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NEW COMBINATIONS, NEW NAMES, TYPIFICATIONS, AND A NEW SECTION, SECT. *HISPANICA*, IN *KOELERIA* (POEAE, POACEAE)

PATRICIA BARBERÁ
Department of Africa and Madagascar
Missouri Botanical Garden
St. Louis, Missouri 63110-2291
pbarbera@mobot.org

ALEJANDRO QUINTANAR
Department of Biodiversity and Conservation
Real Jardín Botánico
Consejo Superior de Investigaciones Científicas
28014 Madrid, Spain
quintanar@rjb.csic.es

PAUL M. PETERSON, ROBERT J. SORENG, AND KONSTANTIN ROMASCHENKO
Department of Botany
National Museum of Natural History
Smithsonian Institution
Washington, DC 20013-7012
peterson@si.edu; sorengr@si.edu; romashchenkok@si.edu

CARLOS AEDO
Department of Biodiversity and Conservation
Real Jardín Botánico
Consejo Superior de Investigaciones Científicas
28014 Madrid, Spain
aedo@rjb.csic.es

ABSTRACT

Based on morphological and molecular evidence we transfer the species of *Trisetum* sect. *Trisetaera*, *T. hispidum*, and *Trisetokoeleria taymirica* into *Koeleria*, describe *Koeleria* sect. *Hispanica*, and provide a new generic emendation. A total of 49 new combinations or new names are included. Additionally, we lectotypify *Avena clarkei* Hook f., *Avena micans* Hook. f., *Avena subalpestris* Hartm., *Avena subspicata* var. *agrostidea* Laest., *Trisetum pubiflorum* Hack., *Trisetum spicatum* f. *minor* Kom., and *Trisetum spicatum* f. *umbrosum* Kom.

RESUMEN

De acuerdo con diversas pruebas de carácter morfológico y molecular, transferimos las especies de *Trisetum* sect. *Trisetaera*, *T. hispidum* y *Trisetokoeleria taymirica* a *Koeleria*, describimos *Koeleria* sect. *Hispanica* y enmendamos la descripción de este género. Presentamos un total de 49 combinaciones o nombres nuevos. Además, designamos lectotipos para *Avena clarkei* Hook f., *Avena micans* Hook. f., *Avena subalpestris* Hartm., *Avena subspicata* var. *agrostidea* Laest., *Trisetum pubiflorum* Hack., *Trisetum spicatum* f. *minor* Kom. y *Trisetum spicatum* f. *umbrosum* Kom.

Recently there has been considerable progress in the systematics of *Trisetum* Pers. [Poeae: Pooideae: Poaceae; type *T. flavescens* (L.) P. Beauv.], a group of perennials with a complicated taxonomic history due to the variability and overlapping morphologies of its species and infrageneric taxa (Randall & Hilu 1986; Finot 2010). Recent molecular phylogenetic studies indicate that *Trisetum* is polyphyletic (Soreng & Davis 2000; Quintanar et al. 2007; Saarela et al. 2017; Barberá et al. 2019; Peterson et al. 2019) and now includes only two or three species. Another interesting aspect

in the systematics of *Trisetum* is the corroboration of these phylogenetic studies of the close relationship of *Trisetum* sect. *Trisetaera* Asch. & Graebn. [type *T. spicatum* (L.) K. Richt.] and species of *Koeleria* Pers. [type *K. pyramidata* (Lam.) P. Beauv.], also composed of perennials (cf. Saarela et al. 2017; Wölk & Röser 2017; Barberá et al. unpublished). Species of *T.* sect. *Trisetaera* and *Koeleria* usually share a similar inflorescence architecture with compact, dense, ovate-spiciform panicles. Both groups are meso- to xerophytic grasses distributed throughout the temperate regions of the Holarctic and Antarctic floristic kingdoms, occurring at medium to high altitudes in the Paleotropical, Neotropical, and Cape kingdoms (Clayton & Renvoize 1986; Watson & Dallwitz 1992; Quintanar et al. 2010). These grasses live in open places from sea level to high montane forests and are found mainly in xeric grassland communities, frequently on rocky soils (Tutin et al. 1980; Tzvelev 1976; Clayton & Renvoize 1986).

Trisetum sensu stricto is characterized in having more or less open, loose panicles, unequal glumes, clearly bifid lemmas apices with a bent or slightly bent dorsal awn more or less twisted at the base that is inserted in the upper third (Barberá et al. 2018). *Trisetum* sect. *Trisetaera* is morphologically distinguished in having narrow panicles with densely clustered spikelets arranged on short, hairy branches, usually comparatively larger and sometimes subequal glumes, bidentate lemmas with a dorsal awn also inserted in the upper third, normaly at a more distal position than in *Trisetum*, usually the awn basally to sub-basally bent, but not twisted. Reichenbach (1830) was the first to recognize the similarities between *Koeleria* and *Trisetum* by making a combination in *Koeleria* [*K. subspicata* (L.) Rchb., nom. illeg. superfl. = *Trisetum spicatum*]. Tzvelev (2011) pointed out that *T.* sect. *Trisetaera* was morphologically very similar to *Koeleria*. The species of *Koeleria* usually have dense and spike-like panicles, relatively large and sometime subequal glumes but the lemmas are muticous, mucronate or, much more rarely, apically or subapically short-awned (Quintanar & Castroviejo 2013). In addition to these characters, the species of *T.* sect. *Trisetaera* do not have conspicuous and marked apical lateral awns but have two short awnlets which are sometime missing (Hultén 1959; Tzvelev 1976, 2011), also seen in *Koeleria*. In a revision of *Trisetum* for northern Asia, *T.* subsect. *Koeleriformia* Enushch. was erected to indicate similarities with *Koeleria* (Enushchenko 2011).

Based on a large unpublished molecular DNA sequence study using four gene regions (ITS, *rpl32-trnL* spacer, *rps16-trnK* spacer, and *rps16* intron), we proposed to move the *T. spicatum* complex into *Koeleria* (Soreng et al. 2017). This was supported by Saarela et al. (2017), who included many representatives of *T.* sect. *Trisetaera*, *Koeleria*, and other taxa considered to belong to the subtribe Koeleriinae Asch. & Graebn. Our current study includes a more extensive sampling of these groups allowing a deep exploration of the relationships between *T.* sect. *Trisetaera* and *Koeleria*, and we now feel confident in making taxonomic changes that were previously tentatively proposed. Nested in our *Koeleria* clade, we find the Scandinavian and Northern Asian *T. subalpestre* (Hartm.) Neuman, the Iberian endemic *T. hispidum* Lange, and the Asiatic hybrid × *Trisetokoeleria taymirica* Tzvelev. *Trisetum subalpestre*, included by Enuschenko (2011) in *T.* sect. *Trisetaera* subsect. *Agrostidea* Prob., is morphologically similar to species included in *T.* sect. *Trisetaera* in having loosely caespitose culms with a spiciform, densely flowered panicle, and lemmas with a dorsal awn inserted in the upper third (Jonsell 1980). *Trisetum hispidum*, previously classified in the heterogeneous *T.* sect. *Hispanica* Chrtek, shares with *T.* sect. *Trisetaera* and *Koeleria* its densely-flowered, compact panicles and relatively large glumes, and its appearance at first glance resembles a robust species of *Koeleria*.

Based on our unpublished molecular DNA phylogeny, we transfer the species of *Trisetum* sect. *Trisetaera*, *T. hispidum*, and *Trisetokoeleria taymirica* into *Koeleria*, describe *Koeleria* sect. *Hispanica*, and emend the generic description. A total of 49 new combinations or new names are

made. In addition, lectotypes are chosen for seven names. We now recognize *Koeleria* in a broad sense as a single, albeit larger, natural genus.

MATERIAL AND METHODS

Taxonomic arrangements are based on our current on-going molecular DNA sequence studies. We have examinated herbarium specimens using the following taxonomic treatments (Domin 1907; Tzvelev 1976, 2011; Tutin et al. 1980; Randall & Hilu 1986; Edgar 1998; Edgar & Gibb 1999; Finot et al. 2004, 2005a, 2005b; Finot 2010; Quintanar & Castroviejo 2013). Taxa that we lack molecular evidence for are preceded by an asterisk (*). The new combinations and new names are listed in **bold** letters. Lectotypifications were made after a thorough review of the material cited in the protologue and study of herbarium vouchers. In addition, we provide a list of unplaced names where we lack adequate information to assess their systematic placement.

TAXONOMY

KOELERIA Pers., Syn. Pl. 1: 97. 1805, **gen. emend.** LECTOTYPE SPECIES: *Poa nitida* Lam. [=*Koeleria pyramidata* (Lam.) P. Beauv. subsp. *pyramidata*], designated by Nash in Britton & Brown 245. 1913.

Description—Perennials, erect and tufted, densely to loosely caespitose with intravaginal branches, also extravaginal in some species, sometimes short rhizomatous, the rhizomes 0.2–1.2(–82) mm long. Shoots with (1–)2–4(–7) leaves. Culms (4.5–)15–80(–100) cm tall, (0.18–)0.6–1(–2.2) mm wide, glabrous or hairy to villous below the panicle, erect to somewhat geniculate at the base. Leaves simple and alternate; leaf sheaths membranous, more or less firmly attached to the culm, open to the base; leaf blades (1.1–)2.9–6.5(–36) cm × (1–)3–5(–5.3) mm, linear, flat to folded, margins strongly involute, glabrous to minutely prickle-toothed or hairy. Ligules truncate, erose, sometime ciliolate. Inflorescences (0.7–)3.4–12(–15.4) cm long, paniculate, terminal, more or less compact with the spikelets densely clustered, spike-like to ovoid in outline, with entire and non-interrupted outlines to irregularly interrupted ones, the rachis not obvious or visible, hairy. Spikelets (2.2–)3.2–9(–10) mm long, laterally compressed, short-pedicellate with (1–)2–3(–5) hermaphrodite florets arranged on a rachilla, often prolonged beyond the uppermost floret and bearing an underdeveloped floret; disarticulation above the glumes and between the florets; callus very short, oblique, usually short-hairy, the hairs 0.02–1(–4) mm long. Glumes herbaceous, heteromorphic, unequal to almost equal in length, dissimilar in shape or more rarely similar; lower glumes (0.7–)2.3–6(–9.5) × (0.2–)0.5–1.5(–2.2) mm, 1(3)-veined, narrowly lanceolate, usually slightly shorter than the proximal lemma; upper glumes (1.7–)4.3–7(–9) × (0.4–)0.8–2.2(–2.8) mm, 3(5)-veined, slightly shorter or equal to or sometimes longer than the proximal lemma, broadly elliptic-lanceolate with hyaline margins, pointed, carinate, often short-mucronate, usually glabrous, very rarely hairy. Lemmas (1.9–)3–7.5(–9) × (0.3–)0.7–1.7(–2.6) mm, herbaceous, elliptic-lanceolate, strongly carinate, with hyaline margins, 3–5-veined, glabrous, papillose to minutely prickle-toothed; apex entire, pointed or bicuspid or bidentate, the teeth 0.2–0.3(–0.9) mm long, blunt or bearing two lateral awnlets (0.3)0.7–1.1(–1.7) mm long, sometimes just mucronate, with mucro 0.1–0.2(–1) mm long, apically to subapically attached, or with a dorsal awn (2–)2.5–6.5(–11.5) mm, usually basally to subbasaly bent and not twisted, inserted 0.7–2.1(–2.4) mm from the lemma apex, at its upper quarter, often almost subapical. Paleas (2–)2.2–5.6(–8) mm long, hyaline, gaping during anthesis, apically notched to bifid, 2-veined and 2-keeled, minutely prickle-toothed. Stamens 3, with anthers (0.3–)0.8–2(–2.5) × (0.1–)0.2–0.3(–1.2) mm. Ovary glabrous, bearing 2 feathery stigmas on short free styles. Lodicules 2, (0.2–)0.6–1.3(–1.5) mm long, hyaline, one-to-several times toothed, frequently 2-toothed or obscurely toothed. Caryopsis (1.6–)2.1–2.7(–3.8) mm long, slightly laterally compressed, the hilum short, punctiform; endosperm soft-liquid (containing lipids) in the mature fruit. Basic chromosome number $x = 7$.

Comments—Overall the approximate number of species in the genus increases from 53 (Quintanar et al. 2010) to 79.

KOELERIA section **TRISETAERA** (Asch. & Graebn.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum* sect. *Trisetaera* Asch. & Graebn., Syn. Mitteleur. Fl. 2: 270. 1899. *Trisetum* subsect. *Koeleriformia* Enushch., Novosti Sist. Vyssh. Rast. 42 (5): 60. 2011, nom. illeg. hom., non Louis-Marie. **TYPE**: *Aira spicata* L. [≡ *Koeleria spicata* (L.) Barberá, Quintanar, Soreng, & P.M. Peterson].

= *Trisetokoeleria* Tzvelev, Novosti Sist. Vyssh. Rast. 7: 73. 1971, pro hybrid. **TYPE**: *Koeleria gorodkowii* Roshev.

= *Trisetum* (sect. *Trisetaera*) subsect. *Agrostidea* Prob., Novosti Sist. Vyssh. Rast. 15: 20. 1979. **TYPE**: *T. agrostideum* (Laest.) Fr. (= *Avena subalpestris* Hartm.).

Koeleria antarctica (G. Forst.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Aira antarctica* G. Forst., Fl. Ins. Austr. 8, no. 41. 1786. *Danthonia antarctica* (G. Forst.) Spreng., Syst. Veg. ed. 16, 1: 331. 1824. *Trisetum antarcticum* (G. Forst.) Trin., Mém. Acad. Imp. Sci. St.-Pétersbourg, sér. 6, Sci. Math. 1 (1): 61. 1830.

***Koeleria arduana** (Edgar & A.P. Druce) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum arduanum* Edgar & A.P. Druce, New Zealand J. Bot. 36: 545, fig. 3. 1998.

Koeleria barbinodis (Trin.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum barbinode* Trin., Linnaea 10 (3): 300. 1836.

Koeleria barbinodis var. **sclerophylla** (Hack.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum sclerophyllum* Hack., Anales Mus. Nac. Buenos Aires 21: 108. 1911. *Trisetum barbinode* var. *sclerophyllum* (Hack.) Finot, Ann. Missouri Bot. Gard. 92 (4): 546. 2005.

***Koeleria barrosii** Barberá, Quintanar, Soreng, & P.M. Peterson, **nom. nov.** Replaced name: *Trisetum pyramidatum* Louis-Marie ex Finot, Ann. Missouri Bot. Gard. 92 (4): 558, fig. 3. 2005. **TYPE**: Chile. Punta Arenas, Leña Dura, 28 Jan 1946, *E. Barros 5706* (holotype: US-1869901!).

Comments—The new name honors Ernesto Barros (1887–1954), a Chilean collector. Finot et al. (2005a) mistakenly gave credit to Manuel Barros (1880–1973) for collecting the type. However, the holotype specimen at US clearly attributes the collection to E. Barros.

Koeleria drucei (Edgar) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum drucei* Edgar, New Zealand J. Bot. 36: 548, fig. 5. 1998.

Koeleria hookeri Barberá, Quintanar, Soreng, & P.M. Peterson, **nom. nov.** Replaced name: *Avena clarkei* Hook f., Fl. Brit. India 7 (22): 278. 1896. *Trisetum clarkei* (Hook. f.) R.R. Stewart, Brittonia 5 (4): 431. 1945. **LECTOTYPE** (**designated here**): **India**. Kashmir, Budrawur [Bhadarwāh], 32º58’N 75º43’E, *C.B. Clarke 31514* (K-32261!).

Comments—Recommendation 23A.2 of the International Code of Nomenclature (Turland et al. 2018) recommends avoidance of the use of the genitive and the adjectival form of the same word to designate two different species of the same genus. Because there is a name at specific rank, *Koeleria clarkeana* Domin, Biblioth. Bot. 14 (65): 272, pl. 18 fig. 11. 1907, currently treated as a species of *Rostraria* Trin., we have decided to avoid the name that would result from combining the

basionym of this species and to provide a new name that honors Joseph Dalton Hooker (1817–1911), who described this species for the first time.

Koeleria inaequalis (Whitney) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum inaequale* Whitney, Occas. Pap. Bernice Pauahi Bishop Mus. 13: 171. 1937.

***Koeleria johnstonii** (Louis-Maire) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum oreophilum* var. *johnstonii* Louis-Maire, Rhodora 30 (360): 237. 1929. *Trisetum johnstonii* (Louis-Marie) Finot, Curr. Topics Pl. Sci. 11: 60. 2010.

Koeleria johnstonii subsp. **mattheii** (Finot) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum mattheii* Finot, Ann. Missouri Bot. Gard. 92 (4): 551, fig. 1. 2005. *Trisetum johnstonii* subsp. *mattheii* (Finot) Finot, Curr. Topics Pl. Sci. 11: 60. 2010.

***Koeleria kangdingensis** (Z.L. Wu) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum clarkei* var. *kangdingense* Z.L. Wu, Acta Biol. Plateau Sin. 2: 16. 1984. *Trisetum kangdingense* (Z.L. Wu) S.M. Phillips & Z.L. Wu, Fl. China 22: 326. 2006.

***Koeleria koidzumiana** (Ohwi) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum koidzumianum* Ohwi, Acta Phytotax. Geobot. 2: 33. 1933.

***Koeleria lasiorhachis** (Hack.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum antarcticum* var. *lasiorhachis* Hack., Man. New Zealand Fl.: 880. 1906. *Trisetum lasiorhachis* (Hack.) Edgar, New Zealand J. Bot. 36: 549, fig. 7. 1998.

***Koeleria lepida** (Edgar & A.P. Druce) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum lepidum* Edgar & A.P. Druce, New Zealand J. Bot. 36: 553, fig. 9. 1998.

Koeleria ligulata (Finot & Zuloaga) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum ligulatum* Finot & Zuloaga, Ann. Missouri Bot. Gard. 91(1): 15, fig. 1. 2004.

***Koeleria micans** (Hook. f.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Avena micans* Hook. f., Fl. Brit. India 7: 279. 1896. *Trisetum micans* (Hook. f.) Bor, Grass. Burma, Ceylon, India & Pakistan: 448. 1960. **LECTOTYPE** (**designated here**): **India**. Uttarakhand state, Garhwal division, Tehri Garhwal, 30º30'N 78º30'E, *J.F. Duthie 46* (K-000032268!).

***Koeleria nancaguensis** (Finot) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum nancaguense* Finot, Ann. Missouri Bot. Gard. 92 (4): 553, fig. 2. 2005.

Koeleria oreophila (Louis-Maire) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum oreophilum* Louis-Maire, Rhodora 30 (359): 221. 1928.

Koeleria oreophila subsp. **barbatipalea** (Hultén ex Veldkamp) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* var. *barbatipaleum* Hultén ex Veldkamp, Gard. Bull. Singapore 36 (1): 135. 1983. *Trisetum barbatipaleum* (Hultén ex Veldkamp) Finot, Contr. U.S. Natl. Herb. 48: 661. 2003. *Trisetum oreophilum* subsp. *barbatipaleum* (Hultén ex Veldkamp) Finot, Curr. Topics Pl. Biol. 11: 62. 2010.

Koeleria oreophila subsp. **colombiana** (Finot) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum oreophilum* subsp. *colombianum* Finot, Curr. Topics Pl. Sci. 11: 60. 2010.

Koeleria oreophila subsp. **rosei** (Scribn. & Merr.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum rosei* Scribn. & Merr., Contr. U.S. Natl. Herb. 8 (4): 289. 1905. *Trisetum oreophilum* subsp. *rosei* (Scribn. & Merr.) Finot, Curr. Topics Pl. Biol. 11: 63. 2010.

Koeleria preslii (Kunth) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Avena preslii* Kunth, Enum. Pl. 1: 304. 1833 ["Preslei"]. *Avena pilosa* J. Presl, Reliq. Haenk. 1 (4–5): 253. 1830, nom. illeg. hom. *Trisetum preslii* (Kunth) É. Desv., Fl. Chil. 6: 347. 1854.

Koeleria projecta (Louis-Marie) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum projectum* Louis-Marie, Rhodora 30 (359): 217. 1928. *Trisetum cernuum* var. *projectum* (Louis-Marie) Beetle, Leafl. W. Bot. 4 (12): 288. 1946. *Trisetum spicatum* var. *projectum* (Louis-Marie) J.T. Howell, Wasmann J. Biol. 37 (12): 22. 1979.

***Koeleria serpentina** (Edgar & A.P. Druce) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum serpentinum* Edgar & A.P. Druce, New Zealand J. Bot. 36: 554, fig. 11. 1998.

Koeleria spicata (L.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** non Reichb. ex Willk. & Lange, Prodr. Fl. Hispan. 1: 72. 1861, nom. inval. Basionym: *Aira spicata* L., Sp. Pl.: 64. 1753. *Avena subspicata* Clairv., Man. Hebor. Suisse: 17. 1811. *Trisetum spicatum* (L.) K. Richt., Pl. Eur. 1: 59. 1890. *Trisetaria spicata* (L.) Paunero, Anales Jard. Bot. Madrid 9: 516. 1950. **Figure 1A–E**.

= *Trisetum pubiflorum* Hack., Oesterr. Bot. Z. 52: 187. 1902. *Trisetum spicatum* var. *pubiflorum* (Hack.) L. Liou, Vasc. Pl. Hengduan Mount. 2: 2224. 1994. **LECTOTYPE** (**designated here**): **China**. Kashmir, Shaksgam Valley, 36º09'N 76º37'E, 12 Aug 1893, *J.F. Duthie 13543* (W-1916-0031902!; isolectotypes: K images!, US-868575!, US-101514 fragment!).

= *Trisetum spicatum* f. *minor* Kom., Fl. Kamtschatka 1: 156. 1927. **LECTOTYPE** (**designated here**): **Russia**. Kamchatka Peninsula, outside Krasheninnikov crater, 54º35'N 160º16'E, 19 Aug 1909, *V. Komarov 3243* (LE!).

= *Trisetum spicatum* f. *umbrosum* Kom., Fl. Kamtschatka 1: 156. 1927. **TYPE**: **Russia**. Kamchatka Peninsula, near Ganal, 53º41'N 157º37'E, 13 Jul 1909, *V. Komarov 2725* (lectotype, **designated here**: LE!; isolectotype: LE!).

Koeleria spicata subsp. **andina** (Benth.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum andinum* Benth., Pl. Hartw.: 261. 1847. *Trisetum spicatum* var. *andinum* (Benth.) Louis-Marie, Rhodora 30 (360): 239. 1929. *Trisetum spicatum* subsp. *andinum* (Benth.) Hultén, Svensk Bot. Tidskr. 53 (2): 224. 1959.

Koeleria spicata subsp. **alaskana** (Nash) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum alaskanum* Nash, Bull. New York Bot. Gard. 2: 155. 1901. *Trisetum spicatum* var. *alaskanum* (Nash) Louis-Marie, Rhodora 30: 239. 1928. *Trisetum spicatum* subsp. *alaskanum* (Nash) Hultén, Svensk Bot. Tidskr. 53: 210. 1959. *Trisetum molle* subsp. *alaskanum* (Nash) Rebr., Arktic. Fl. SSSR 2: 100. 1964.

***Koeleria spicata** subsp. **australiensis** (Hultén ex Veldkamp) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* subsp. *australiense* Hultén ex Veldkamp, Gard. Bull. Singapore 36 (1): 135. 1983.

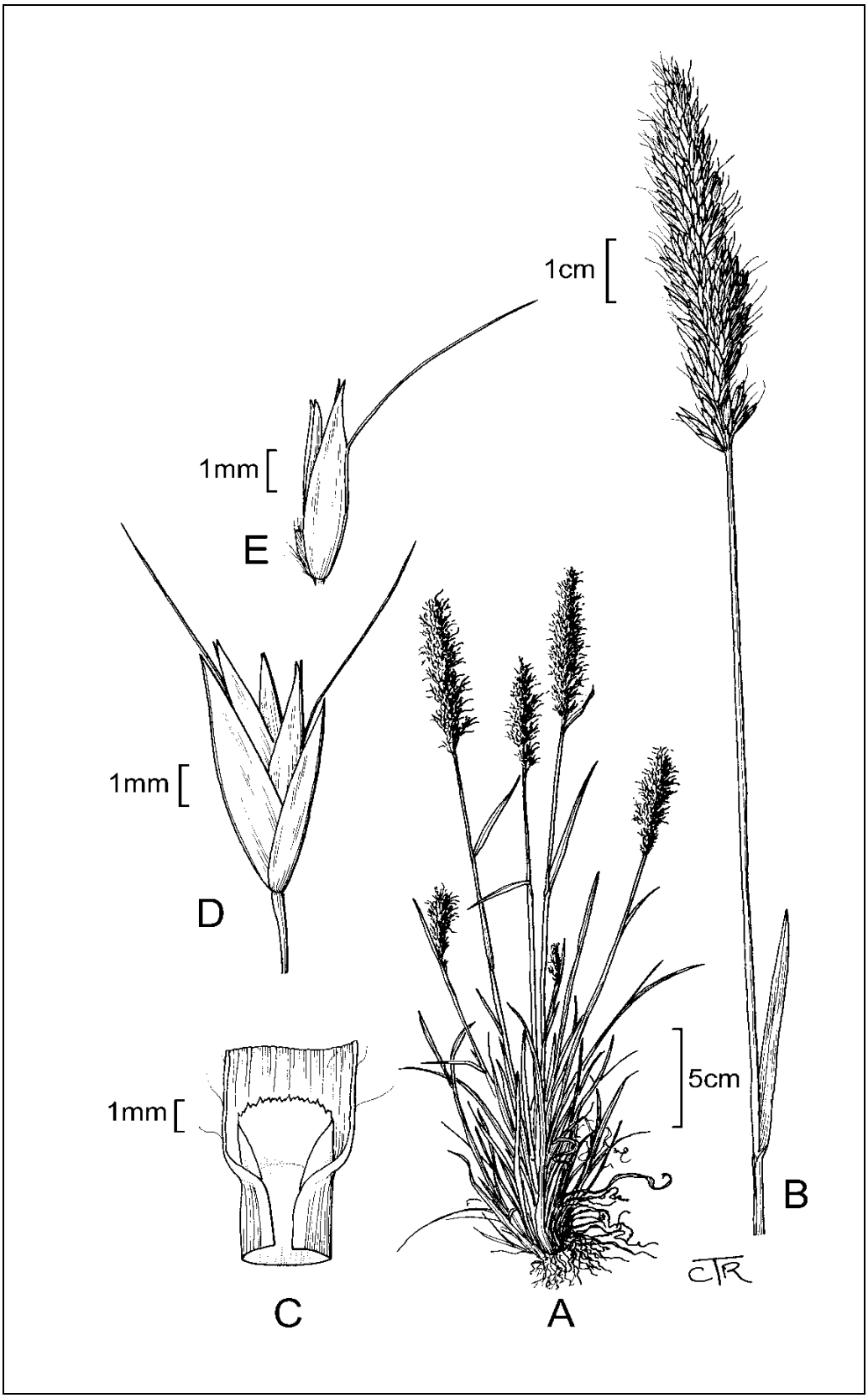

Figure 1. *Koeleria spicata*. A. Habit. B. Culm. C. Ligule. D. Spikelet. E. Floret. Drawn by Cindy T. Roche for the Flora of North America.

Koeleria spicata subsp. **cumingii** (Nees) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Koeleria cumingii* Nees, Syn. Pl. Glumac. 1: 294. 1854. *Trisetum cumingii* (Nees) Nicora, Fl. Patagónica 3: 250. 1978. *Trisetum spicatum* var. *cumingii* (Nees) Finot, Ann. Missouri Bot. Gard. 92 (4): 562–563. 2005. *Trisetum spicatum* subsp. *cumingii* (Nees) Finot, Finot, Curr. Topics Pl. Biol. 11: 67. 2010.

***Koeleria spicata** subsp. **dianthema** (Louis-Marie) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* var. *dianthemum* Louis-Marie, Rhodora 30 (360): 239. 1929. *Trisetum biflorum* Phil., Anales Univ. Chile 48: 568. 1873, nom. illeg. hom. *Trisetum dianthemum* (Louis-Marie) Finot, Contr. U.S. Natl. Herb. 48: 664. 2003. *Trisetum spicatum* subsp. *dianthemum* (Louis-Marie) Finot, Curr. Topics Pl. Biol. 11: 66. 2010.

***Koeleria spicata** subsp. **geghamensis** (Gabrieljan) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum geghamense* Gabrieljan, Fl. Rastitel'nost' Rastitel'nye Resursy Armyansk. S.S.R. 16: 11-12. 2007.

***Koeleria spicata** subsp. **himalaica** (Hultén ex Veldkamp) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* subsp. *himalaicum* Hultén ex Veldkamp, Gard. Bull. Singapore 36 (1): 135. 1983.

***Koeleria spicata** subsp. **hultenii** (Chrtek) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* subsp. *hultenii* Chrtek, Acta Univ. Carol., Biol. 1967: 101. 1968.

***Koeleria spicata** subsp. **kinabaluensis** (Chrtek) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* subsp. *kinabaluense* Chrtek, Folia Geobot. Phytotax. 5: 447. 1970.

Koeleria spicata subsp. **mollis** (Kunth) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum molle* Kunth, Révis. Gramin. 1: 101. 1829. *Avena mollis* Michx., Fl. Bor.-Amer. 1: 72. 1803, nom. illeg. hom. *Trisetum spicatum* var. *molle* (Kunth) Beal, Grass. N. Amer. 2: 377. 1896. *Trisetum triflorum* subsp. *molle* (Kunth) Á. Löve & D. Löve, Univ. Colorado Stud., Ser. Biol. 17: 7. 1965. *Trisetum spicatum* subsp. *molle* (Kunth) Piper, Contr. U.S. Natl. Herb. 11: 125. 1906.

***Koeleria spicata** subsp. **mongolica** (Hultén ex Veldkamp) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* subsp. *mongolicum* Hultén ex Veldkamp, Gard. Bull. Singapore 36 (1): 135. 1983. *Trisetum mongolicum* (Hultén ex Veldkamp) Peshkova, Fl. Centr. Sibir. 1: 97. 1979.

Koeleria spicata subsp. **ovatipaniculata** (Vasey) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* subsp. *ovatipaniculatum* Hultén ex Jonsell, Svensk Bot. Tidskr. 69 (2): 132. 1975. *Trisetum ovatipaniculatum* (Hultén ex Jonsell) Galushko, Novosti Sist. Vyssh. Rast. 13: 254. 1976. *Trisetaria spicata* subsp. *ovatipaniculata* (Hultén ex Jonsell) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135 (2): 385. 1996.

Koeleria spicata subsp. **phleoides** (d'Urv.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Avena phleoides* d'Urv., Fl. Iles Malouin. 30, 19. 1825. *Trisetum phleoides* (d'Urv.) Kunth, Révis. Gramin. 1: 101. 1829. *Trisetum subspicatum* var. *phleoides* (d'Urv.)

Hack., Svenska Exped. Magell. 3 (5): 222. 1900. *Trisetum spicatum* subsp. *phleoides* (d'Urv.) Macloskie, Rep. Princeton Univ. Exp. Patagonia, Botany 8 (1,5,1): 206. 1904.

***Koeleria spicata** subsp. **tibetica** (P.C. Kuo & Z.L. Wu) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum tibeticum* P.C. Kuo & Z.L. Wu, Fl. Xizang. 5: 188, pl. 93 figs. 1–3. 1987. *Trisetum spicatum* subsp. *tibeticum* (P.C. Kuo & Z.L. Wu) Dickoré, Stapfia 39: 201. 1995.

Koeleria spicata subsp. **virescens** (Regel) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Avena flavescens* var. *virescens* Regel, Bull. Soc. Imp. Naturalistes Moscou 41 (3–4): 299. 1868. *Trisetum fedtschenkoi* Henrard, Blumea 3 (3): 425. 1940. *Trisetum spicatum* subsp. *virescens* (Regel) Tzvelev, Novosti Sist. Vyssh. Rast. 7: 65. 1971. 1970.

Koeleria spicata subsp. **wrangelensis** (V.V. Petrovsky) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum spicatum* subsp. *wrangelense* V.V. Petrovsky, Bot. Zhurn. (Kiev) 63 (9): 1263. 1978. *Trisetum wrangelense* (V.V. Petrovsky) Prob., Sosud. Rast. Sovetsk. Dal'nego Vostoka 1: 163. 1985.

Koeleria subalpestris (Hartm.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Avena subalpestris* Hartm., Handb. Skand. Fl., ed. 3: 21. 1838. *Trisetum subalpestre* (Hartm.) Neuman, Sver. Fl.: 755. 1901. *Trisetaria subalpestris* (Hartm.) Banfi & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano 135 (2): 385. 1996. **LECTOTYPE** (**designated here**): **Sweden**. Lapland, Norrbotten County, Karesuando, Maunu, 68º28'N 22º12'E, *L.L. Laestadius III.92* (UPS-V-077305!; isolectotypes: BM-001034617!, LE-10136!, MO-2106460!, P-2222191!, UPS-V-103570!, UPS-V-105878!, UPS-V-232821!).

= *Avena subspicata* var. *agrostidea* Laest., Nova Acta Regiae Soc. Sci. Upsal. 11: 245. 1839. *Trisetum agrostideum* (Laest.) Fr., Novit. Fl. Suec. Mant. 3 (12): 180. 1845. **LECTOTYPE** (**designated here**): **Sweden**. Norrbottens Län (not stated), Karesuando, 1837, *L.L. Laestadius s.n.* (W-24520!).

Koeleria taymirica (Tzvelev) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** *Trisetokoeleria taymirica* Tzvelev, Novosti Sist. Vyssh. Rast. 11: 72. 1974, pro hybrid.

Koeleria tenella (Petrie) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum antarcticum* subsp. *tenellum* Petrie, Trans. & Proc. New Zealand Inst. 44: 187. 1912. *Trisetum antarcticum* var. *tenellum* (Petrie) Cheeseman, Man. New Zealand Fl.: 169. 1925. *Trisetum tenellum* (Petrie) A.W. Hill, Index Kew. Suppl. 9: 289. 1938.

Koeleria vaseyi Barberá, Quintanar, Soreng, & P.M. Peterson, **nom. nov.** Replaced name: *Trisetum montanum* Vasey, Bull. Torrey Bot. Club 13 (7): 118. 1886. *Trisetum spicatum* subsp. *montanum* (Vasey) W.A. Weber, Phytologia 33 (2): 106. 1976.

Comments—The new name honors George Vasey (1822–1893), who first described this species.

Koeleria youngii (Hook. f.) Barberá, Quintanar, Soreng, & P.M. Peterson, **comb. nov.** Basionym: *Trisetum youngii* Hook. f., Handb. N. Zeal. Fl. 335. 1864.

Figure 2. *Koeleria hispanica* (≡ *Trisetum hispidum* lectotype) collected by *J. Lange* (C) in Spain.

KOELERIA section **HISPANICA** Barberá, Quintanar, Soreng, & P.M. Peterson, **sect. nov. TYPE**: *Trisetum hispidum* Lange.

Description—Culms hairy, the hairs 0.1–0.8 mm long. Leaves densely hairy, the hairs 0.1–1.3 mm long. Panicles subcylindric or ovate-lanceolate; rachis hairy. Lemmas 3-4 mm long, lanceolate, hairy, the hairs 0.2–0.6 mm long; apex bidentate, the teeth 0.2–0.6 mm long each bearing two lateral mucros 0.5–0.8 mm long, the dorsal or subapical awn 2.5–4 mm long inserted on upper quarter, the awn straight or bent near base. Anthers 1.8–2.5 mm long.

Koeleria hispanica Barberá, Quintanar, Soreng, & P.M. Peterson, **nom. nov.** Replaced name: *Trisetum hispidum* Lange, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1860: 42. 1861, non *Koeleria hispida* (Savi) DC. **TYPE**: **Spain**. [León Province, Villafranca del Bierzo] "In fissuris rupium ad Villafranca del Vierzo (prov. Legion.) reg. mont. inf.", 20 Jul 1851 or 1852, *J. M. Ch. Lange 61* (lectotype designated by Silva Pando & Pino Pérez, Bot. Complut. 43: 54. 2019: C-10017263 [image!]; isolectotype: C-1001264 [image!]). **Figure 2**.

Comments—The new name honors the territory (Hispania) where this species is endemic. This robust species of *Koeleria* has densely-flowered and lobate panicles, hairy 2–3-flowered spikelets with relatively large glumes. The lateral awnlets at the lemma apex are short but prominent and the dorsal awn is somewhat bent near its base and inserted on the upper quarter of the lemma. However, in our phylogenetic topologies it appears to be closer to *K.* sect. *Koeleria* than to representatives of *T.* sect. *Trisetaera*. We erect a monotypic section for this curious species that shows characters that do not fit in the existing sections of *Koeleria*.

Unplaced taxa

Trisetum ambiguum Rúgolo & Nicora, Bol. Soc. Argent. Bot. 25 (3–4): 468. 1988.
Trisetum longiglume Hack., Repert. Spec. Nov. Regni Veg. 7: 319. 1909.
Trisetum longiglume var. *glabratum* Nicora, Fl. Patag. 3: 245. 1978.
Trisetum macbridei Hitchc., Contr. U.S. Natl. Herb. 24 (8): 359. 1927.

Comments—The placement of *T. ambiguum*, *T. longiglume*, and *T. macbridei* in our molecular phylogeny is incongruent between our plastid and ITS topologies, i.e., they align in the different clades within the Koeleriinae, probably indicating a reticulate origin.

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