizaba, sandy plains,14000 ft, 7 Aug 1891, *Seaton 228* (NY); 18 km de Perote camino a la cima del Cofre, 3790 m, 10 Feb 1984, *González et al. 137* (MO); Pico de Orizaba, 14000 ft, Sep 1941, *Liebmann 2886, 3030, 6117* (C); *Wawra 947* (W); *Ross 1276* (W). **VENEZUELA. Mérida:** Sierra Nevada–Laguna La Coromoto, 3300–3400 m, 18 Feb 1966, *Schulz & Rodríguez 317* (US); 13000 ft, Feb 1846, *Funck & Schlim 1132* (P); 4000–4400 m, 24 Sep 1952, *Humbert 26353* (COL, MER, P, US); 4000–4400 m, *Humbert 26806* (MER); *Humbert 26506* (P, US); pastizal, 3700 m, 25 Sep 1970, *Castelano & Monasterio 20* (VEN); Laguna La Coromoto, Plantaginetum, 3200 m, 24 Feb 1955, *Vareschii 3853* (VEN); 3400 m, Oct 1956, *Aristeguieta 2602* (VEN, US); 3300 m, 3 Jul 1987, *Briceño & Adamo 1988* (MERF); Valle de Mucubají, abajo del Pico Mucuñuque, 08°46´35˝N, 70°48´57˝W, 3730 m, 3 Sep 1998, *Berg 98-29-16* (K); Laguna Mucubají, swamps around the lagoon, 8°47.5´N, 70°49´W, 3600 m, 6 Nov 2000, *D. Stančík 4172* (CAR, COL, PRC); 3570 m, 23 Aug 1980, *Briceño & Adamo 184* (Herbarium Briceño, MERF, MO, PRC, US); camino hacia Mucunuque, 4000–4300 m, 4 Nov 1992, *Meier et al. 3026* (VEN); Laguna de Mucubají, 3600 m, Dec 1952, *Aristeguieta 964* (US); Páramo de Mucubaji, 3500 m, 23 Aug 1980, *Briceño & Adamo 187* (MO); S side of Hwy 7, 5 km E of Laguna Victoria, 3000 m, 22 Aug 1972, *Hanselmann & Loleveless 296* (MO); Laguna de Mucubají, 8 Nov 1952, *Aristeguieta s.n.* (VEN); 3900 m, 9 Sep 1958, *Vareschi 7021* (VEN); 8 Nov 1952, *Aristeguieta 947* (VEN). Mun. Tabay, Laguna La Coromoto, 8°35.5´N, 71°01´W, 3300 m, 7 Nov 2000, *D. Stančík 4181* (CAR, COL, PRC); Laguna La Coromoto, 3300–3400 m, 15 Dec 1966, *Schulz 317* (MER); Sierra St. Domingo, Pico de Mucunuqui, al S de Laguna Grande, 4400 m, 28 Nov 1959, *Barclay & Juajíbioy 9895* (COL); Páramo de Mucuchies, Pico de Aguila, 4418 m, 21 Nov 1959, *Barclay & Juajíbioy 9656* (COL, MO, US); Sierra del Norte, 6 Oct 1952, *Humbert 26824* (COL, MER, P, US); Mun. Mucuchies, Páramo de Piedras Blancas, Lagua Negra, 8°49´N, 70°57´W, 4270 m, 4 Nov 2000, *D. Stančík 4191* (CAR, COL, PRC, W); 4200 m, *D. Stančík 4207* (CAR, COL, PRC, W); *D. Stančík 4176* (AAU, CAR, COL, PRC); 8°48.5´N, 70°55.5´W, 3800 m, *D. Stančík 4225* (CAR, COL, PRC); Laguna Tapada, 8°49´N, 70°56´43˝W, 4100 m, *D. Stančík 4242* (AAU, CAR, COL, PRC); 4100 m, *D. Stančík 4243* (CAR, COL, PRC, W); Laguna Negra, 9 Sep 1952, *Aristeguieta 1003* (VEN); Laguna Los Patos, Laguna El Infernito, 3700 m, Aug 1956, *Aristeguieta 2464* (VEN). Páramo de Piedras Blancas, 4400 m, 8 Dec 1979, *Barreto 645* (MERC); 4000–4600 m, 9 May 1985, *Briceño et al. 1146* (MERC); 4000–4600 m, 14 Nov 1981, *Briceño et al. 440* (Herbarium Briceño, MERC); sector Las Cruces, 3700–3900 m, 8 Sep 2000, *Briceño 3711* (Herbarium Briceño); Mun. La Culata, Páramo La Culata, *Briceño & Adamo 1067* (MERF); 3300 m, 7 Jun 1984, *Briceño & Adamo 949* (MERF); Mun. Mucuchies, Páramo de Misinta, NE de Mucuchies, 4000 m, 26 Oct 1984, *Briceño & Adamo 1139* (MERF); Páramo Las Monsalves, selva de Polylepis, 3900 m, 10 Nov 1952, *Vareschi 2232, 2134, 2244* (VEN); 3920 m, *Vareschi 2248* (VEN); Pico Espejo–Timoncito, paramo, 4300–4700 m, 16 Dec 1952, *Bernardi 275* (NY). **Táchira:** Mun. La Grita, Páramo La Negra, 08°15´N, 71°53´W, 3200 m, 11 Nov 2000, *D. Stančík 4280* (CAR, PRC); *D. Stančík 4279* (CAR, COL, PRC); Sierra Nevada, camino a Pico Bolívar, cerca de Refugio Moya, 4100–4300 m, 10 Oct 1953, *Littele 15712* (MER); Pico Bolívar y Espejo, 15–18 Dec 1959, *Barclay & Juajíbioy 10214* (US); Sierra Nevada, Loma Redonda, Páramo Media Luna, 4100 m, 3 Feb 1995, *Berg 649* (MERC); *Berg & Steinmetz 187* (Herbarium Briceño, MERC); Loma Redonda, 3940 m,

7 Oct 1994, *Briceño 2854* (Herbarium Briceño); Alto de La Cruz, 4040–4300 m, 11 Nov 1994, *Briceño et al. 3077* (Herbarium Briceño); Mun. Rangel, Laguna La Ciega, 4200 m, 29 Sep 2000, Briceño & Molinillo 3766 (Herbarium Briceño); Mun. Rangel, Páramo El Banco, 4420 m, 21 Oct 1997, *Briceño & Molinillo 3447* (Herbarium Briceño); Páramo de Misinta, NE de Mucuchies, 4000 m, 5 Jun 1987, *Briceño & Adamo 1131* (Herbarium Briceño); Páramo El Toro, Los Arbolitos y Los Nevados, 3100 m, 12 Oct 1988, *Briceño et al. 2330* (Herbarium Briceño); cresta Pico el Toro, 4200 m, 25 Nov 1994, *Briceño 3119* (Herbarium Briceño, PRC); via El Leon, 3460–3580 m, 4 Nov 1994, *Briceño 3111* (Herbarium Briceño, PRC); Valle de los Calderones, Páramo de los Pozones, 3350 m, 19 Oct 1995, *Briceño 3357* (Herbarium Briceño); Laguna Verde–Laguna Suero, 3990–4190 m, 29 Mar 1994, *Briceño et al. 2667* (Herbarium Briceño); Laguna El Espejo, 3800–3950 m, 9 Dec 1994, *Briceño 3178* (Herbarium Briceño); Laguna de Los Anteojos, 3900 m, 2 Dec 1994, *Briceño et al. 3158* (Herbarium Briceño); Laguna La Fría, 3460–3580 m, 4 Nov 1994, *Briceño et al. 3054* (Herbarium Briceño, PRC). **Trujillo:** Páramo de la Cristalina, 2900 m, Oct 1910, *Jahn 18* (US, VEN); 20 Oct 1910, *Jahn 43* (VEN); Tuname–Guirigoy, 3200 m, Aug 1958, *Aristeguieta & Medina 3531* (VEN); Guirigoy, hacia La Parida, 3400 m, Aug 1958, *Aristeguieta & Medina 3558* (VEN); Dept. Escuque, Cabimbi, Teta de Niquitao–Laguna Negra, 3800–3900 m, 19 Aug 1988, *Briceño s.n.* (Herbarium Briceño).

54b. Festuca tolucensis subsp. **perijae** Stančík, Darwiniana 41(1–4): 146, f. 11a–f. 2003. Type: Colombia. Magdalena, Sierra de Perijá, E of Manaure, Cerro Avión, 3550–3450 m, 8 Nov 1959, *J. Cuatrecasas & Castañeda 25136* (holotype: COL!; isotype: US!).

Panicles slender and compact. Spikelets 9–10 mm long; lower glumes 5.5–6.5 mm; upper glumes 6.5–7.5 mm long; lemmas 6–7 mm long.

Leaf blade anatomy.—Abaxial epidermis continuous, not extending to the vascular bundles.

Distribution and habitat.—Fesctuca tolucensis subsp. *perijae* is known only from the Serranía de Perijá on the Colombian–Venezuelan border, and is found in paramos at an altitude between 3000–3500 m.

Additional specimens examined. **COLOMBIA. Magdalena:** Sierra de Perijá, plain between Cerro Venado and Cerro Avión, 3270–3350 m, *J. Cuatrecasas & Castañeda 25133* (COL, US). **VENEZUELA. Zulia:** Sierra de Perijá–Serranía de Valledupar, campamento "Monte Viruela", 10º25´13˝N, 72º52´42˝W, 3100 m, *S.S. Tillett 747-1122* (COL).

54c. Festuca tolucensis subsp. **culata** Stančík & P.M. Peterson, **subsp. nov.** Type: Venezuela. Mérida, Mun. La Culata, Páramo La Culata, 3300 m, 8°45´42˝N, 71°03´W, 3300 m, 12 Nov 2000, *D. Stančík 4259* (holotype: PRC!; isotypes: CAR!, COL!).

Haec subspecies a *Festuca tolucensis* subsp. *tolucensis* et *F. tolucensis* subsp. *perijae* spiculis 10–11 (non 7–10) mm, glumis minoribus (inferioribus 2–2.5 non 4–6.5 mm, superioribus 4–5 non 6–7.5 mm) distinguitur.

Spikelets 10–11 mm long; lower glumes 2–2.5 mm long; upper glumes 4–5 mm long.

Leaf blade anatomy.—Abaxial epidermis continuous, extending just to a single vascular bundle.

Distribution and habitat.—Festuca tolucensis subsp. *culata* is known only from Mérida where the subspecies occurs in rocky paramos of La Culata and El Escorial, at an altutude of about 3000–3350 m.

Additional specimens examined. **VENEZUELA. Mérida:** Páramo El Escorial, 3100–3420 m, 10 Jul 1987, *Briceño & Adamo 2052* (Herbarium Briceño, PRC). Mun. La Culata, Páramo La Culata, 3300 m, 8°45´42˝N, 71°03´W, 3300 m, 12 Nov 2000, *D. Stančík 4258* (CAR, COL, PRC).

55. Festuca turimiquirensis Stančík & P.M. Peterson, **sp. nov.** (**Figs. 49, 70**). Type: Venezuela. Anzoátegui, Distr. Libertad, ridges and tops of Montanas Negras, along the Sucre and Anzoátegui border, 20 km NE of Bergantín, NE of Buenos Aires, Serranía de Turimiquire, 10°04´30˝N, 64°11´W, 2000–2350 m, bamboo-ericaceous scrub and elfin cloud forest, 28 Nov 1981, *G. Davidse et al. 19610* (holotype: MO!, isotypes: NY!, VEN!).

Haec species a *F. tolucensis* glumis minoribus (inferibus 3–4 non 5–8.5 mm, superioribus 4–5.5 non 5–9.5 mm), aristis longioribus et paniculae majoribus (6–7 cm lat., non 0.5–1.5 cm), et sclerenchymate abaxiali non continui differt.

Tussocked perennials with intra- and extravaginal innovations. Culms 70–80 cm tall, erect,

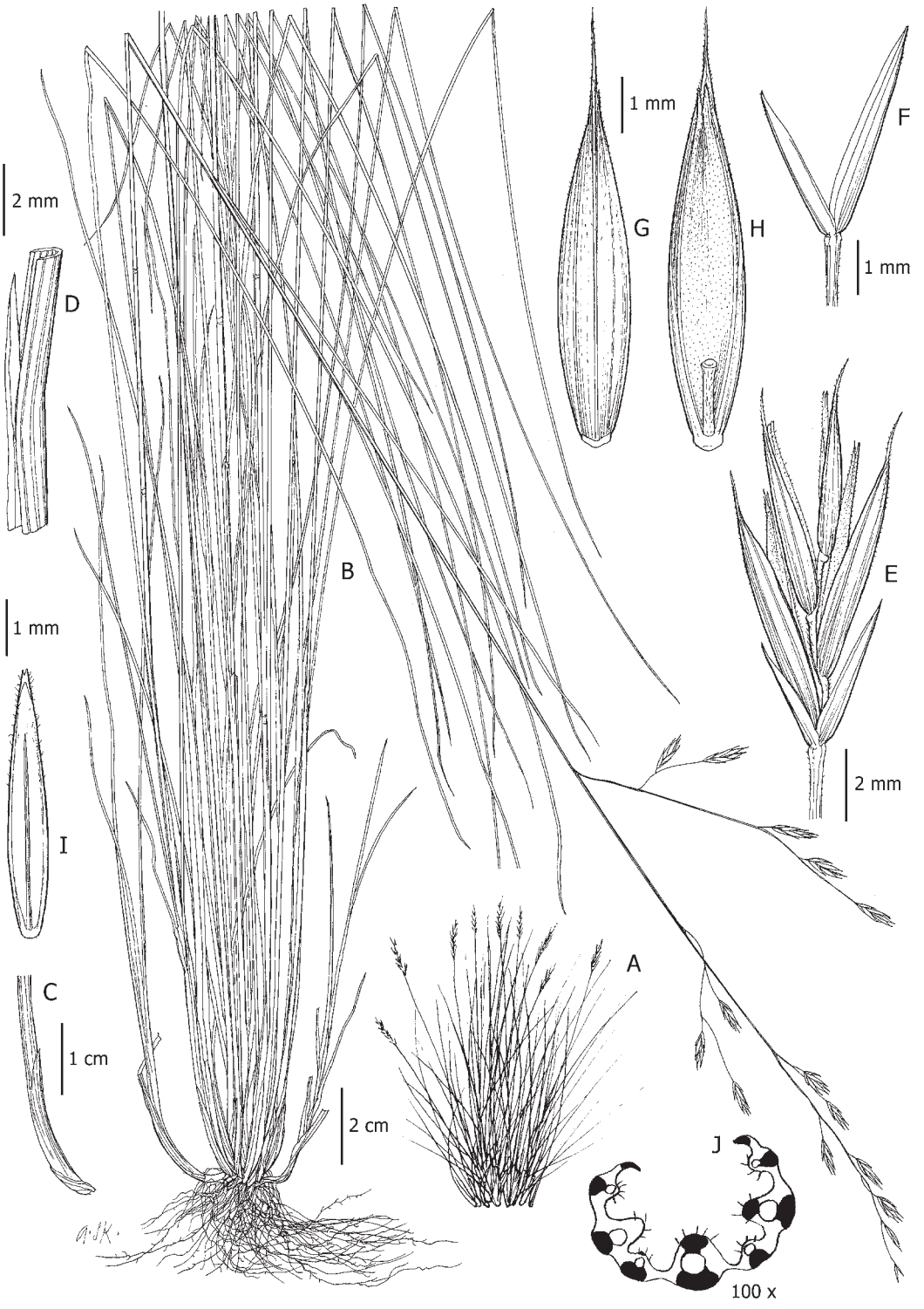


Figure 70. *Festuca turimiquirensis.* **A.** Stylized growth form. **B.** Habit. **C.** Extravaginal shoot. **D.** Ligule. **E.** Spikelet. **F.** Glumes. **G.** Lemma. **H.** Lemma with palea and rachilla. **I.** Caryopsis. **J.** Leaf blade cross-section. A–I, *Davidse et al. 19610* (NY).

glabrous; nodes 3 or 4 near base. Leaf sheaths membranous, brown, glabrous, striate; ligules 1.5–4 mm long, apex acute; blades 40–50 cm long, 0.6–0.7 mm wide, conduplicate, abaxially glabrous, green. Panicles 15–17 × 6–7 cm, open, ovate; branches glabrous. Spikelets 10–11 mm long, ovate, florets 4; rachillas 1.2–1.4 mm long, hairy; glumes 3–5.5 mm long, membranous, upper 1/3 scabrous, apex acute; lower glumes 3–4 mm long, lanceolate, 1-nerved; upper glumes 4–5.5 mm long, lanceolate, 3-nerved; lemmas 7–8.5 mm long, lanceolate, 5-nerved, membranous, upper 1/2 scabrous, awned, the awn 0.7–2.5 mm long; paleas as long as the lemma, membranous, scabrous; anthers ca. 3 mm long; ovary apex sparsely hairy. Caryopses lanceolate; hilum 5/6 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections usually with 7 vascular bundles, 5 ribs above; sclerenchyma under abaxial epidermis discontinuous, forming large fascicles, adaxial sclerenchyma present and extending to every second vascular bundle; adaxial epidermis with scattered hairs, the hairs ca. 0.1 mm long.

Observations. This Venezuelan species is geographically isolated and known only from the type collection. *Festuca turimiquirensis* differs from *F. tolucensis* by having smaller spikelets (lower glumes 3–4 versus 5–8.5 mm long, upper glumes 4–5.5 versus 5–9.5 mm long), opened panicles (6–7 versus 0.5–1.5 cm wide), and the abaxial sclerenchyma is discontinuous (versus continuous).

Distribution and habitat.—Festuca turimiquirensis is restricted to the Serranía de Turimiquire (Anzoategui) of Venezuela where it occurs in grasslands on rocky slopes in open areas between 2000–2350 m.

56. Festuca vaginalis (Benth.) Laegaard, Novon 8(1): 30. 1988. (**Figs. 64, 71, 97D**). *Poa vaginalis* Benth., Pl. Hartw. 261. 1846. Type: Ecuador. Pichincha, Hacienda de Antisana, *K.T. Hartweg 1450* (holotype: K!; isotype: US-88715!).

Tussocked perennials with intravaginal innovations. Culms 20–60 cm tall, erect, glabrous; nodes 1, basal and 1 or 2 short leaves. Leaf sheaths coriaceous, stramineous, occasionally grayish, glabrous; ligules 0.8–1.2 mm long, coriaceous, oblong or triangular, apex short-ciliate; blades (4–)7–17 cm long, 0.4–0.8 mm wide, conduplicate, glaucous. Panicles 10–15 × 0.5 cm, contracted, narrow, whitish or purplish-white, occasionally pale green; Spikelets 8–9.5 mm long, lanceolate, florets 2 or 3; rachilla short-pubescent; glumes (5.5–)6.5–9 mm long, almost as long as the spikelet, membranous, white or with purple stripes, midnerve scabrous distally, apex obtuse; lower glumes (5.5–)6.5–8 (–9) mm long, 1-nerved; upper glumes 6.5–9 mm long, 3-nerved; lemmas 7.5–8.5 mm long, oblong, 5-nerved, membranous, apex short two-dentate, awned, the awn 0.5–1 mm long; callus glabrous; paleas 3/4 as long as the lemma, scabrous on keels; lodicules lanceolate; anthers 0.6–0.9 mm long; ovary apex glabrous. Caryopses lanceolate, hilum 2/3 as long as the grain, linear.

Leaf blade anatomy.—Cross-sections with (7–)9–11 vascular bundles and 5–9 ribs above; sclerenchyma discontinuous under both abaxial and adaxial epidermis, girders absent; bulliform cells absent; adaxial epidermis with scattered hairs, the hairs 0.075–0.09 mm long.

Observations.—Festuca vaginalis is morphologically distinct from the other species treated in this revision and we do not know which species might be its closest sister. *Festuca vaginalis* has been mentioned as occurring in Ecuador and Colombia (Luteyn 1999, Rangel 2000); although its occurrence in Colombia has not been confirmed.

Distribution and habitat.— Festuca vaginalis is endemic to Ecuador. It occurs on volcanic rocks in superparamos and dry grass paramos between 3500–5000 m. It also has spread secondarily onto disturbed areas of dry grass paramos and along road embankments, so called "arenal."

KEY TO THE SUBSPECIES OF *FESTUCA VAGINALIS*

1a. Culms 30–60 cm long, robust; leaf blades ca. 0.8 mm wide; panicles whitish or purplish-white ....**56a. F. vaginalis** subsp. **vaginalis**

1b. Culms 20–30 cm tall, not robust; leaf blades 0.4–0.5(–0.6) mm wide; panicles pale-green ....**56b. F. vaginalis** subsp. **cayambae**

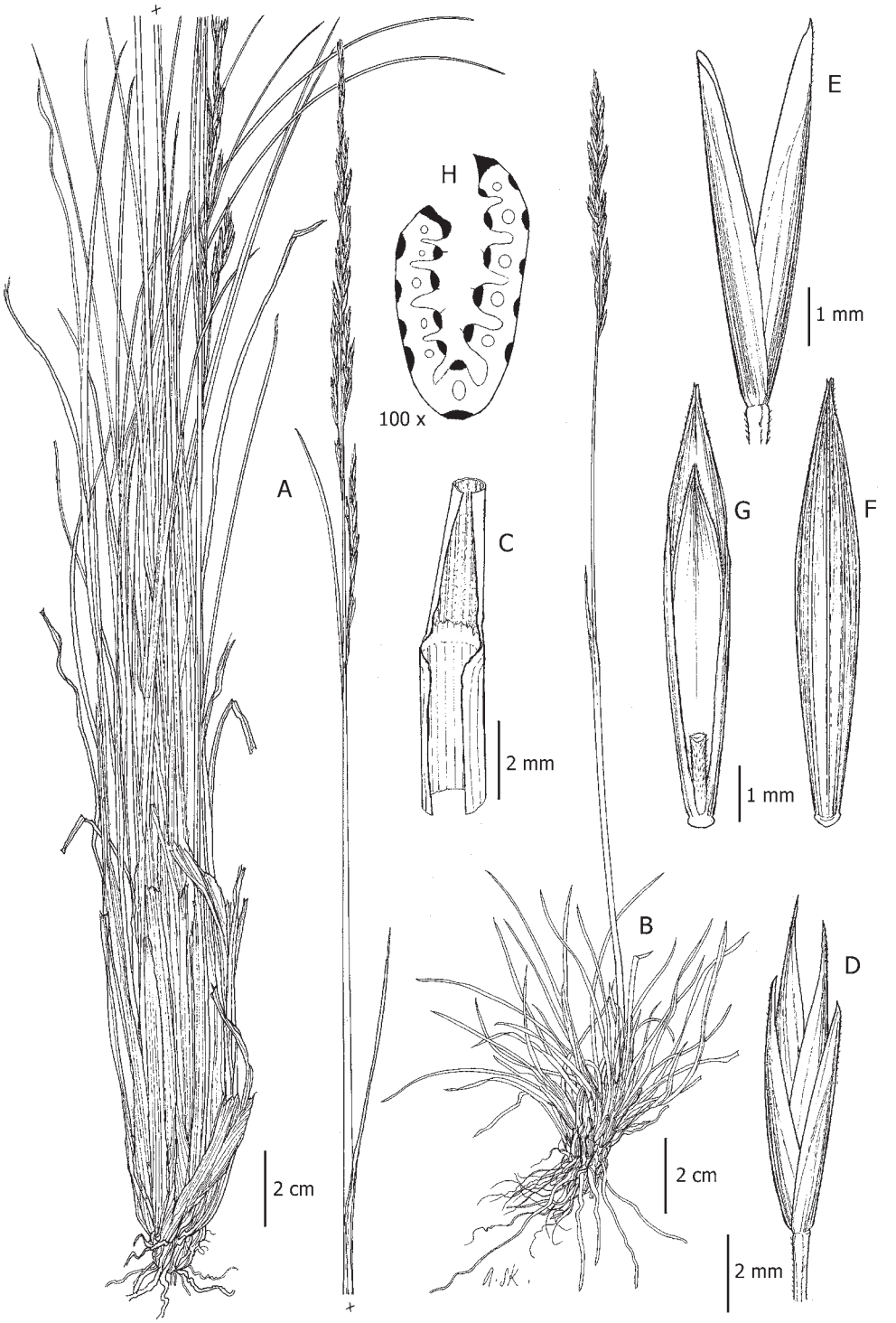


Figure 71. *Festuca vaginalis* subsp. *vaginalis* **A.** & **B.** Habit. **C.** Ligule. **D.** Spikelet. **E.** Glumes. **F.** Lemma. **G.** Lemma with palea and rachilla. **H.** Leaf blade cross-section. A–H, *Stančík 3134* (COL).

56A. Festuca vaginalis subsp. **vaginalis (Fig. 71)**.

Culms 30–60 cm long, robust. Leaf blades ca. 0.8 mm wide. Panicles whitish or purplish-white.

Leaf blade anatomy.—Cross-sections with 9–11 vascular bundles.

Additional specimens examined. **ECUADOR. Bolívar:** Volcán Chimborazo, W side, 1º28´S, 78º48´W, 4800 m, 14 Sep 1995, *Sklenář & Kostečková 143-2* (QCNE); road Salinas–Los Arenales, km 6, 01º22´S, 79º00´W, 4000 m, *S. Laegaard 55327* (AAU); valley 4 km S of Cruces de los Arenales, 4270–4300 m, 3 Mar 1992, *S. Laegaard 101559* (AAU, QCA); 01º25´S, 78º54´W, 4160–4200 m, *S. Laegaard 101495* (AAU); km 66.5 SW of Ambato on Hwy to Guaranda and 1.2 on road Fecundo Vela, km 1.2 km, 4290 m, 03 May 1990, *P.M. Peterson 8987 & C.R. Annable* (K, MO, US, QCNE). **Cotopaxi:** Angamarca road, km 5 from junction to Latacunga–La Mana road, 01º00´S, 78º55´W, 4250–4280 m, *S. Laegaard 102149* (AAU); Volcán Cotopaxi, road to Refugium, 00º40´S, 78º26´W, 4350 m, *S. Laegaard 103127* (AAU); SW slope, 4100 m, *E. Asplund 7497* (F, K, NY, S, US); El Tambo SE of Volcán Cotopaxi, 00º42´S, 78º18´W, 3650 m, *S. Laegaard 55536* (AAU); Hacienda Pauzacha, 00º44´S, 78º29´W, 3650 m, *S. Laegaard 55735* (AAU); road Zumbahua–Pujili, km 39, 00º53´S, 78º47´W, 3750–3800 m, *S. Laegaard 102096* (AAU); Parque Nacional Cotopaxi, Laguna Limpiopungo, 3800 m, *P.M. Peterson 8739, C.R. Annable & M.E. Poston* (MO, QCA, QCNE, US); plate below NE side of volcano, 00°37´S, 78°24´W, 3800 m, 26 Jun 1999, *D. Stančík 3137* (PRC, QCA); NE side of volcano Cotopaxi, 00°37.5´S, 78°24.2´W, 3820 m, 26 Jun 1999, *D. Stančík 3134* (PRC, QCA); valley NW of Limpiopungo to foot of Volcán Rumiñahui, 00º38´S, 78º28´W, 4300 m, 25 Feb 1992, *S. Laegaard 101460* (AAU, QCNE). Laguna Quilotoa, 00º51´S, 78º53´W, 3480–3820 m, *S. Laegaard 101335A* (AAU); Panamerican Hwy., km 2 S of Cruce de Cordillera, 00º39´S, 78º35´W, 3500 m, 13 Aug 1984, *S. Laegaard 52656* (AAU, QCNE); *S. Laegaard 52659* (AAU); S of Cruce de Arenales, km 5, 01º32´S, 78º52´W, 3950 m, 18 Sep 1998, *S. Laegaard 19159* (AAU, LOJA); Rancho Santa María, 00º43´S, 78º29´W, 3750–3950 m, *S. Laegaard 52202* (AAU); Mun. Chaupi, NE slope of volcán Illiniza Norte, 00°38´11˝S, 78°43´1˝W, 4450 m, 12 Oct 2000, *D. Stančík 4013* (PRC, QCA); SE slope of volcán, 00°38´45˝S, 78°25´32˝W, 4300 m, 28 Sep 2000, *D. Stančík 3881* (PRC, QCA, US). **Chimborazo:** Volcán Chimborazo, lower Refugio, 01º28´S, 78º50´W, 4840 m, *S. Laegaard 102796* (AAU,QCNE); 5000 m, 11 May 1992, *Rauh & Hirsch E315* (US); road from Refugium, km 4.7, 01º27´S, 78º52´W, 4330–4400 m, *S. Laegaard 102795* (AAU, QCNE); Chimborazo, *Sodiro s.n.* (US); lower Refugium, 01º27´S, 78º50´W, 4800 m, 5 Mar 1988, *S. Laegaard et al. 70553* (QCA); *Sodiro s.n.* (QPLS); 01º27´S, 78º50´W, 4800 m, *S. Laegaard et al. 70554* (AAU, QCNE); paroquilla San Juan, 01º30´S, 78º49´W, 4150 m, 4 Aug 1992, *Ceron et al. 19822* (QAP); Cruce de los Arenales, km 5, 01º27´S, 78º52´W, 4330–4400 m, *S. Laegaard 102795* (AAU, QCNE); km 4.7 from lower refugio of Volcano Chimborazo, arenales, 01°27´S, 78°50´W, 4500 m, 5 Mar 1988, *S. Laegaard & S.A. Renvoize 70558* (K); Panamerican Hwy. Riobamba–Ambato, km 22, 01º30´S, 78º42´W, 3500 m, 11 Oct 1985, *S. Laegaard 55400* (AAU, QCA); S side of Volcano, 4300 m, 1929, *Rimbach 97a* (US); Urbina – paramo on E flank of Mt. Chimborazo, 3600 m, *A.S. Hitchcock 22019* (K, NY, US); S slope, 3800 m, *Fagerlind & Wibom 934bis* (S); *Fagerlind & Wibom 932* (S); Dec 1890, *Sodiro s.n.* (QPLS); 4600 m, *E. Asplund 8399* (S); Nudo deIgualata–Sanancajas, 3600 m, *Acosta-Solís 21187* (US); km 18.2 ESE of Lago Colta on road to Pallatanga, 3700 m, 21 May 1990, *P.M. Peterson 9228, E.J. Judziewicz, R.M. King & P.M. Jorgensen* (MO, QCA, QCNE, US); Prov. Riobamba, praed Toledo, Sep 1891, *Sodiro s.n.* (P); Mun. Guaranda, W side of volcán Chimborazo, road to Refugium, 01°28´S, 78°52´W, 4100 m, 5 Jul 1999, *D. Stančík 3163* (PRC, QCA); Mun. Riobamba, volcán Chimborazo, around upper Refugio, 5000 m, 20 Sep 2000, *D. Stančík 3706* (PRC, QCA); sector Cruce de los Arenales, 01°28´15˝S, 78°54´6˝ W, 4300 m, 20 Sep 2000, *D. Stančík 3718* (PRC, QCA). **Imbabura:** Páramo on the N side of Nevado Cayambe, 0°03´07˝N, 77°59´27˝W, 17 Aug 2004, *Sklenář 8067, 8115* (PRC). **Morona–Santiago:** Hda. Hargualla–Hda. San Eduardo, way to Parque Nacional Sangay, 02°0.25´S, 78°27´W, 3700 m, 19 Jul 1999, *D. Stančík 3323* (PRC, QCA); Parque Nacional Sangay, a confluence of Quebrada Plazabamba Chico with Q. Plazabamba, 02°0.48´S, 78°25.4´W, 3600 m, 21 Jul 1999, *D. Stančík 3341* (PRC, QCA). **Pichincha:** Cerro Antisana, W. Huagrahialina Campamento, 4200 m, *Black 278, 279* (AAU); 4600 m, *E. Asplund 17338* (NY, S); 00º32´S, 78º12´W, type locality, 4030 m, *S. Laegaard 102848* (AAU); between Antisana and

Sincholagua, *E. Asplund 3648* (US); Rucu Pichincha, NE slope, 00º10´S, 78°34´W, 4300–4500 m, *Sklenář & Kostečková 198* (AAU); Lloa–Guagua Pichinha road, km 11, 00º12´S, 78º35´W, 4310 m, 9 May 1992, *S. Laegaard 102743* (AAU, QCNE); around Refugium, 00º12´S, 78º35´W, 4550 m, *S. Laegaard 102758* (AAU); 4600 m, *E. Asplund 7397* (K, NY, S, US); Pichincha, Cotocollao, *Sodiro s.n.* (QPLS); 3200 m, *E. Asplund 6620* (S, US); Páramo de Guamani, 00º18´S, 78º14´W, 3750 m, *S. Laegaard 51386* (AAU, QCNE); 00º20´S, 78º14´W, 3700 m, *S. Laegaard 19598* (AAU, LOJA, PRC, QCNE); 3600–3800 m, *E. Asplund 8721* (S); 4050 m, *Barclay & Juajíbioy 8905* (COL, US); Andium Quitensium, *Jameson 230* (P); Mun. Pifo, Páramo de Guamaní, 00°20´S, 78°12´W, 4000 m, 19 Jun 1999, *D. Stančík 3014* (PRC, QCA); 3700 m, *D. Stančík 3020* (PRC, QCA, US); *D. Stančík 3001* (PRC, QCA). **Tungurahua:** Volcán Chimborazo, SW of San Fernando, 3500 m, 23 Jul 1959, *Barclay & Juajíbioy 8166* (COL, US); above Mocha, 3300 m, *E. Asplund 7872* (S).

56b. Festuca vaginalis subsp. **cayambae** Stančík, Folia Geobot. Phytotax. 39(1):107. 2004. Type: Ecuador. Pichincha, along road to Volcán Cayambe, near entrance to National Park, 78º04´W, 00º03´S, 3550 m, 1 Mar 1988, *S. Laegaard & S.A. Renvoize 70488* (holotype: AAU!; isotypes: QCA!, QCNE!, K!).

Culms 20–30 cm tall, not robust. Leaf blades 0.4–0.5(–0.6) mm wide. Panicles pale-green.

Leaf blade anatomy.—Cross-sections with 7 vascular bundles.

Additional specimens examined. **ECUADOR. Bolívar:** km 60.4 SW of Ambato on Hwy to Guaranda, 4090 m, *P.M. Peterson & C.R. Annable 8984* (QCNE, US); 01º25´S, 78º52´W, 3950 m, 15 Feb 1999, *S. Laegaard 19589* (AAU, PRC); km 66.5, 3760 m, 3 May 1990, *P.M. Peterson & C.R. Annable 9000* (K, MO, QCA, US); km 33, 01º18´S, 78º48´W, 3700 m, 1 Mar 1992, *S. Laegaard 101505* (AAU, QCNE); Cruce de los Arenales, 01º25´S, 78º54´W, 4160–4200 m, *S. Laegaard 101493* (AAU, PRC). **Cañar:** Panamerican Hwy. ca. 5 km S of Cañar, 02°33´S,78°56´W, 3500 m, *S. Laegaard 105123* (AAU); 3350 m, *S. Laegaard 101828* (AAU). **Chimborazo:** Mun. Guaranda, pasture around Vereda Río Colorado, 4200 m, 2 Jul 1999, *D. Stančík 3182* (PRC, QCA, W). **Cotopaxi:** Mun. Chaupi, NE slope of volcán Illiniza Norte, 00°37´59˝S, 78°42´42˝W, 4000–4050 m, 12 Oct 2000, *D. Stančík 4033, 4035* (PRC, QCA). **Pichincha:** Hacienda Antisana and Mt. Sincholagua, *E. Asplund 8648* (S).

EXCLUDED NAME

Festuca sublimis forma *vivipara* St.-Yves, Candollea 3: 255. 1927. Type: Peru. Puca de Ladrillos, entre Pacasmayo et Mayobamba, 3400 m, *Stübel Fl. Peru 30* (syntype: B?); Ecuador. Ilizna, Tisiche, *Stübel Fl. Ecuador 301* (syntype: B?).

Comments.—The status of this taxon is in question since we were unable to locate any of the syntypes. Alexeev (1986) cited this taxon as a synonym of *F. asplundii* but did not indicate that he saw any of the original material.

SCANNING ELECTRON MICROGRAPHS OF LEAF EPIDERMAL SURFACES

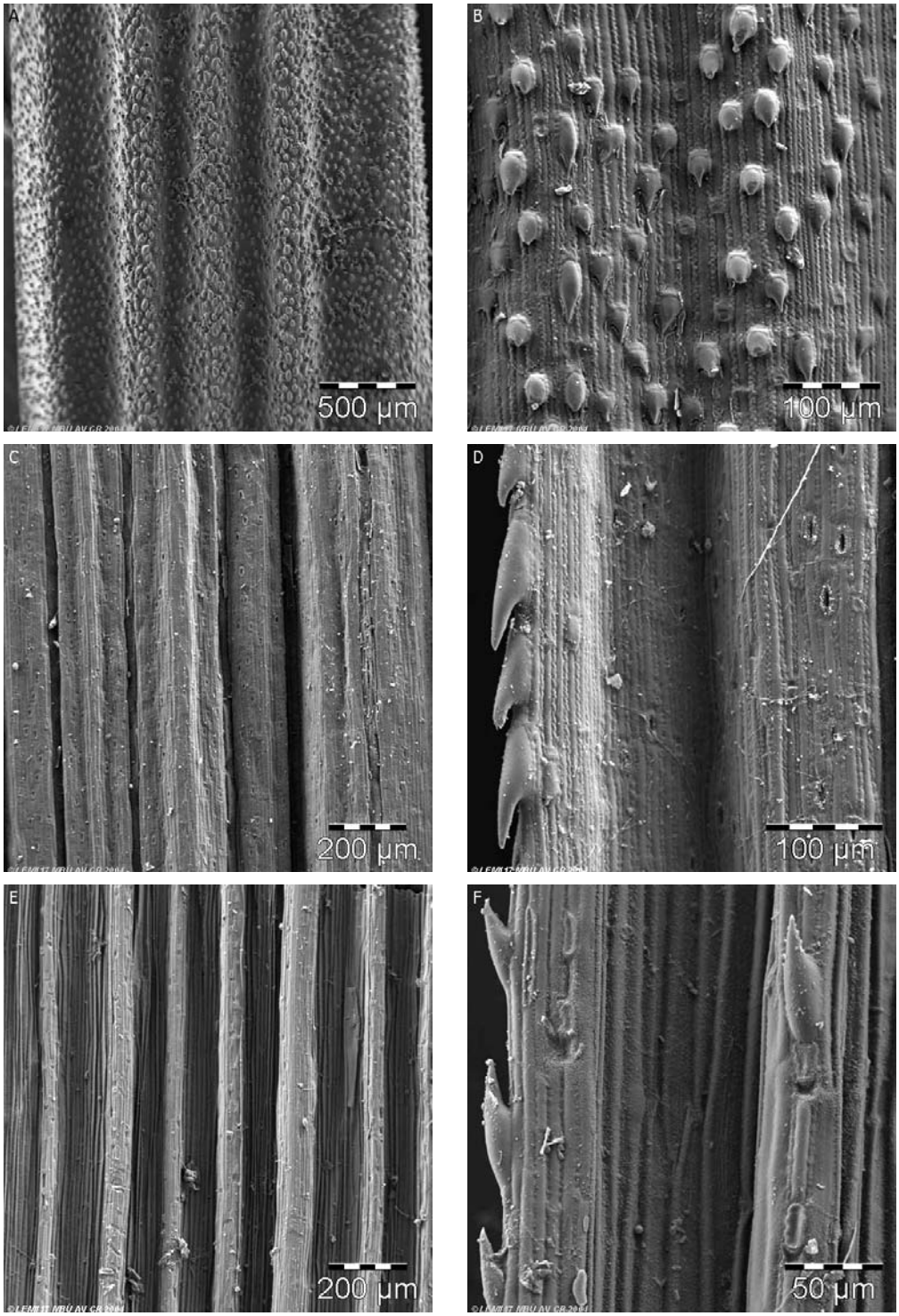


Figure 72. Leaf blade surfaces. **A–D.** *Festuca amplissima* subsp. *amplissima*. **A.** Abaxial epidermis with ribs, densely covered with prickles. **B.** Abaxial epidermis, detail view of long cell with sinuous walls, rounded silica bodies, and prickles. **C.** Adaxial epidermis with long cells and regularly occurring stomata. **D.** Adaxial epidermis with long and short (silica bodies) cells, stomata (surrounded by wax), and prickles on the margin. **E & F.** *F. coromotensis*. **E.** Abaxial epidermis with regular ribs. **F.** Abaxial epidermis with detail of oval (sinuous) silica bodies and prickles. A & B, *Barclay 7033* (COL); C & D, *Liebmann 6110* (C); E, F, *Stančík 4180* (PRC).

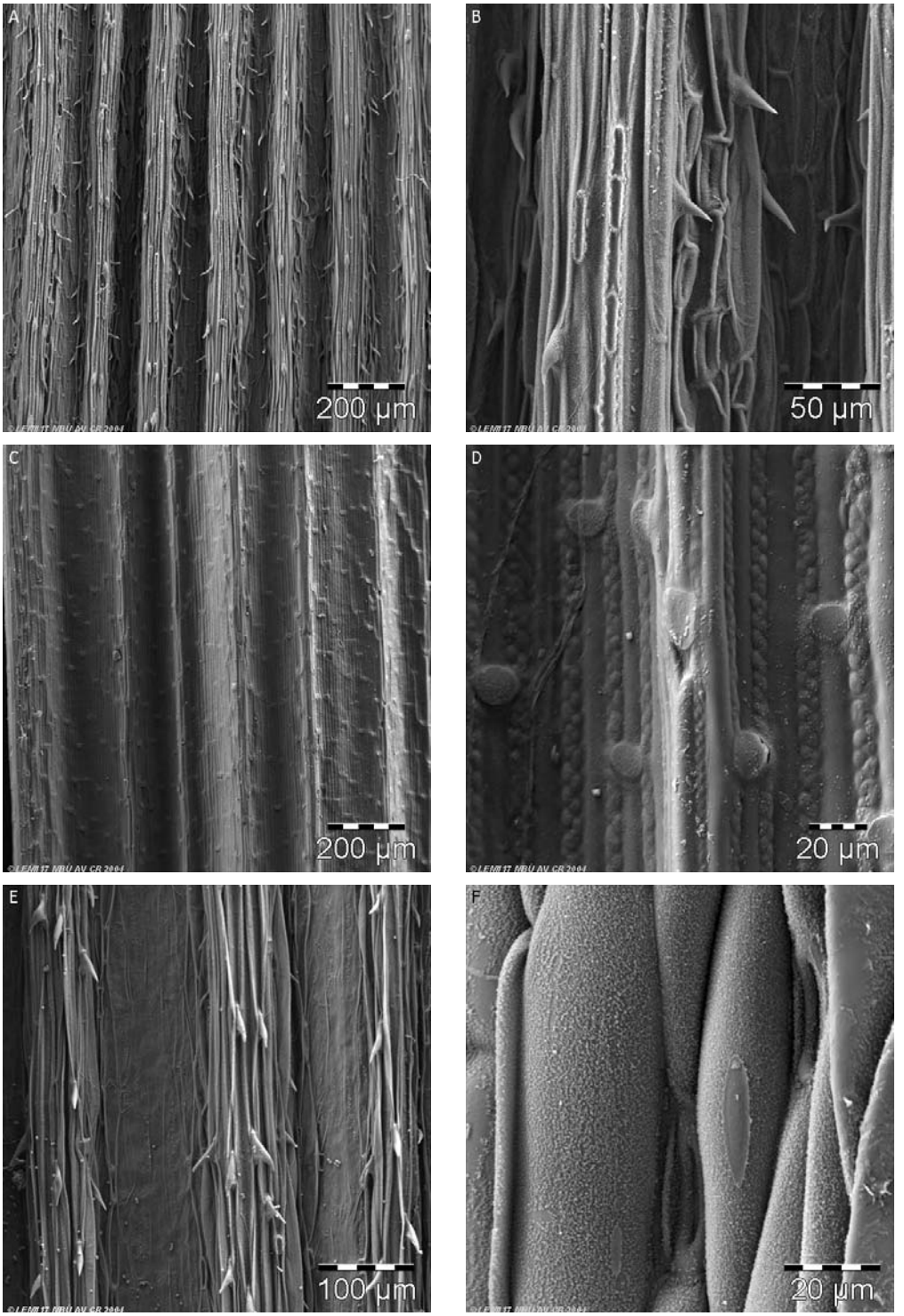


Figure 73. Leaf blade surfaces. **A & B.** *Festuca coromotensis*. **A.** Adaxial epidermis with ribs, sparsely covered with short macro-hairs. **B.** Adaxial epidermis, detail view of silica bodies, stomata and macro-hairs. **C–F.** *F. elviae*. **C.** Abaxial epidermis with long cells and regularly occurring silica bodies. **D.** Abaxial epidermis, detail view of silica bodies with short cork cell. **E.** Adaxial epidermis with regular ribs and short macro-hairs. **F.** Adaxial epidermis, detail view of stomata and cell walls covered by fine crystals of wax. A & B, *Stančík 4180* (PRC); C−E, *Stančík 4178* (PRC); F, *Stančík 4171* (PRC).

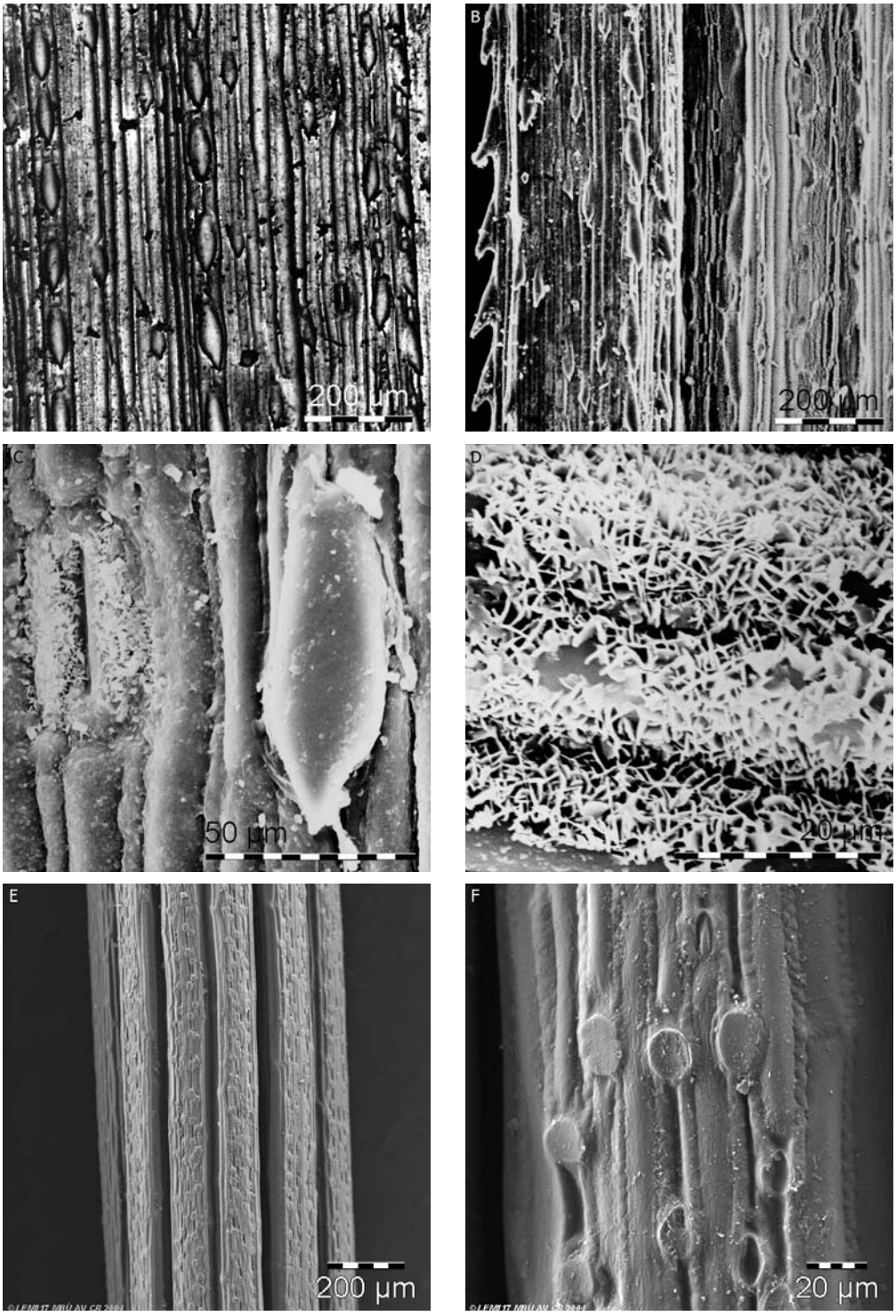


Figure 74. Leaf blade surfaces. **A–D.** *Festuca flacca*. **A.** Abaxial epidermis with small ribs densely covered with prickles. **B.** Adaxial epidermis covered with prickles and stomata. **C.** Adaxial epidermis, detail view of stoma and prickle. **D.** Adaxial epidermis, detail view of wax crystals. **E & F.** *F. guaramacalana*. **E.** Abaxial epidermis with regular ribs **F.** Abaxial epidermis with detail of circular silica bodies. A−D, *Stančík 4180* (PRC); E & F, *Stančík 4286* (PRC).

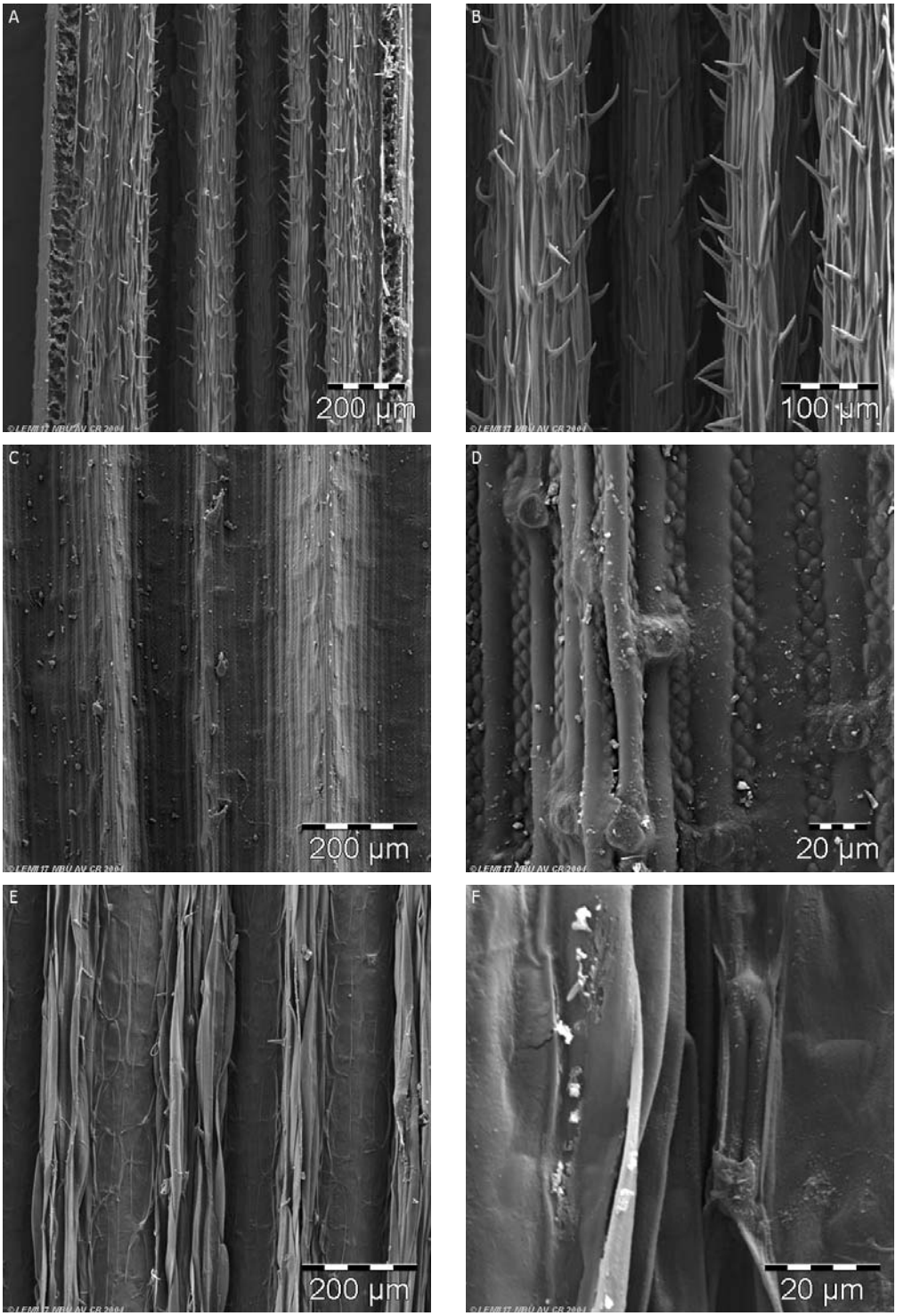


Figure 75. Leaf blade surfaces. **A & B.** *Festuca guaramacalana*. **A.** Adaxial epidermis with ribs, covered with macro-hairs. **B.** Adaxial epidermis, detail view of macro-hairs. **C–F.** *F. sodiroana.* **C.** Abaxial epidermis with small ribs and occasionally occurring prickles. **D.** Abaxial epidermis, detail view of long and short (silica bodies) cells. **E.** Adaxial epidermis with regular ribs and sparse short macro-hairs. **F.** Adaxial epidermis, detail view of stoma. A & B, *Stančík 4286* (PRC); C−F, *Stančík 2632* (PRC).

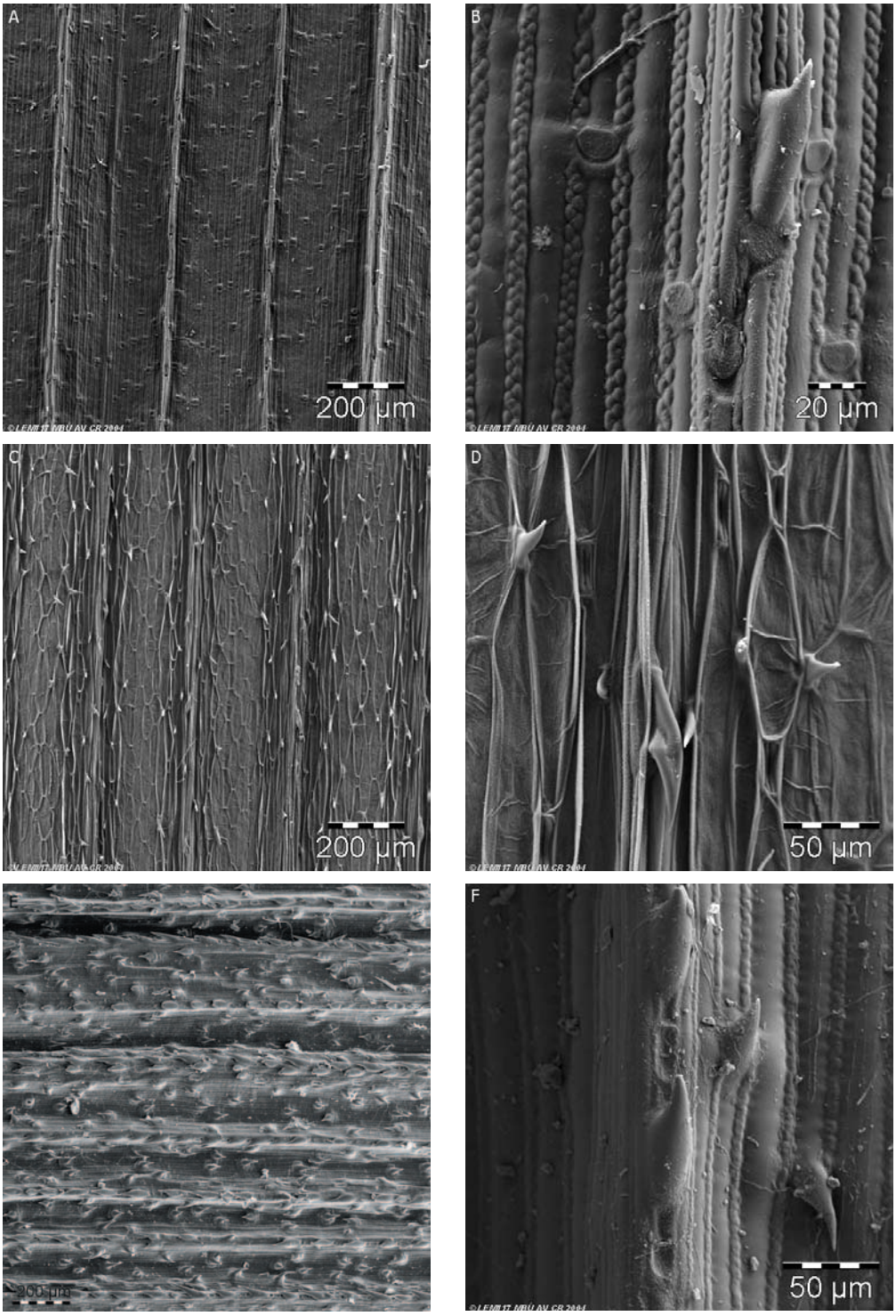


Figure 76. Leaf blade surfaces. **A–D.** *Festuca ulochaeta*. **A.** Abaxial epidermis with small ribs. **B.** Abaxial epidermis, detail view of prickle and silica bodies with cork cells. **C.** Adaxial epidermis with small ribs and regurally occurring stomata and short macro-hairs. **D.** Adaxial epidermis, detail view of stomata and macro-hairs. **E & F.** *F. caldasii*. **E.** Abaxial epidermis densely covered with prickles. **F.** Abaxial epidermis with detail of oval (sinuous) silica bodies and prickles. A–D, *Stančík 4179* (PRC); E & F, *Laegaard 20405* (AAU).

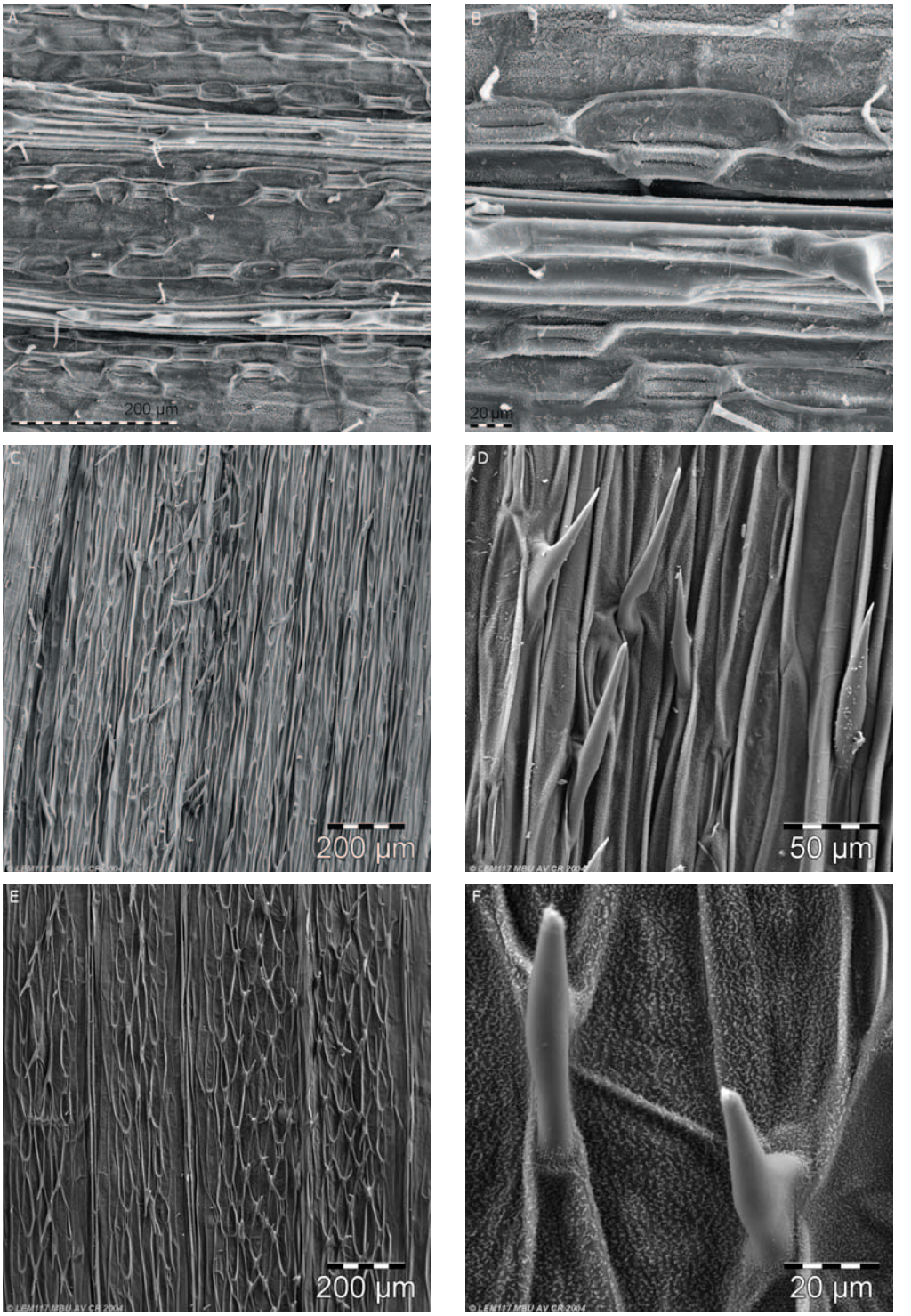


Figure 77. Leaf blade surfaces. **A & B.** *Festuca caldasii*. **A.** Adaxial epidermis with small ribs and regurally distributed stomata and macro-hairs. **B.** Adaxial epidermis, detail view of stomata covered by wax. **C–F.** *F. reclinata.* **C.** Abaxial epidermis with long cells and regularly occurring stomata and slender prickles. **D.** Abaxial epidermis, detail view of prickles and stomata. **E.** Adaxial epidermis with small ribs; regurally occurring prickles and stomata. **F.** Adaxial epidermis with detail of prickles and wax covering cell walls. A & B, *Laegaard 102535* (AAU); C–F, *Cuatrecasas & Barriga 9970* (COL).

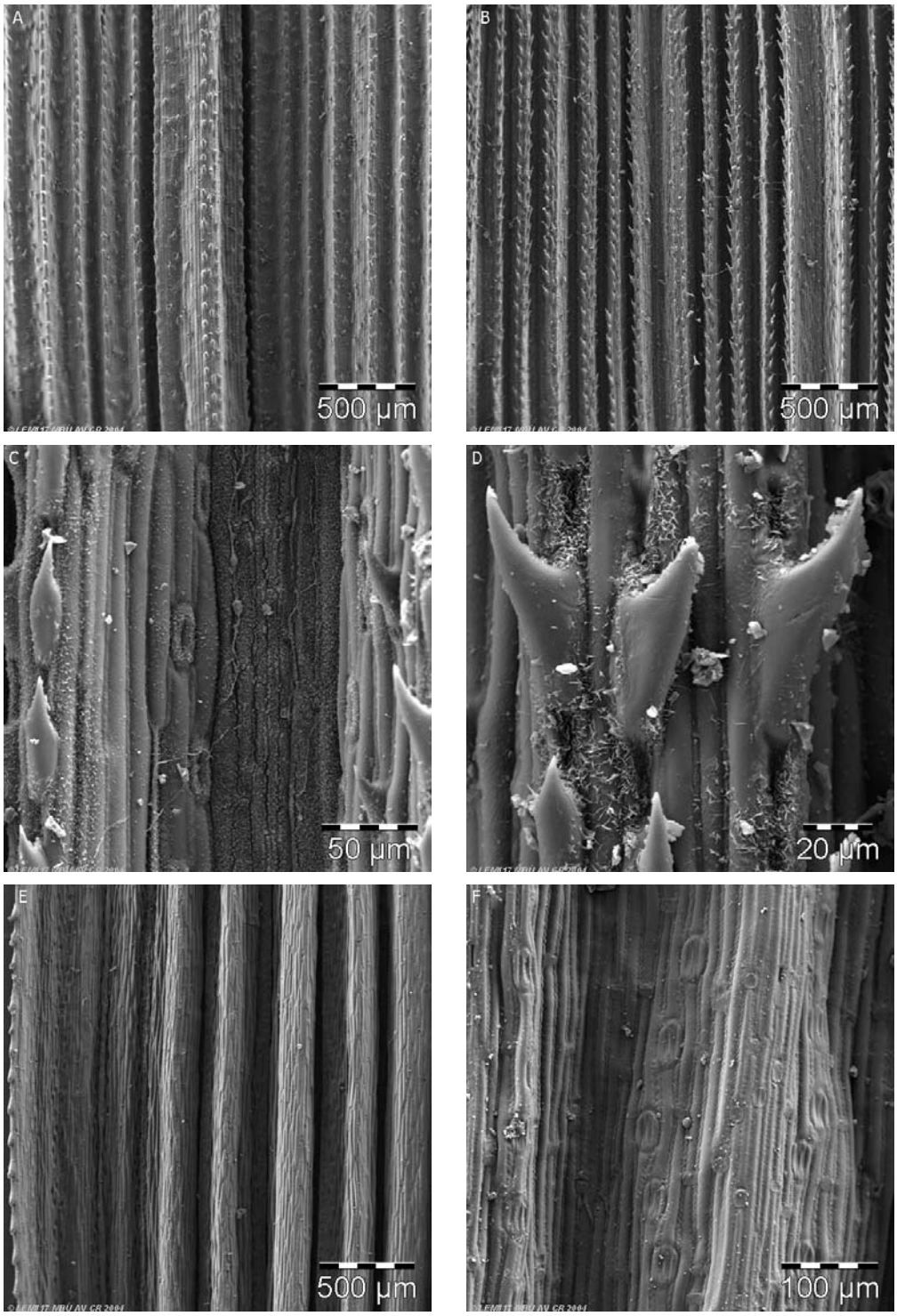


Figure 78. Leaf blade surfaces. **A–D.** *Festuca woodii*. **A.** Abaxial epidermis with ribs, densely covered with prickles. **B.** Adaxial epidermis with pronounced ribs densely covered with prickles. **C.** Adaxial epidermis with detail view of stomata laying between two ribs. **D.** Adaxial epidermis with detail view of prickles and waxes covering cell walls. **E & F.** *F. arundinacea*. **E.** Abaxial epidermis with regular ribs and rows of prickles. **F.** Abaxial epidermis with detail view of stomata and silica bodies. A−D, *Wood 5254* (COL); E & F, *Stančík 3221* (PRC).

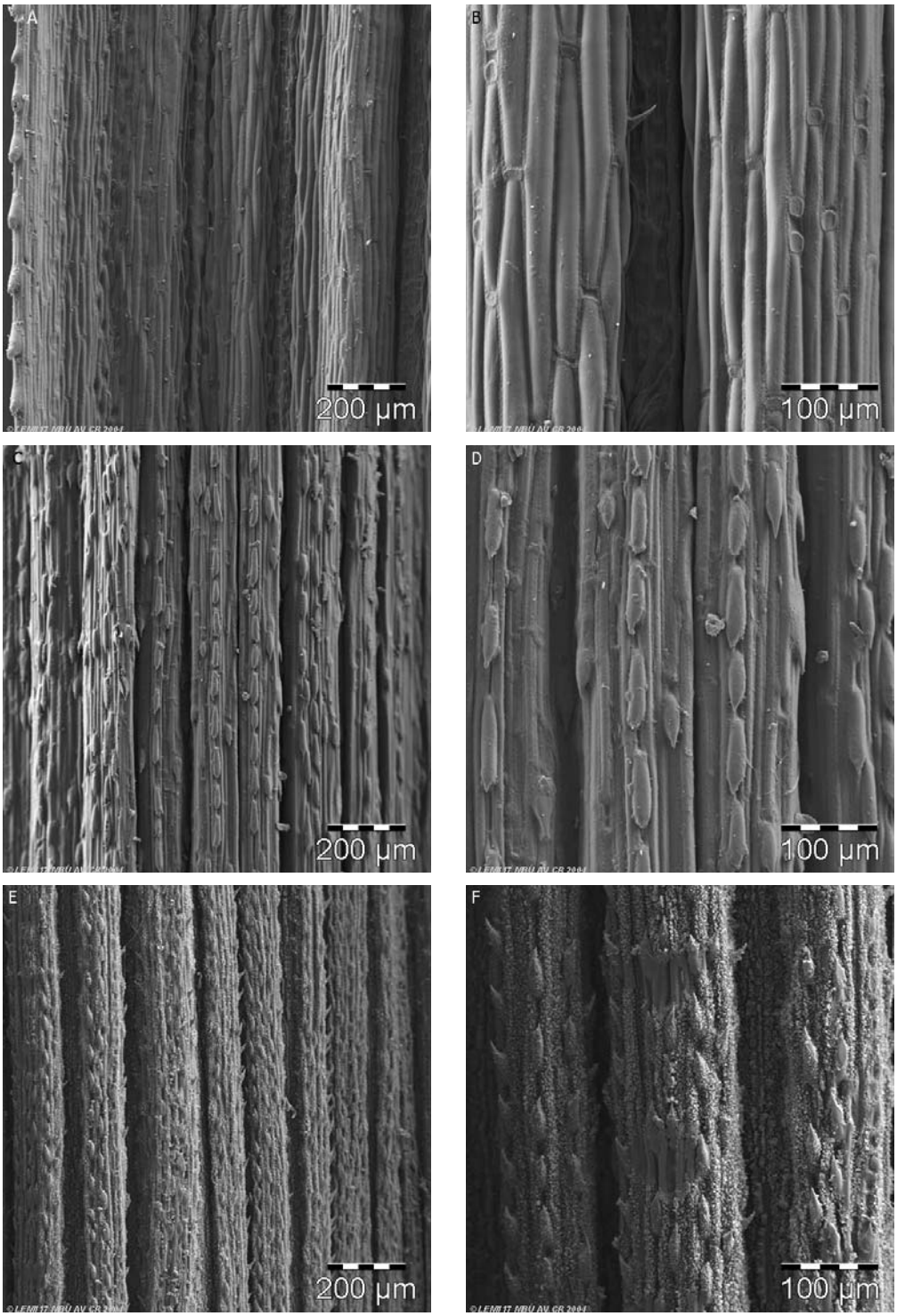


Figure 79. Leaf blade surfaces. **A & B.** *Festuca arundinacea*. **A.** Adaxial epidermis with rows of stomata between small ribs. **B.** Adaxial epidermis, detail view of long cells interrupted by short cells (silica bodies and cork cells). **C–F.** *F. quadridentata*. **C.** Abaxial epidermis covered by prickles. **D.** Abaxial epidermis with detail view of prickles and short cells. **E.** Adaxial epidermis with pronounced ribs densely covered with prickles and wax. **F.** Adaxial epidermis with detail of wax and prickles. A & B, *Stančík 3221* (PRC); C–F, *Laegaard & Sklenář 20308* (PRC).

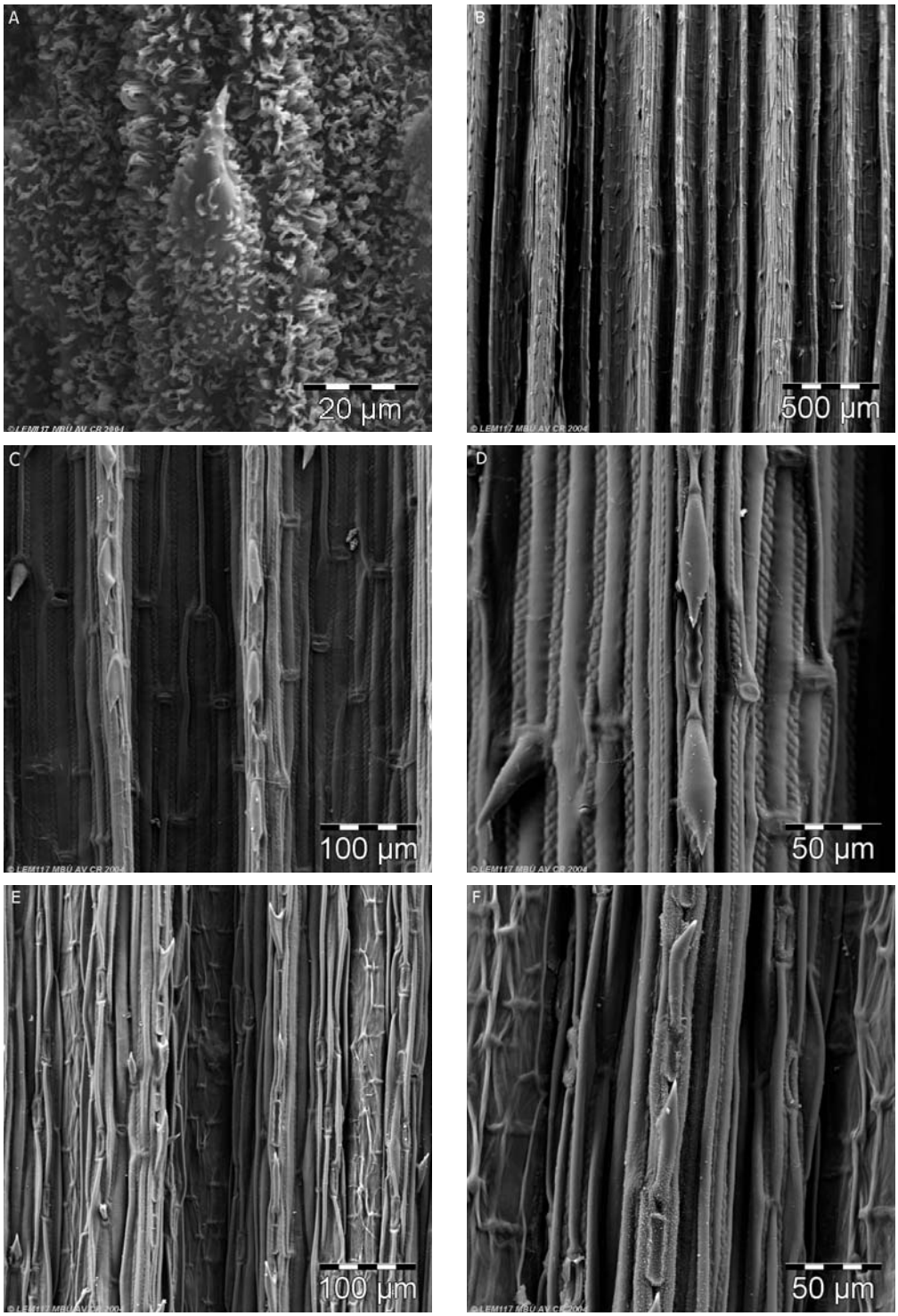


Figure 80. Leaf blade surfaces. **A.** *Festuca quadridentata*. Abaxial epidermis with detail view of wax. **B–F.** *F. venezuelana*. **B.** Abaxial epidermis with small ribs covered by prickles. **C.** Abaxial epidermis with detail view of silica bodies and prickles. **D.** Adaxial epidermis with small ribs with prickles, stomata and silica bodies. **E.** Adaxial epidermis. **F.** Adaxial epidermis with detail view of prickles, stomata and silica bodies. A, *Laegaard & Sklenář 20308* (PRC); B−F, *Stančík 4263*(PRC).

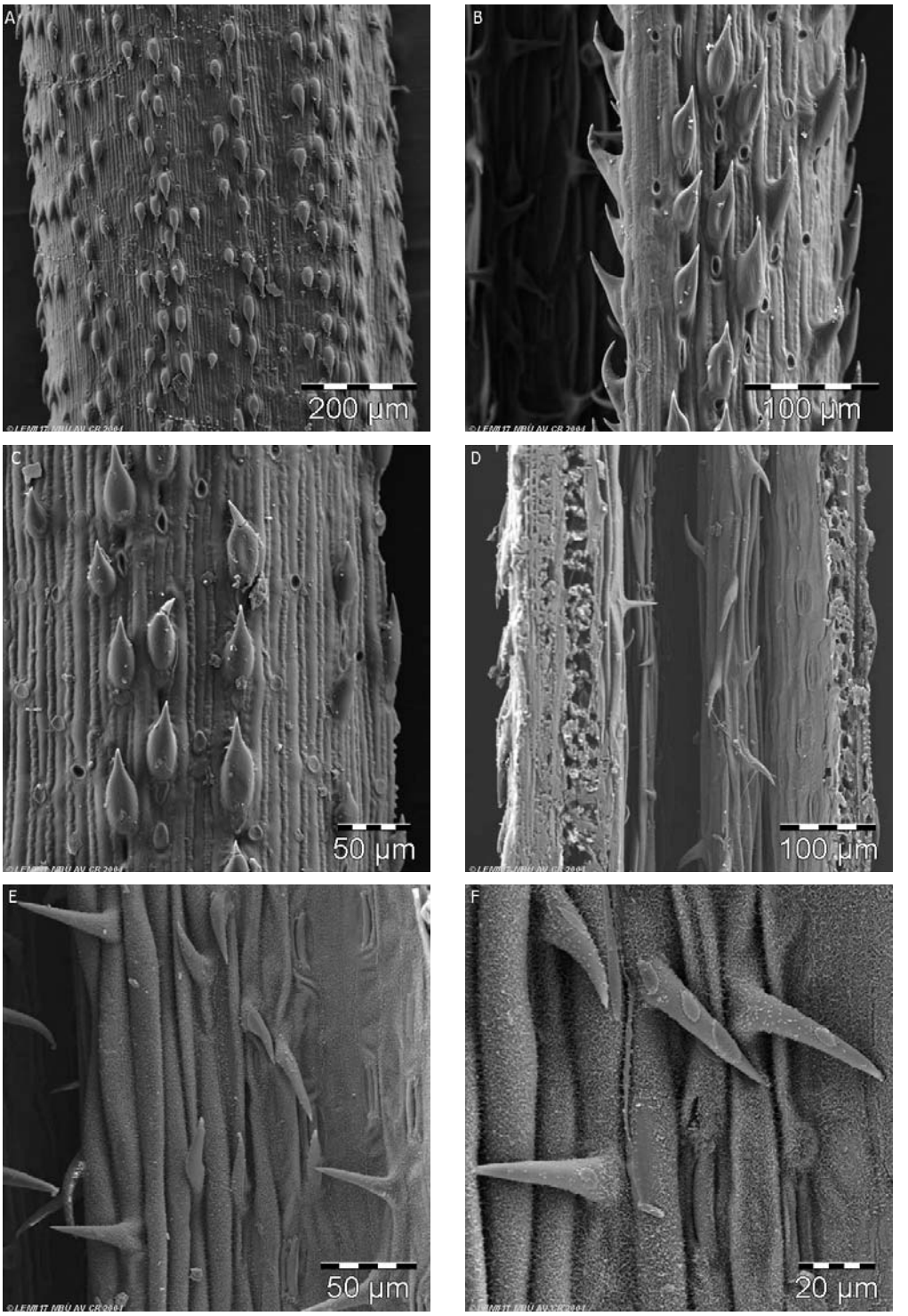


Figure 81. Leaf blade surfaces. **A–F.** *Festuca fragilis*. **A.** Abaxial epidermis densely covered with prickles and silica bodies. **B, C.** Abaxial epidermis with detail view of silica bodies and prickles. **D.** Adaxial epidermis with ribs and macro-hairs. Stomata on the bottom of ribs. **E.** Adaxial epidermis with detail view of macro-hairs and stomata. **F.** Adaxial epidermis with detail view of wax covering cell walls. A−C, *Wood 5259* (COL); D–F, *Stančík 4248* (PRC).

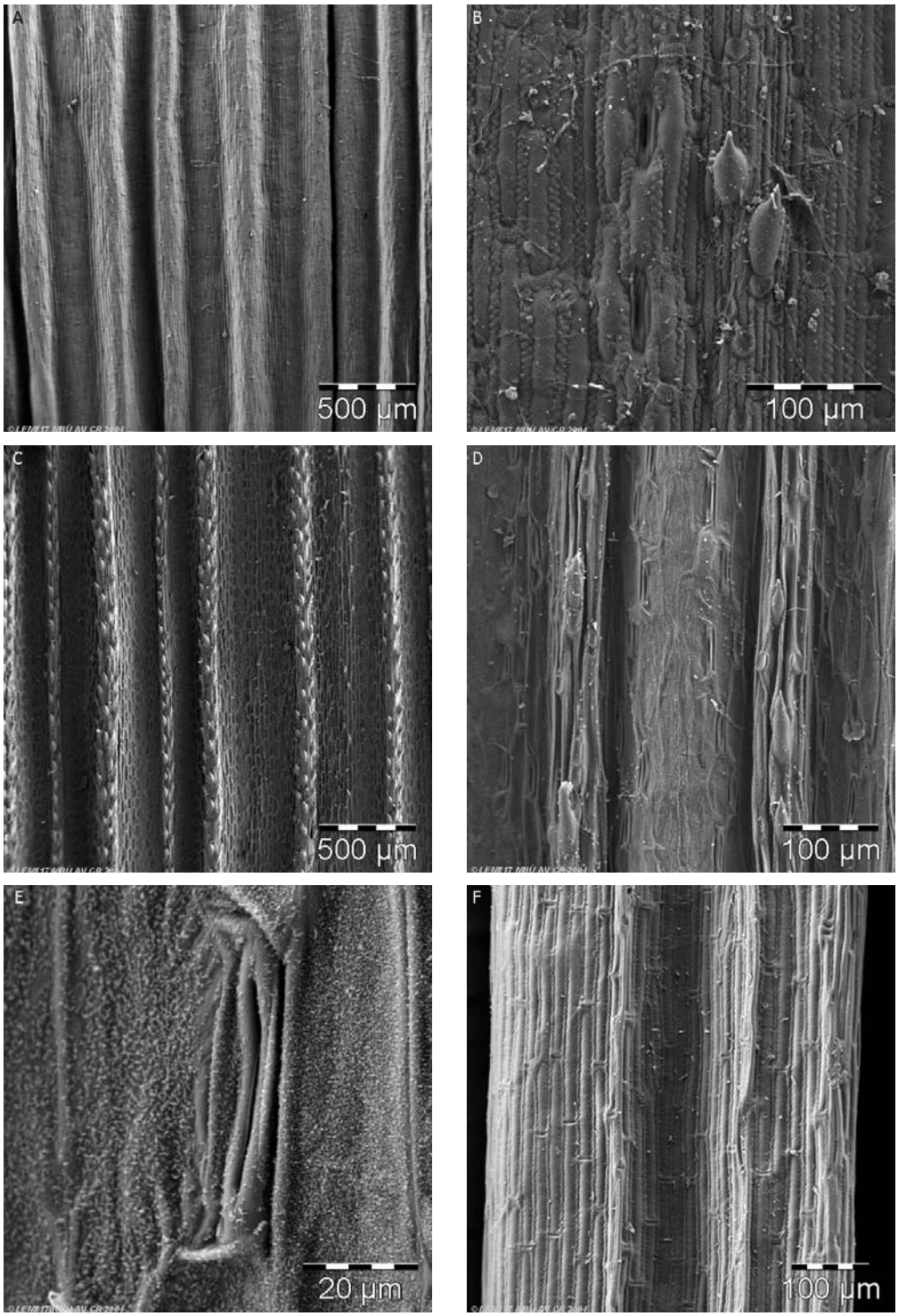


Figure 82. Leaf blade surfaces. **A–E.** *Festuca fimbriata*. **A.** Abaxial epidermis with ribs. **B.** Abaxial epidermis, detail view of silica bodies, prickles and stomata. **C.** Adaxial epidermis with pronounced ribs covered densely with prickles. **D.** Adaxial epidermis, detail view of ribs with prickles and silica bodies on the top of ribs, stomata between the ribs. **E.** Adaxial epidermis, detail view of stoma and wax on the cell walls. **F.** *F. rubra*. Abaxial epidermis with long and short cells. A−E, *Brade & Kuhlman 15631* (PRC); F, *Stančík 3457* (PRC).

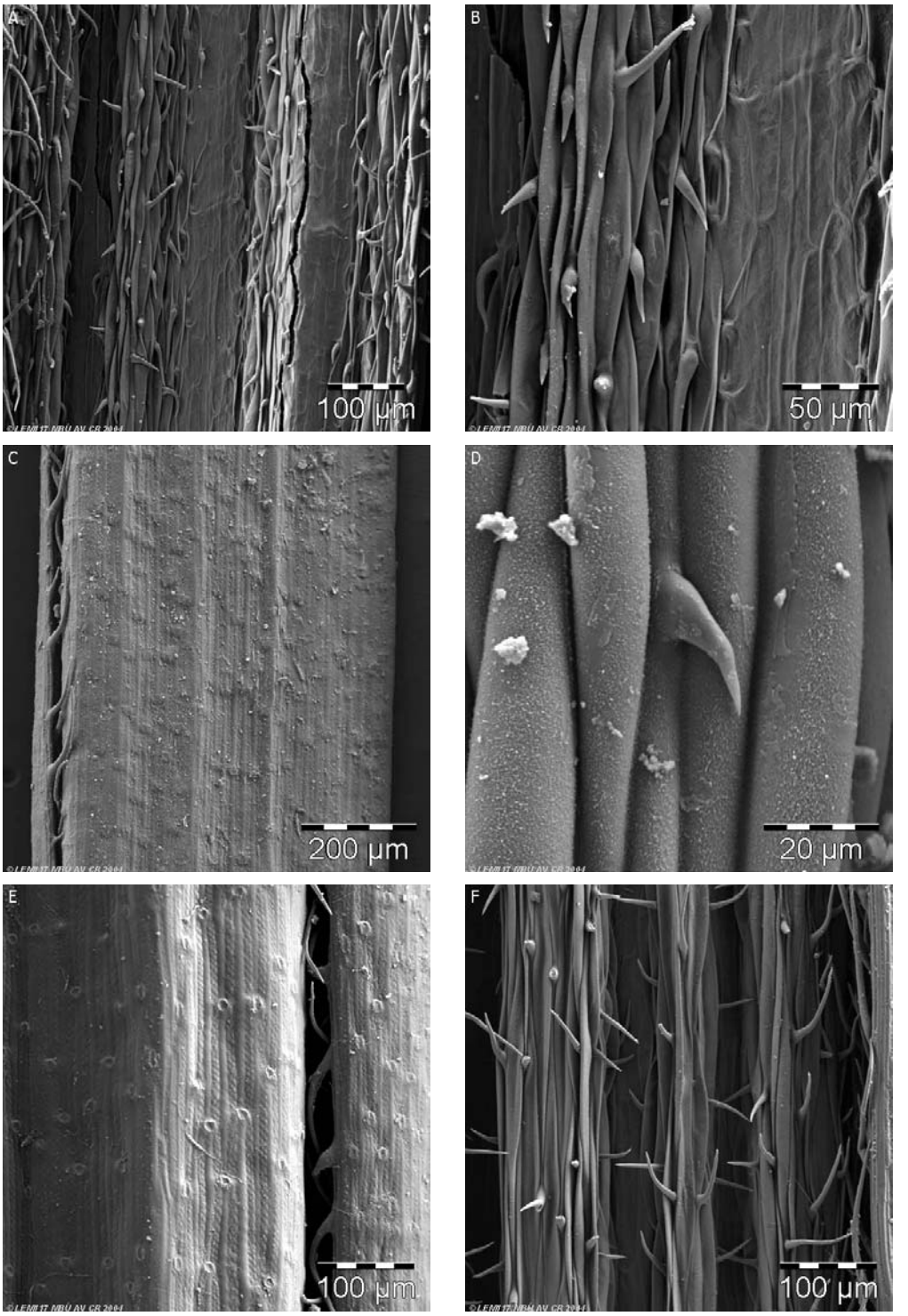


Figure 83. Leaf blade surfaces. **A & B.** *Festuca rubra*. **A.** Adaxial epidermis with ribs covered with macro-hairs. **B.** Adaxial epidermis, detail view of macro-hairs and stomata on the base of the ribs. **C & D.** *F. andicola.* **C.** Abaxial epidermis of the involute blade with macro-hairs on the margin. **D.** Adaxial epidermis, detail view of macro-hair and wax on the cell walls. **E & F.** *F. soukupii*. **E.** Abaxial epidermis of the involute blade with silica bodies and macro-hairs on the margin. **F.** Adaxial epidermis with macro-hairs on the ribs. A & B, *Stančík 3457* (PRC); C & D, Laegaard 52807 (AAU); E &F, *Stančík 3455* (PRC).

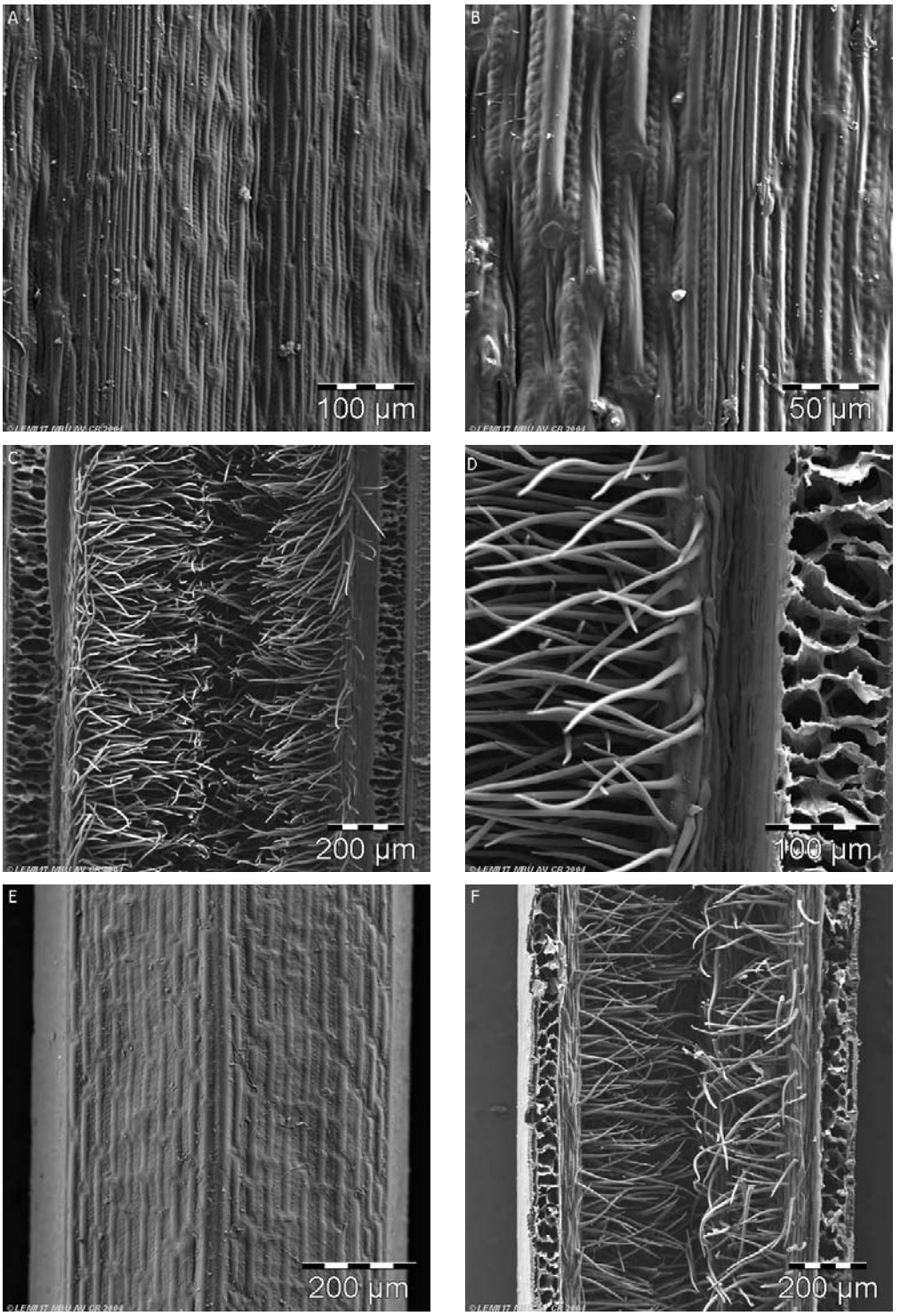


Figure 84. Leaf blade surfaces. **A–D.** *Festuca azucarica*. **A.** Abaxial epidermis with long and short cells. **B.** Abaxial epidermis, detail view of rounded silica bodies. **C.** Adaxial epidermis with ribs covered with long macro-hairs. **D.** Adaxial epidermis, detail view of stomata at the bottom of rib (middle part of this image). **E & F.** *F. colombiana*. **E.** Abaxial epidermis with long and short cells. **F.** Adaxial epidermis, macro-hairs on the lateral walls of the ribs. A−D, *Stančík 3405* (PRC); E & F, *Stančík 2561*(PRC).

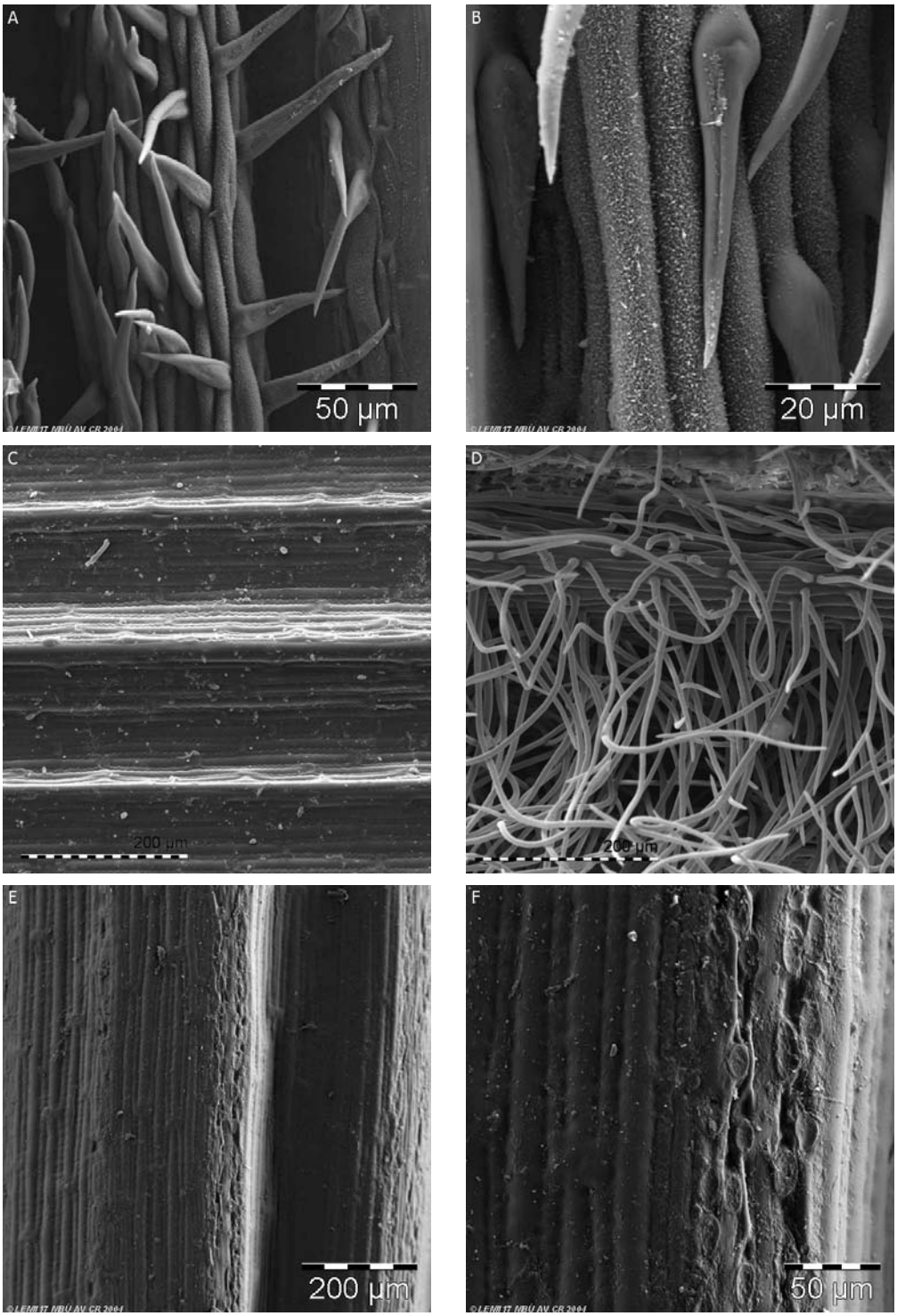


Figure 85. Leaf blade surfaces. **A & B.** *Festuca colombiana*. **A.** Adaxial epidermis, detail view of stomata and macro-hairs. **B.** Adaxial epidermis, detail view of wax. **C & D** *F. dasyantha.* **C.** Abaxial epidermis with small ribs, long and short cells. **D.** Adaxial epidermis with ribs covered with long macro-hairs. **E & F.** *F. hatico*. **E.** Abaxial epidermis with small ribs. **F.** Abaxial epidermis, detail view of silica bodies. A & B, *Stančík 1289* (PRC); C & D, *Laegaard 101260* (AAU); E & F, *Stančík 4289* (PRC).

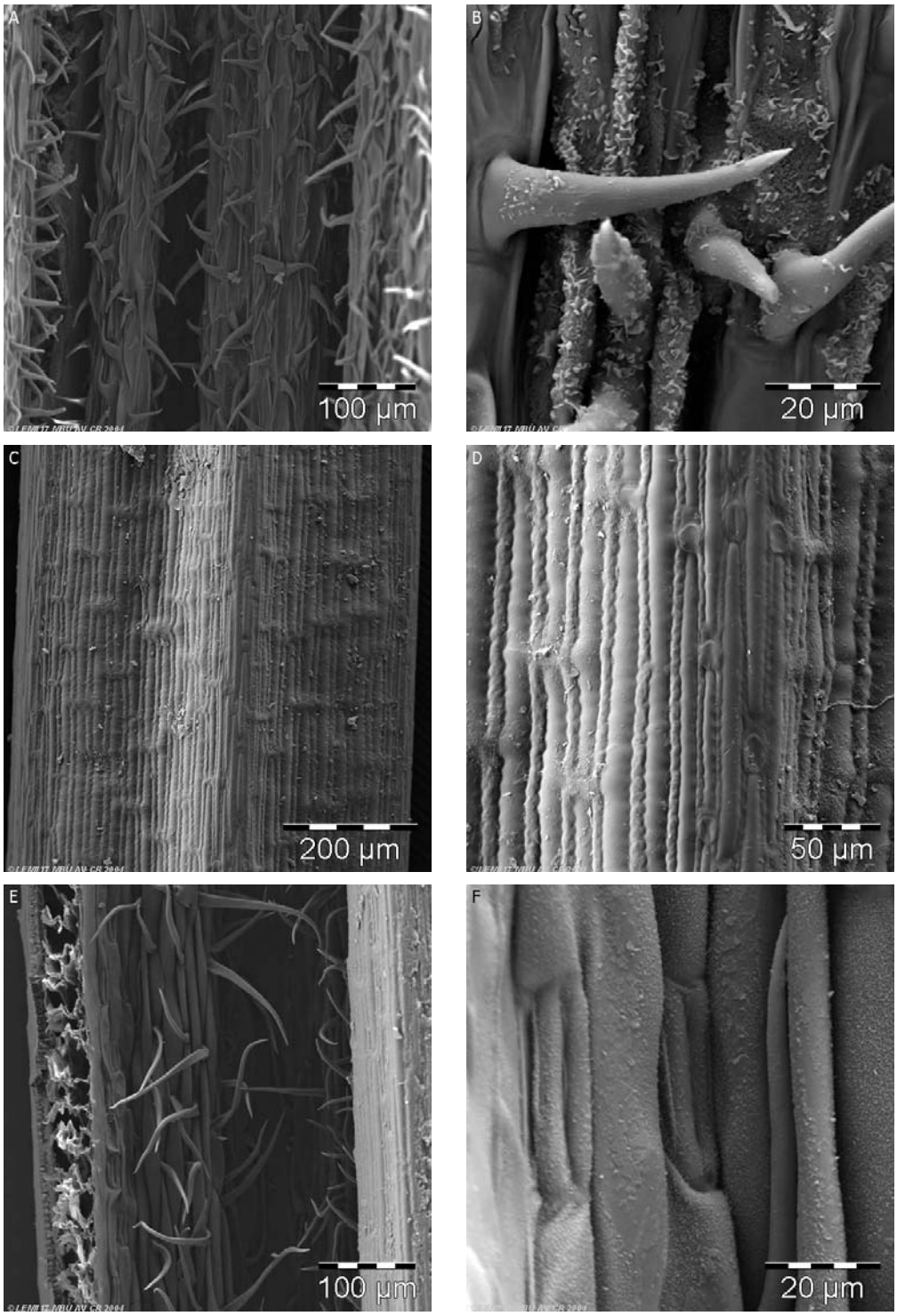
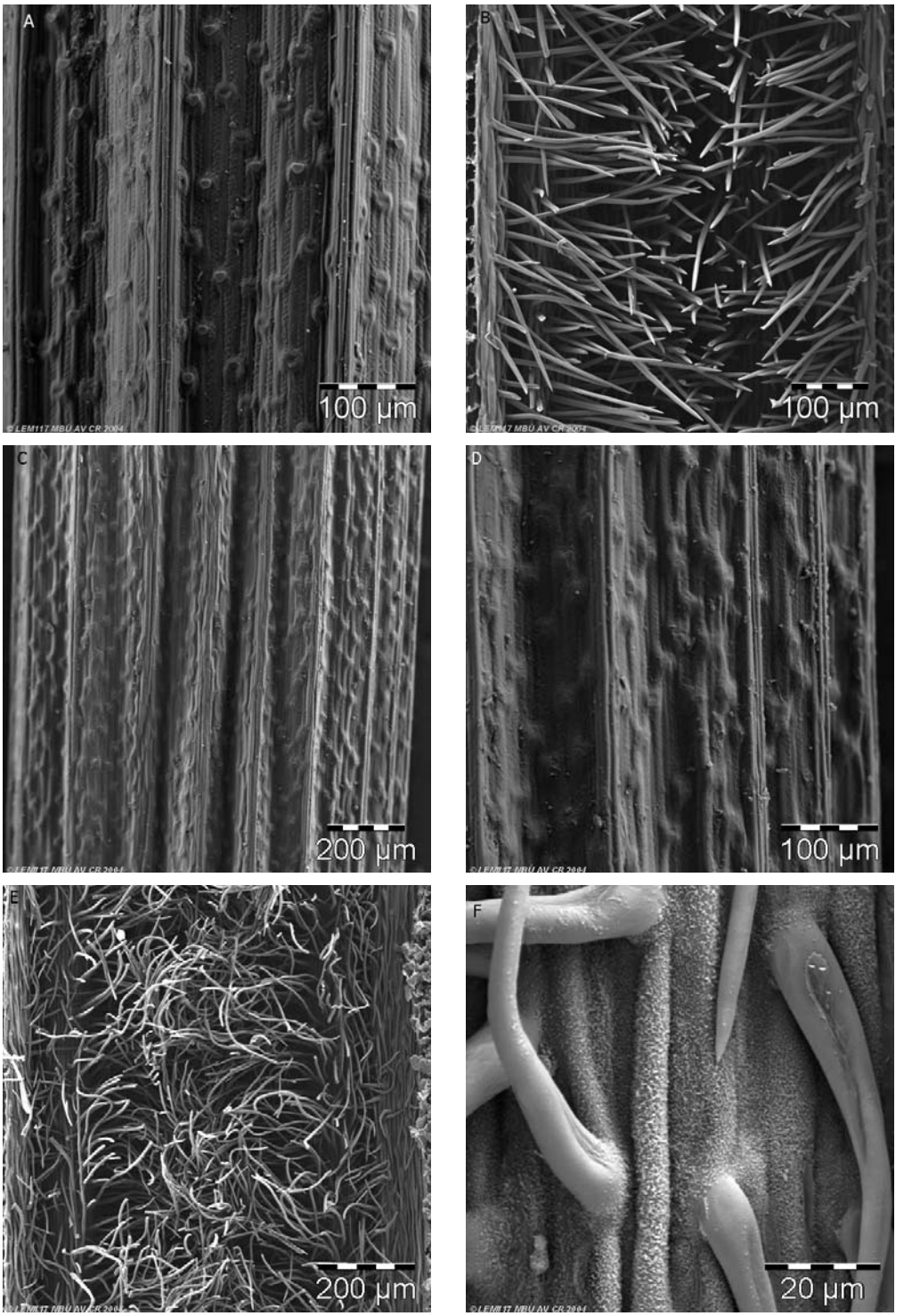


Figure 86. Leaf blade surfaces. **A & B.** *Festuca hatico*. **A.** Adaxial epidermis with ribs, densely covered with macro-hairs. **B.** Adaxial epidermis, detail view of macro-hairs and wax deposits. **C–F.** *F. laegaardii*. **C.** Abaxial epidermis with small ribs. **D.** Abaxial epidermis, detail view of long and short cells (primarily silica bodies). **E.** Adaxial epidermis with ribs covered with macro-hairs, stomata on the base of the ribs. **F.** Adaxial epidermis, detail view of stomata. A & B, *Stančík 4289* (PRC); C–F, *Stančík 3365* (PRC).



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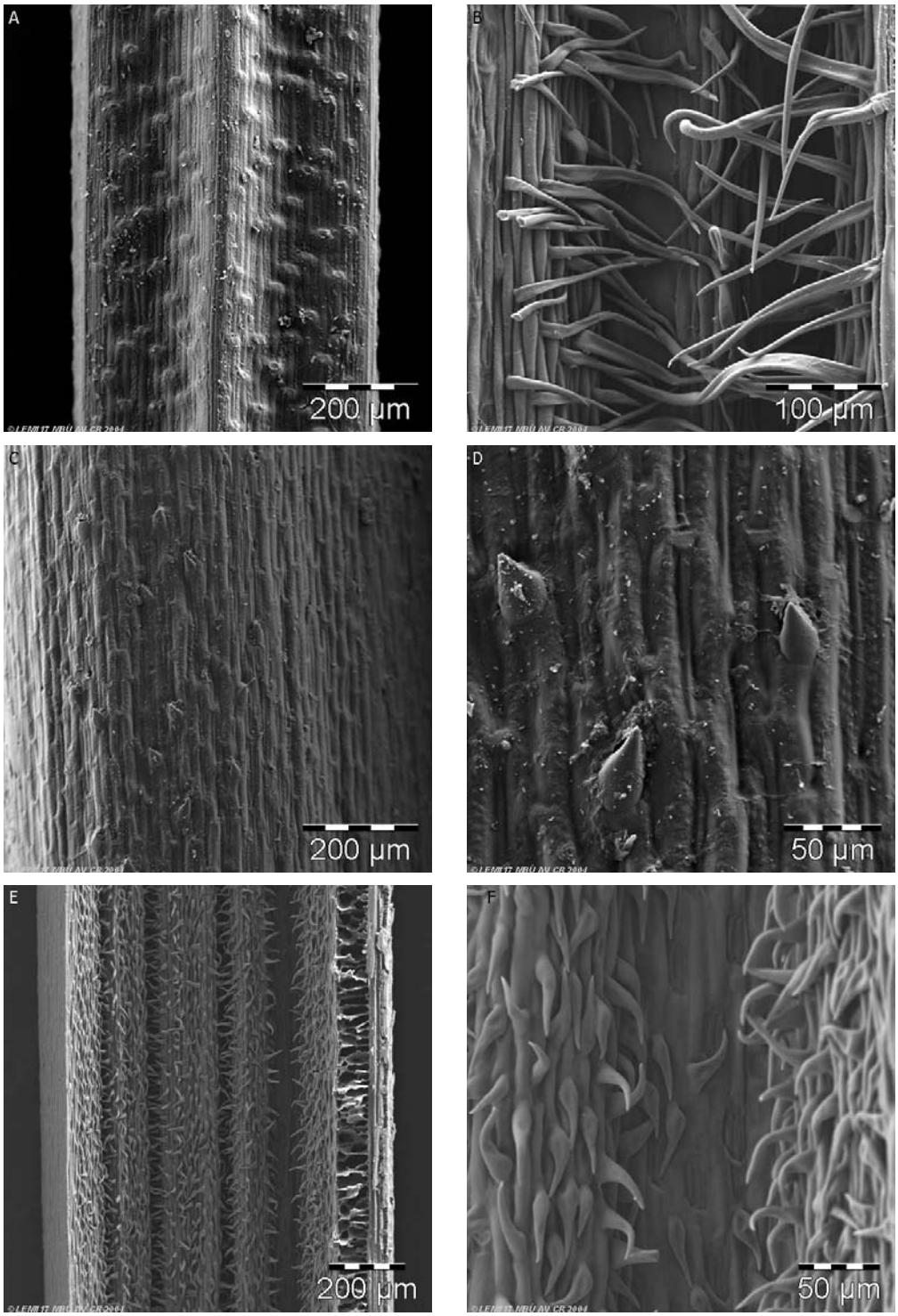

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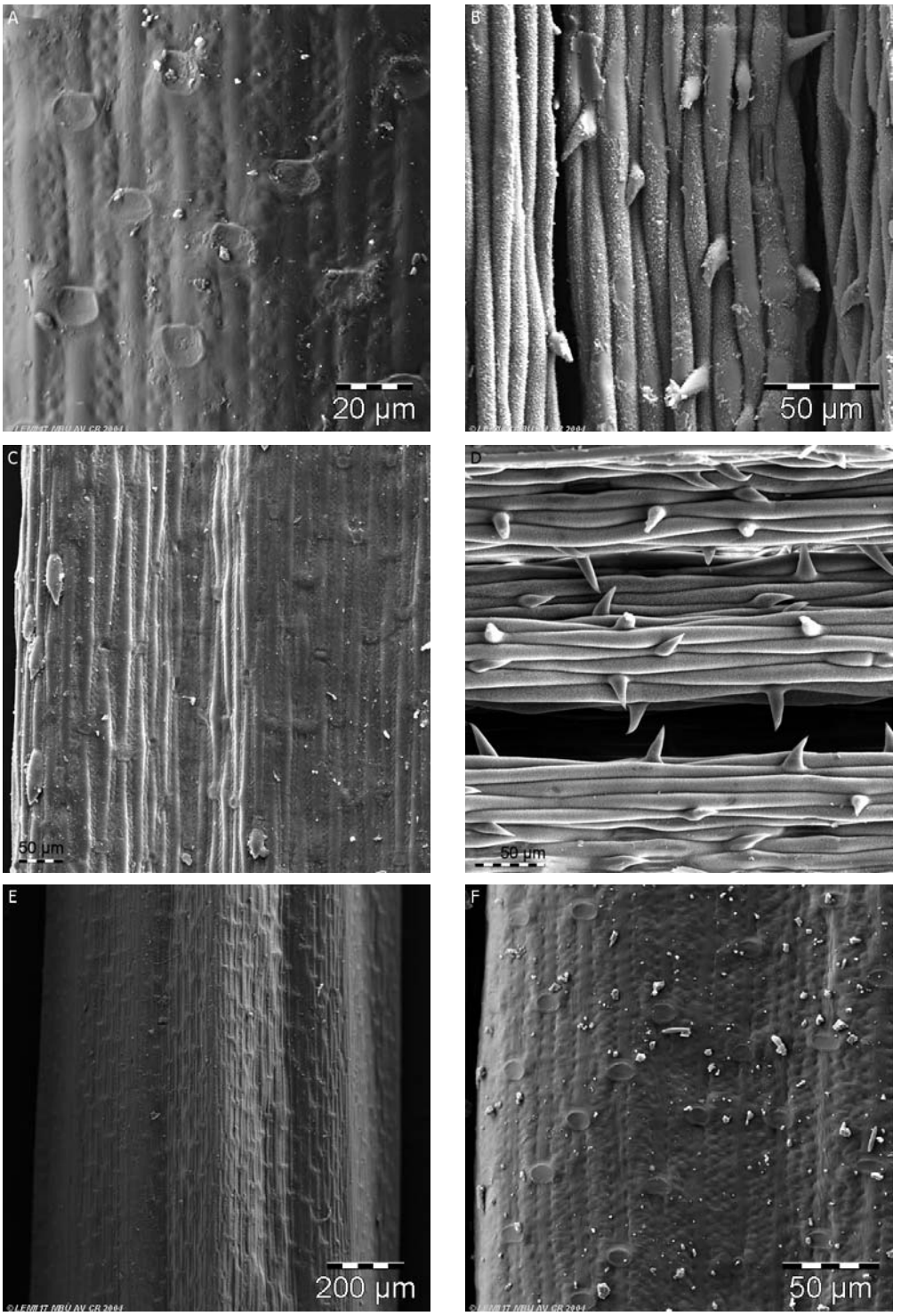

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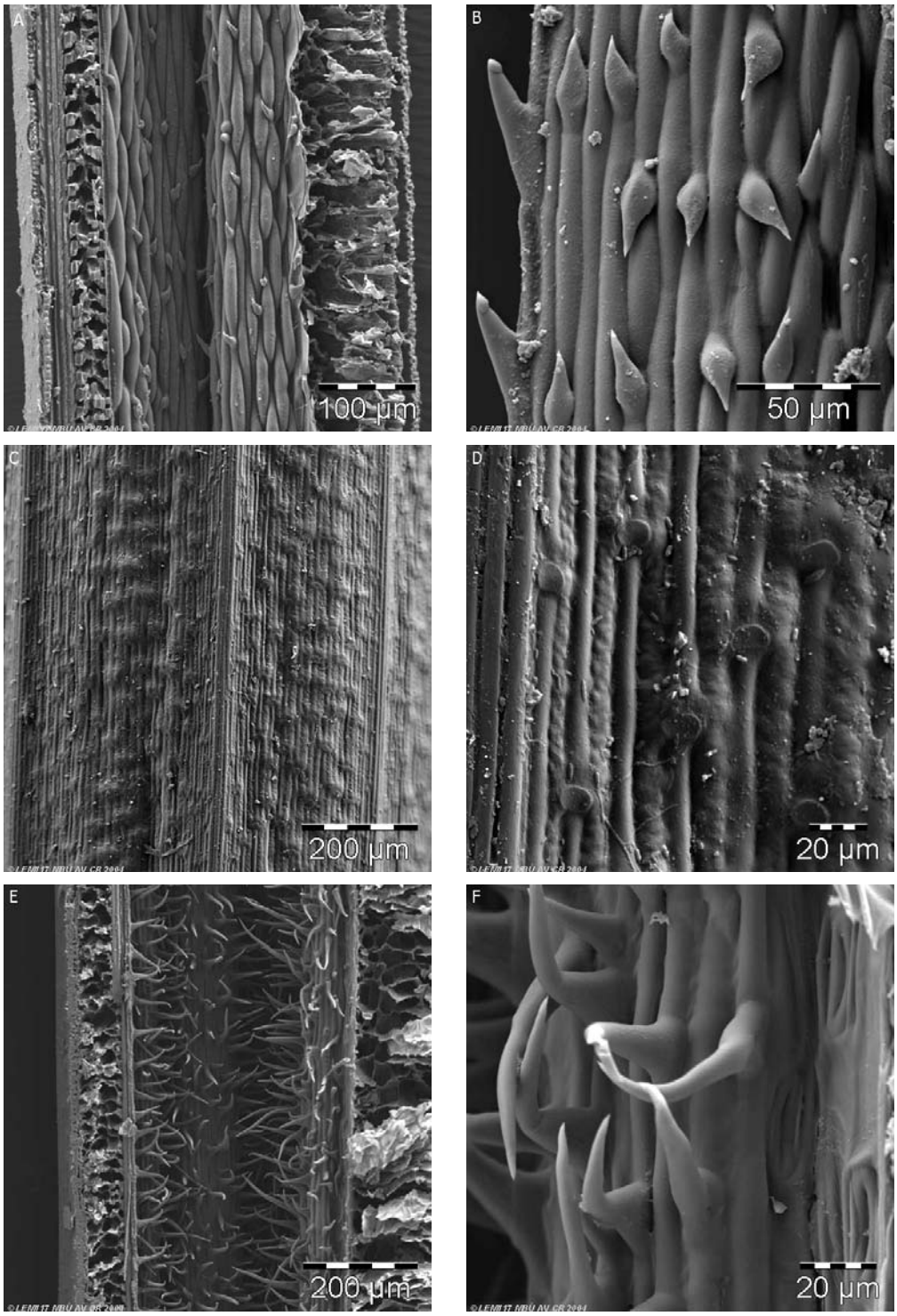

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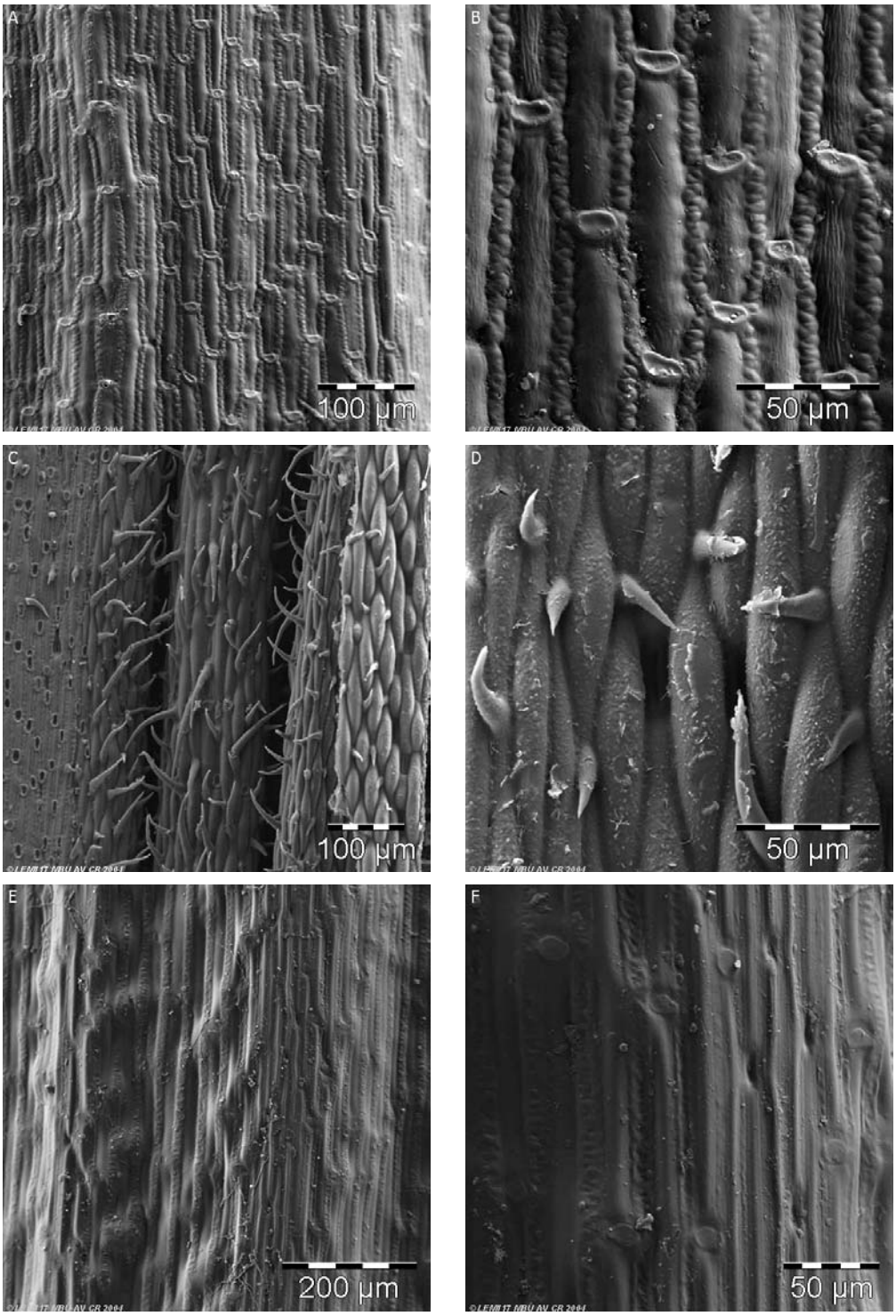

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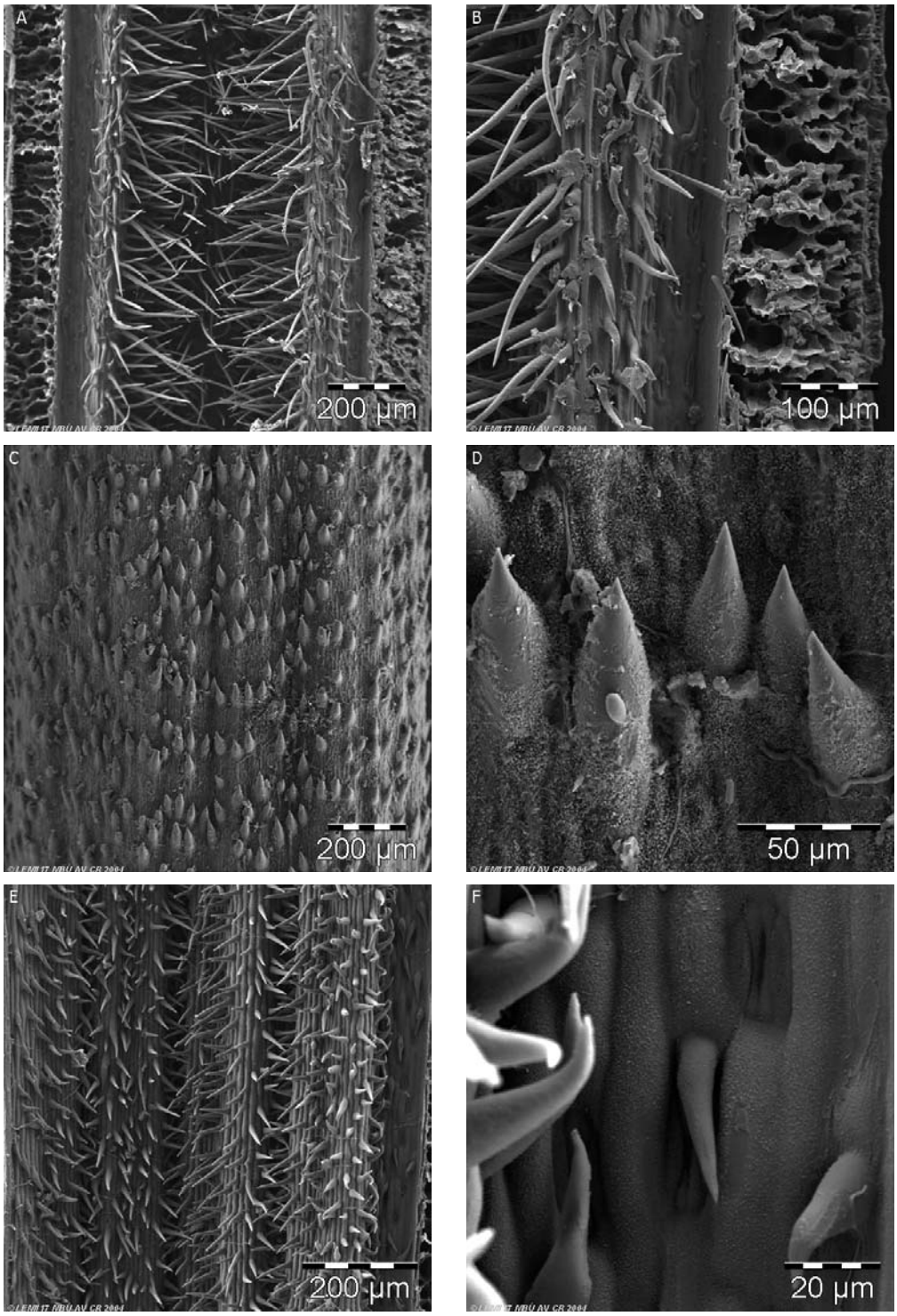

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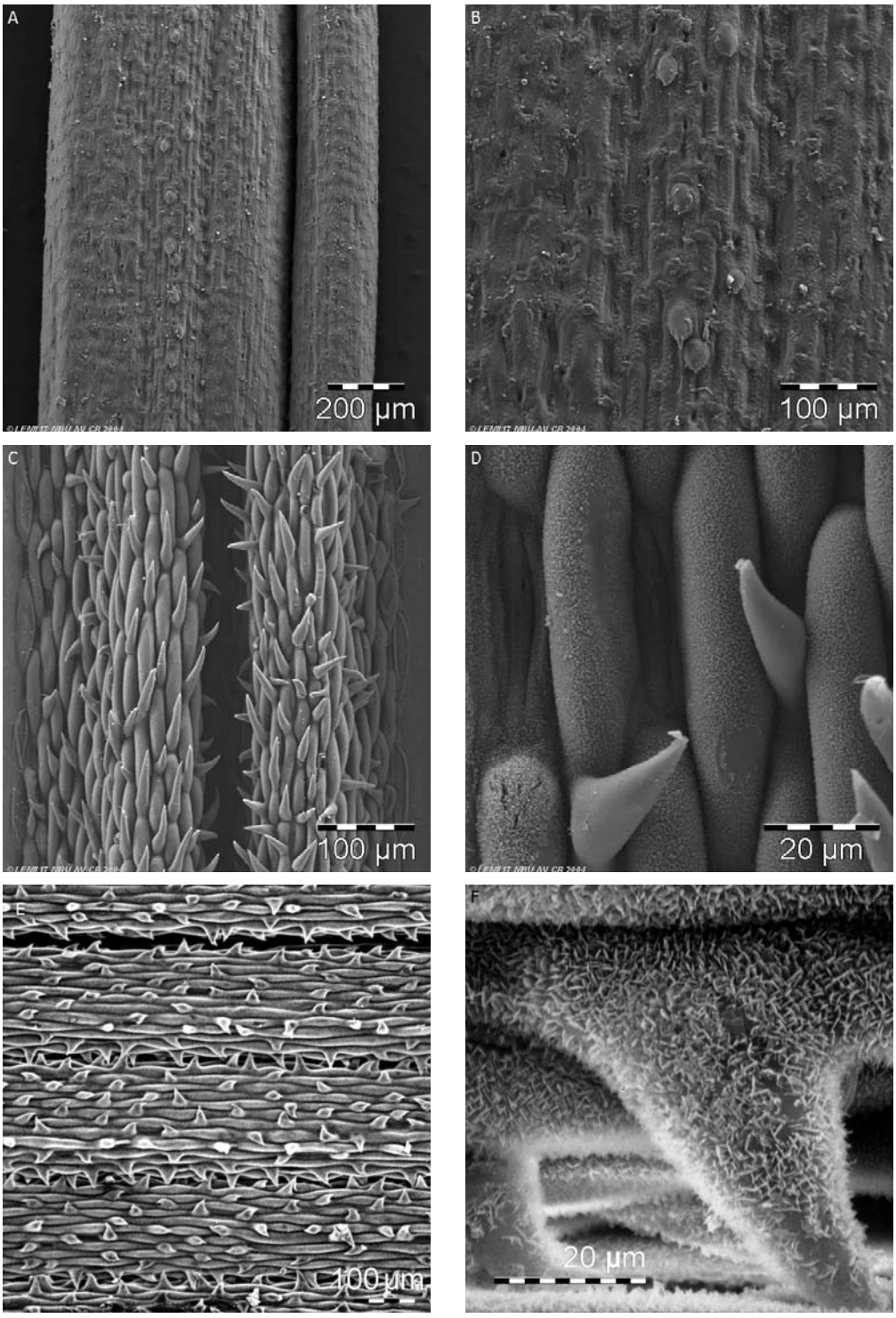

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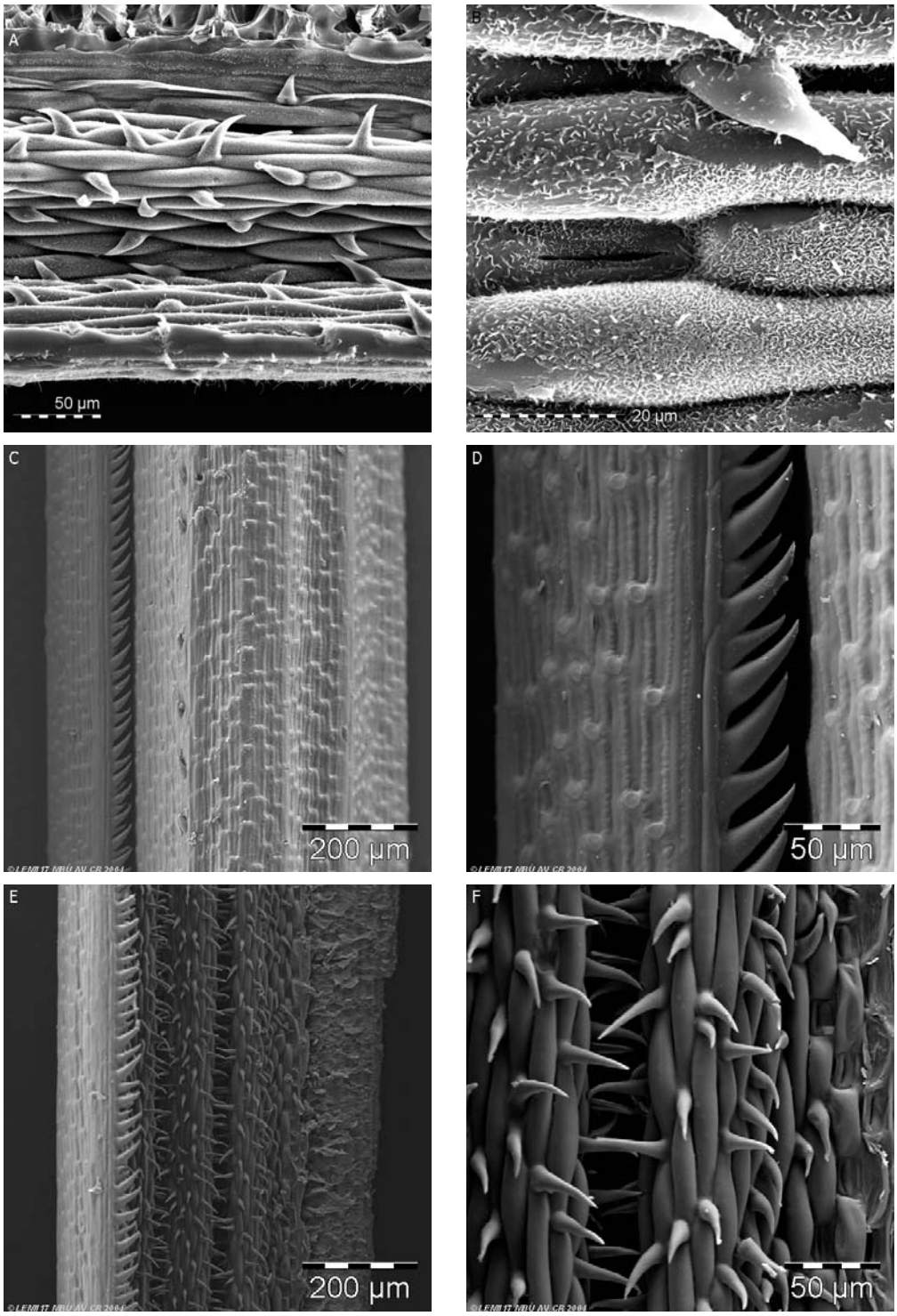

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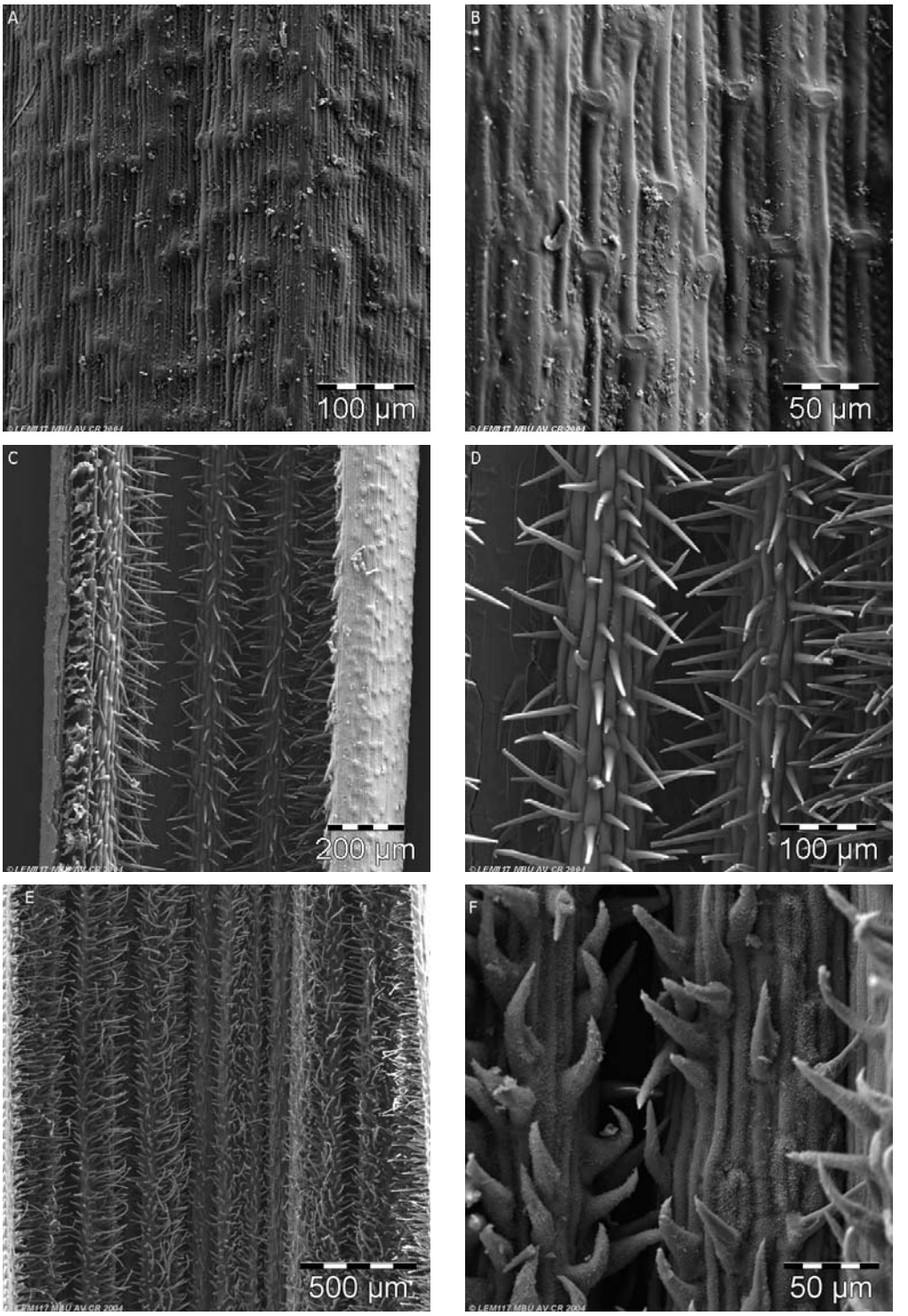

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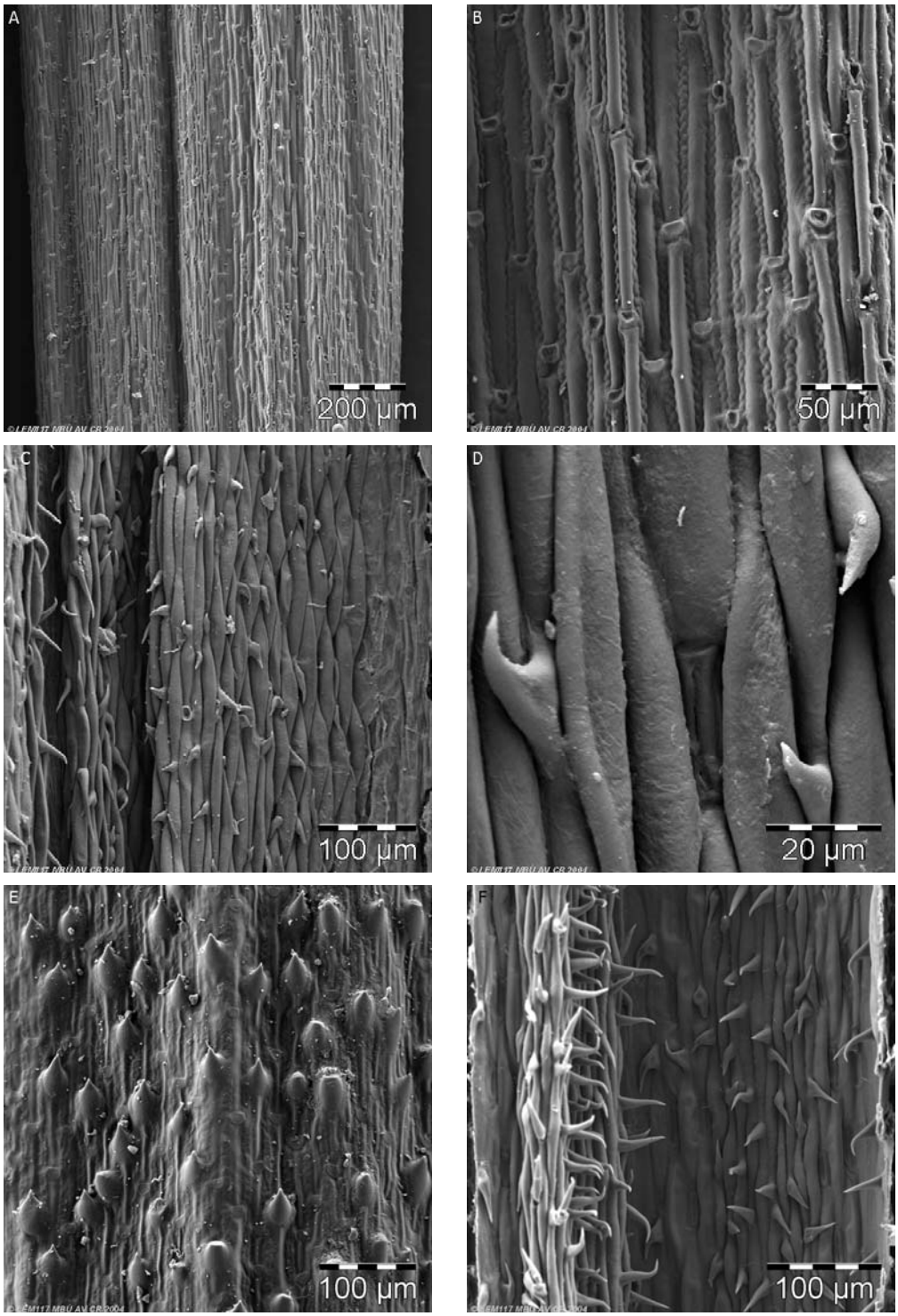

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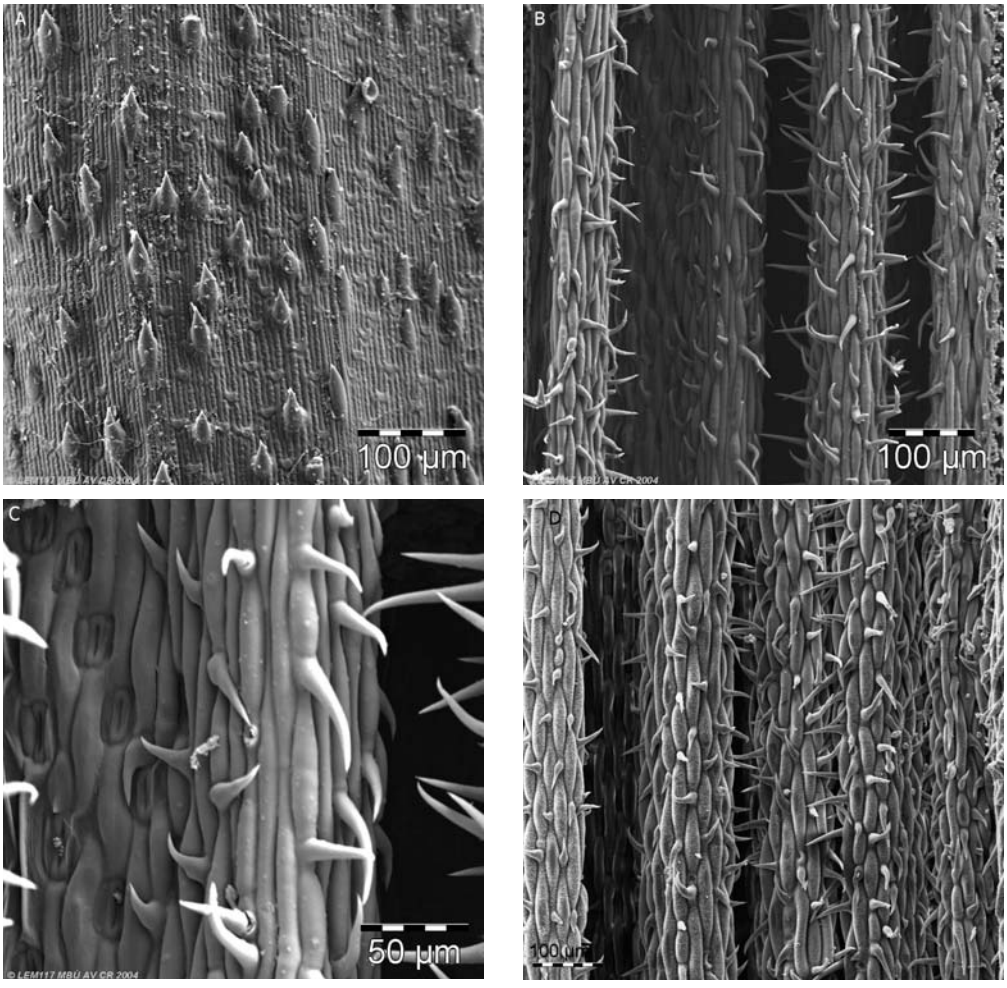

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