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A NEW RHIZOMATOUS SPECIES OF *FESTUCA* (POACEAE, POEAE) FROM NORTHWESTERN ARGENTINA

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Abstract. Müller, J. & P. Catalán. 2010. A new rhizomatous species of *Festuca* (Poaceae, Poeae) from northwestern Argentina. *Darwiniana* 48(1): 87-92.

Festuca yalaensis, a new rhizomatous, narrow-leaved *Festuca* from the province of Jujuy (NW Argentina) is described and illustrated. Its delimitation with respect to other *Festuca* species and its phylogenetic placement within the Loliinae clade are discussed.

Keywords. *Festuca*, NW Argentina, phylogeny, taxonomy.

Resumen. Müller, J. & P. Catalán. 2010. Una nueva especie rizomatosa de *Festuca* (Poaceae, Poeae) del noroeste de Argentina. *Darwiniana* 48(1): 87-92.

Se describe e ilustra *Festuca yalaensis*, una nueva *Festuca* rizomatosa de hojas finas procedente de la provincia de Jujuy (NO Argentina). Se discuten su delimitación con respecto a otras especies de *Festuca* y su posición filogenética en el clado de la subtribu Loliinae.

Palabras clave. *Festuca*, filogenia, Noroeste de Argentina, taxonomía.

INTRODUCCIÓN

According to Zuloaga et al. (1994) and Soreng et al. (2003), the flora of Argentina contains 50 species of *Festuca* L. Türpe (1969), in her treatment of the Argentinean fescues, separated two large groups of taxa, one included the the broad-leaved (leaf 4-15 mm width), rhizomatose to cespitose *Festuca*, and the second included the narrow-leaved (leaf <4 mm width), cespitose or rhizomatose *Festuca*. After the monographs of Parodi (1953), Türpe (1969), and Nicora (1979), on the *Festuca* of Argentina, and the contribution of Alexeev (1984a), on the South American fescues, some of the Argentinean *Festuca* belonging to the narrow-leaved group are still difficult to determinate (Catalán & Müller, unpubl. results). During a visit to the Lagunas de Yala, near San Salvador de Jujuy (Jujuy, Argentina), a remarkably stoloniferous-rhizomatous, fine-leaved fescue was discovered that cannot be attributed to any described species. In Argentina and adjacent countries (Chile: Matthei, 1982; Bolivia: Renvoize, 1998), only a few rhizomatous fine-leaved *Festuca* species have been recognized, which include the native *F. simpliciuscula* (Hack.) E. B. Alexeev and the introduced *F. rubra* L. s.l., both hitherto not found north of the province of Mendoza (W Argentina). From both, the species from Yala can be easily distinguished by innovation leaves with trabeculate sclerenchyma girders. We thus describe it here as a new species.

MATERIAL AND METHODS

Morphological and anatomical analysis

Micromorphological characters were studied

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using a Zeiss Stemi 2000 stereo microscope and an Olympus CH 40 optical microscope.

DNA sequence analysis

We analyzed the plastid *trn*TL (Genbank GQ849281) and *trn*LF (Genbank GQ849280) sequences and the nuclear ITS (Genbank GQ849279) sequence of the new species from the type locality. These sequences were pooled with our previous data of world representatives of *Festuca* and other close Loliinae and Poeae taxa (Catalán, 2006; Inda et al., 2008), including a large sampling of American *Festuca*, for the reconstruction of the evolutionary relationships of the new species and its close relatives. A heuristic parsimony (10,000 random entry trees, TBR, mulpars off, saving no more than 10 trees of length <10 per replicate; 1000 bootstrap replicates with the same parameters as in the original search) search was conducted with the combined *trn*TF/ITS data set.

RESULTS AND DISCUSSION

Festuca yalaensis Joch. Müll. & Catalán, sp. nov. TYPE: Argentina. Jujuy, Dept. Belgrano, Lagunas de Yala, small valley W of Laguna Rodeo, 24°6'S 65°29'W, c. 2200 m, 24-XI-2008, *Müller & Catalán 10522* (holotype JE; isotypes LPB, M, MCNS, RB, SI, W). Fig. 1.

A aliis speciebus generis habito rhizomatoso-stolonifero, foliis innovationibus planis vel conduplicatis, 0.8-2 mm latis, cum fasciculis sclerenchymaticis cum epidermidibus adaxiali abaxialique conjunctis et ovariis pilosis differt.

Perennial herbs, 50-120 cm tall, rhizomatous, stoloniferous. Innovation extravaginal. Culms green, in the basal third 0.7-1.5 mm thick, smooth, with (3)4-5 nodes; ligule of culm leaves a fimbriate rim 0.2-0.6 mm long; lamina flat, 9-10.5 cm long, 1-2.5 mm wide; lamina of the uppermost culm leaf 6-15 cm long, much shorter to slightly longer than its sheath; lower culm leaves with lamina shorter than that of the uppermost leaf, lamina longer than its sheath. Sheaths of innovation leaves open to near base, membranaceous, pale green, brown at base, abaxially antrorsely scabrous between the veins, adaxially glabrous, with long cells with straight undulate walls. Ligules membranous, truncate, 0.3-0.5 mm long, erose, with dense fimbriae 60-120 µm long, lacking auricles. Laminae erect, rather flaccid, lineal to filiform in shape, flat to involute or to conduplicate, 15-40 cm long, 0.8-2 mm wide, abaxially scabrous in the distal 1/5-1/3, adaxially with an indument of lax short hairs. Abaxial leaf epidermis with frequent short cells usually longer than wide and short cell couples, but few silica-suberous couples between successive long cells. Panicles 8-17 cm long, 1-2.5 cm wide, lax, erect, with 4-7 lateral branches with simple to multiple basal branching, basalmost branch about 1/2 as long as the panicle, with 2-3 basal branches, panicles with 30-80 spikelets; panicle branches scabrous, rachis scabrous at least in the distal 1/4, peduncles scabrous or glabrous, 1-5 mm long. Spikelets lanceolate, (5)6-9.5(11.5) mm long (7.2-8.5 mm to tip of fourth lemma), (2)3-5(7)-flowered; rachilla sparsely scabrous except on the palea side, the prickles often accompanied by short cells. Glumes green with narrow scarious margins, abaxially smooth except for distalmost portions of midrib and edges; lower glume lanceolate, 1veined, (1.8)2.8-3.8 mm long, upper glume lanceolate, 3veined, (3)3.8-4.8 mm long, 1.2-1.8 times as long as the lower. Lemmas herbaceous, green, 5veined, basal lemmas 4.5-6.3 mm long, lemmas muticous or more rarely with an apical awn to 0.8 mm long, abaxial side distally scabrous on the veins and on the awn; callus rounded, adaxially and marginally with short hairs. Paleae about equalling lemma; apex shortly bifid; dorsal side short-hairy in the apical fourth, keels short-hairy in the apical half; edges ciliate in the upper half. Lodicules shortly bifid, glabrous. Anthers 3, 2.2-3 mm long; pollen grains 33-42 µm in diameter. Ovaries apically with few to scattered hairs; mature caryopsis unknown.

Distribution and habitat. *Festuca yalaensis* is hitherto known only from the type collection made in humid grassland [with *Festuca nemoralis* Türpe and *F. parodiana* (St.-Yves) Nicora] on a siliceous steep grassy slope above a creek near the Laguna de Yala.

Etymology. The specific epithet name derives from the Lagunas de Yala locality in NW Argentina.

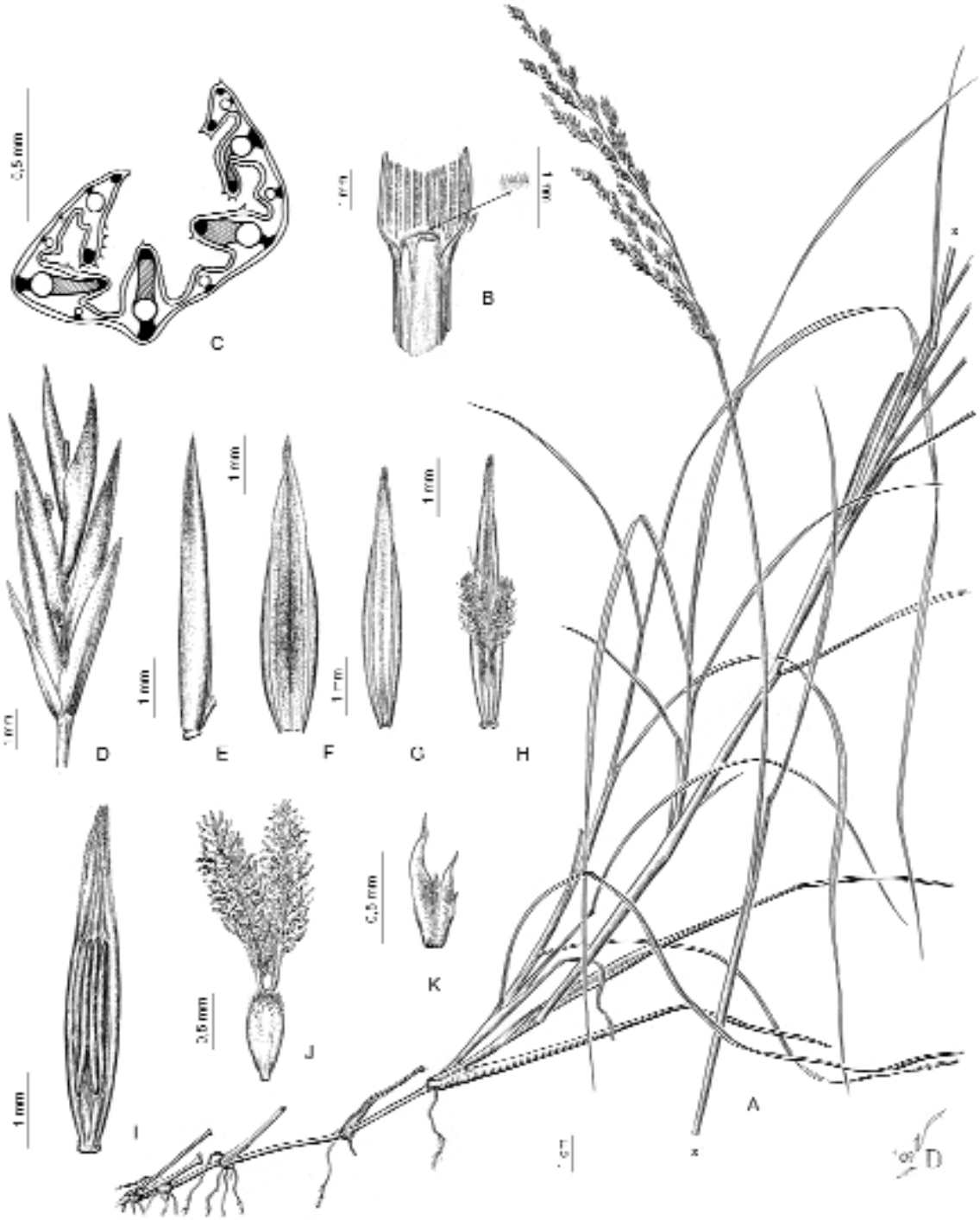

Fig. 1. Illustration of *Festuca yalaensis*. **A,** habit. **B,** sheath, ligule, and blade. **C,** innovation leaf-blade cross section (sclerenchyma strands are indicated in black and grey). **D,** spikelet. **E,** floret with rachilla. **F,** lemma, dorsal view. **G,** palea, dorsal view. **H,** palea with gynoecium, ventral view. **I,** palea with stamens, ventral view. **J,** gynoecium. **K,** lodicule. From holotype and isotype SI.

Leaf anatomy

The plant shows adaxial leaf epidermis with a marginal row of dense stout, short hairs (with undulate walls), submarginal rows with scattered short hairs and short cells between successive long cells with undulate walls, ribs with frequent short hairs and scattered short cells between successive long cells with undulate walls. The short cells are otherwise lacking on the adaxial side; the guard cells of leaf stomata are 45-60 µm. Leaves are flat to U-shaped in cross section, with 9-13 veins, 5-6 prominent, acute, 4-7 weak ribs, 4-5 deep and 8-11 shallow furrows, the 3 primary veins are connected by sclerenchyma girders with the abaxial and adaxial epidermis, some weaker and submarginal veins are connected to the abaxial epidermis, and some ribs with subepidermal abaxial and/or adaxial sclerenchyma strands but not to the veins. Additional free sclerenchyma strands along the leaf edges are present or not. Bulliform cells in the furrows are present or not in the adaxial epidermis of flat and conduplicate leaves.

Taxonomy and Phylogeny

Festuca yalaensis can be easily distinguished from other rhizomatous South American fescues by its much narrower leaves (up to 2.5 mm wide vs. at least 4 mm wide), with the exception of the fine-leaved *F. simpliciuscula* and the introduced *F. rubra* s.l. *Festuca yalaensis* differs from *F. simpliciuscula* in its taller habit (at least 50 cm vs. up to 30 cm) and complete sclerenchyma girders (vs. sclerenchyma in isolated abaxial strands) and from *F. rubra* in its complete sclerenchyma girders (vs. sclerenchyma in isolated abaxial strands), open (vs. closed) leaf-sheath, truncate with erose margin (vs. almost absent with smooth margin) ligule, and hairy (vs. glabrous) ovary tip.

Festuca yalaensis fell within the well supported fine-leaved Loliinae clade (87% bootstrap support, BS) and was nested within the strongly supported American II clade (97% BS) (Fig. 2). This South American geographically-circumscribed lineage included representatives of different infrageneric *Festuca* ranks and other Loliinae (*Hellerochloa*) and Poeae s.l. (*Dielsiochloa*) genera. The evolutionary placement of *Festuca yalaensis* within an American clade of *Festuca* taxa and close congeners was supported by the two independent plastid and ITS data sets. The plastid tree showed a topology similar to that of the combined tree with moderate support for the American II clade (74% BS, results not shown) whereas the ITS tree recovered an American II + American I clade but with low support (58% BS; results not shown). *Festuca yalaensis* was sister to a clade of southern South American *F. nardifolia*/*F. orthophylla* taxa (Fig. 2) in 71% of the 4167 most parsimonious combined trees; however this relationship was poorly supported (BS < 50%).

Taxonomic confusion regarding the infrageneric delimitations of the group of complex broad-to-fine-leaved South American *Festuca* precluded a confident supraspecific classification of *Festuca yalaensis*. Several South American *Festuca* taxa that show narrow flat to conduplicate innovation leaf-blades with complete sclerenchyma strands in the main veins have been predominantly aligned under *Festuca* subg. Festuca. These have been attributed to either *Festuca* sect. Festuca, *F.* sect. Aulaxyper Dumort. or *F.* sect. Cataphyllophorae E. B. Alexeev, depending on the cespitose vs. rhizomatous habit or the possession of cataphylls, respectively (cf. Alexeev, 1984b; Stančík, 2003). However, the characters considered in the description of taxa attributed to the two first sectional ranks do no agree with those employed in the classification of the European *Festuca* (cf. Hackel, 1882).

The phylogenetic analysis did not help to resolve the systematics of this group. Our results, in agreement with those of Catalán (2006) and Inda et al. (2008), introduced more ambiguity after the recovery of a strongly supported American II clade that included not only representatives of *Festuca* subgen. Festuca s. l. (*F. andicola* Kunth, *F. longivaginata* Tovar, *F. nardifolia* Griseb., *F. orthophylla* Pilg., *F. yalaensis*) but also of the broad-leaved *F.* subgen. Subulatae (Tzvelev) E. B. Alexeev (*F. cochabambana* E. B. Alexeev, *F. cuzcoensis* Stancík & P. M. Peterson, *F. parodiana*) and of the close genera *Hellerochloa* Fourn. (*H. fragilis* (Luces) Rauschert) and *Dielsiochloa* Pilg. (*D. floribunda* Pilg.). Our data further support the views of Inda et al. (2008) in that the unexpected placement of broad-leaved American *Festuca* species within a clade of apparently fine-leaved American *Festuca* species might have resulted from a past

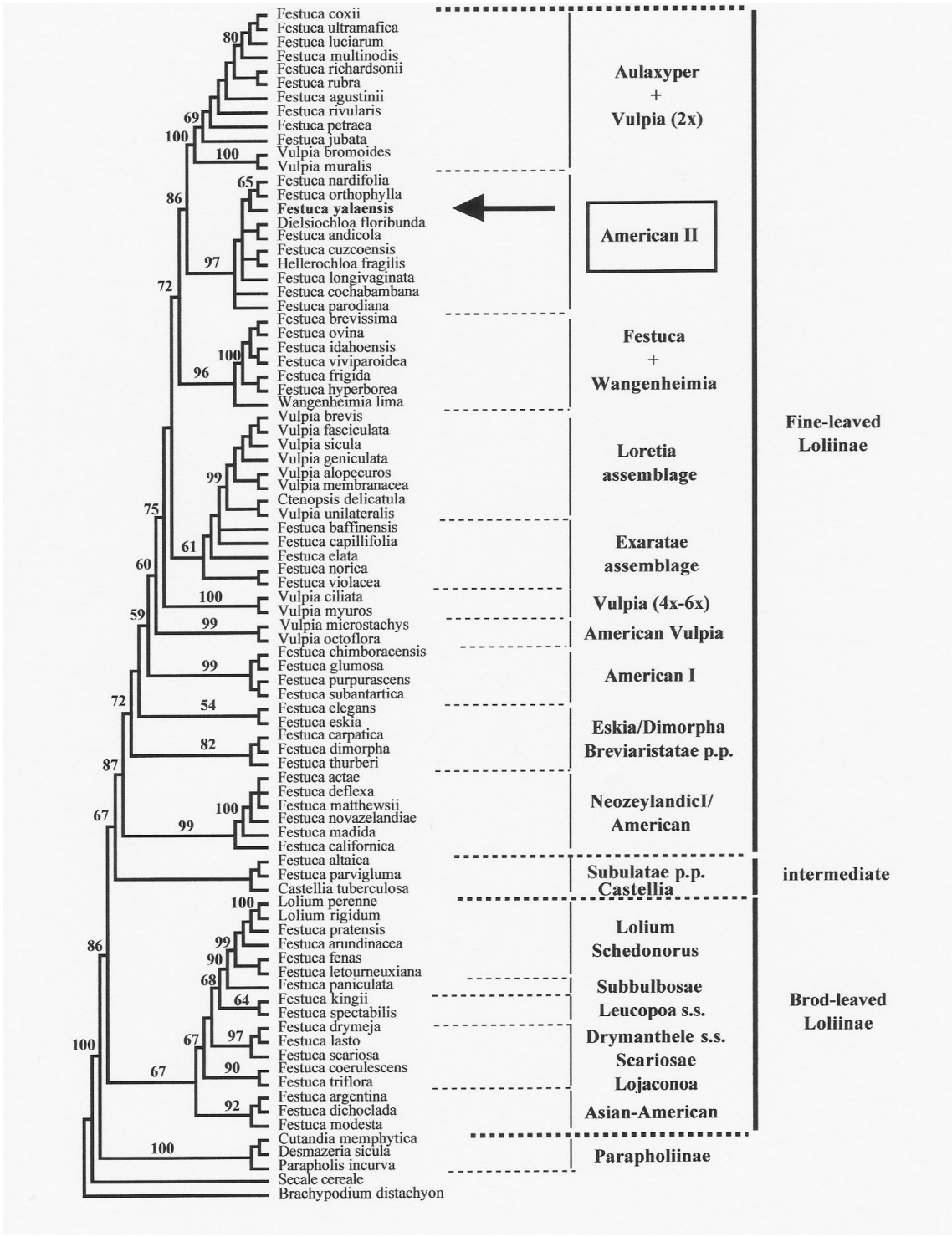

Fig. 2. 50% Majority Rule consensus tree of 4167 most parsimonious Loliinae trees (tree length 1957; consistency index excluding uninformative characters 0.463; retention index 0.765) based on combined *trn*TF/ITS data showing the phylogenetic placement of *Festuca yalaensis*. Bootstrap support values ≥ 50% are indicated above branches.

history of colonization, hybridization and geographical radiation involved in the origin of the polyploid American clades I and II rather than from systematic misattributions. Despite of this, the taxonomy of the narrow-leaved trabeculate South American *Festuca* is still in need of further evolutionary and systematic study.

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