

TWO NEW COMBINATIONS IN PEYRITSCHIA
(POACEAE: POOIDEAE: AVENINAE)

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ABSTRACT

Trisetum howellii Hitchc., an endemic species from the Galapagos Islands, Ecuador, and *Trisetum pinetorum* Swallen, an endemic species from Guatemala, are transferred into **Peyritschia** [**P. howellii** (Hitchc.) Finot & P.M. Peterson; **P. pinetorum** (Swallen) Finot & P.M. Peterson]. *Peyritschia* is now circumscribed to include seven species with new areas of distribution documented in South America. A key distinguishing the species and table comparing the salient morphological features of all species within *Peyritschia* are provided.

RESUMEN

Trisetum howellii Hitchc., especie endémica de las Islas Galápagos, Ecuador, y *Trisetum pinetorum* Swallen, especie endémica de Guatemala se transfieren a **Peyritschia** [**P. howellii** (Hitchc.) Finot & P.M. Peterson; **P. pinetorum** (Swallen) Finot & P.M. Peterson]. *Peyritschia*, así circunscrita, incluye siete especies con nuevas áreas de distribución documentadas en Sudamérica. Se proporciona una clave para distinguir las especies y un cuadro donde se comparan las características morfológicas sobresalientes de todas las especies de *Peyritschia*.

The genus *Peyritschia* was described by Fournier (1886) and originally included only one species, *P. koelerioides* (Peyr.) E. Fourn., based on *Aira koelerioides* Peyr., from southern México and Guatemala (Finot et al. 2004). A second species from México, *Deschampsia pringlei* Scribn., was transferred to *Peyritschia* by S.D. Koch in 1979 [= *P. pringlei* (Scribn.) S.D. Koch], and is also known from Guatemala, Costa Rica, Venezuela, and Ecuador (Hernández-Torres & Koch 1988; Pohl & Davidse 1994; Finot et al. 2004). This small genus (*Peyritschia*) was later included within *Trisetum* by Hernández-Torres and Koch (1987). When placed in *Trisetum*, *P. koelerioides* and *P. pringlei* are named: *Trisetum altijugum* (E. Fourn.) Scribn. and *T. kochianum* Hern.-Torres, respectively.

Peyritschia has isomorphic to sub-isomorphic, linear, 1-3-nerved glumes; bilobed lemmas that are awned near the base or the middle of the back or the awn reduced to a subapical mucro; paleas that are tightly enclosed by the margins of the lemma; linear lodicules; and an androecium composed of two stamens. In contrast, *Trisetum* has heteromorphic, ovate-lanceolate or oblanceolate, 1-5-nerved glumes [first glume 1(-3)-nerved, second glume 3(-5)-nerved]; lemmas with 2 to 4 short setae at the apex due to the prolongation of the nerves and a dorsal awn born on the upper third of the lemma, rarely located near the middle of the back; paleas that are free from the margins of the lemma; lodicules with 2- or 3-lobed apices; and an androecium with three stamens (Finot et al.

2004, 2005a, 2005b). *Peyritschia* includes perennial herbs with flat leaf blades, membranous ligules, narrow to contracted-spiciform or lax and somewhat open panicles, 2(–3)-flowered spikelets, rachillas disarticulating above the glumes and between the florets, glabrous ovaries, and caryopses with liquid endosperm. Previous studies showed that the micromorphology of the lemmatal epidermis has good characters to distinguish *Trisetum* from *Peyritschia*. Most species of *Peyritschia* lack prickles hairs (present in all species of *Trisetum*), although, if present, they are restricted to the keel or the apex of the lemma in *P. deyeuxioides* and *P. pinetorum*. All species of *Peyritschia* have bordered hooks alternating with epidermal long cells (hooks not bordered, nor alternating with long cells in *Trisetum*) and lack macrohairs (macrohairs are present in some species of *Trisetum*) [Finot et al. 2006]. These characteristics along with the salient features of the spikelet, were considered important for resurrecting the genus by Finot (2003a) who transferred three additional species into *Peyritschia*: *P. conferta* (Pilg.) Finot (= *Trisetum confertum* Pilg.) from Bolivia, Ecuador and Venezuela; *P. deyeuxioides* (Kunth) Finot (= *T. deyeuxioides* Kunth) widely distributed in México, and extending into Central and South America (Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panamá and Venezuela); and *P. humilis* (Louis-Marie) Finot (= *T. humile* Louis-Marie), an endemic in México (Finot et al. 2004).

Trisetum confertum was originally described from an Ecuadorian specimen (Crescit in Prov. Imbabura, ad Loma de Canaballa et locis vicinis; alt. 2100–2300 m; A. Stübel 152; holotype, B; isotypes, US-81771 ex B, CONC fragm. and photo ex B). Hitchcock (1927) cited this species as occurring in Cochabamba, Bolivia. Later, Valencia (1941) moved the species to *Deschampsia* [*D. conferta* (Pilg.) Valencia]. However, Parodi (1949) and Chiappella (2000) excluded it from *Deschampsia*.

More recently, two species, *Trisetum deyeuxioides* and *T. humilis*, were transferred in *Peyritschia*, based on spikelet and floret characteristics (Finot 2003a; Finot et al. 2004).

Three of the five currently recognized species of *Peyritschia* are found in Guatemala: *P. koelerioides* (the type species of the genus) also extends into southern México; *P. pringlei* also present in México, Costa Rica, Venezuela, and Ecuador; and *P. deyeuxioides* ranging from southern México to Ecuador (Pohl & Davidse 1994; Espejo-Serna et al. 2000; Finot 2003a; Finot et al. 2004).

The following seven species of *Trisetum* have been mentioned as occurring in Guatemala: *T. angustum* Swallen from San Marcos near Volcán Tajumulco, also extending into southern México; *T. pinetorum* Swallen here transferred to *Peyritschia*, from Quetzaltenango near Volcán Santo Tomás, and now known from México; *T. viride* (Kunth) Kunth (syn. *T. altum* Swallen) from El Progreso also widespread in México; *T. irazuense* (Kuntze) Hitchc. from Huehuetenango near Tunimá, mentioned for the first time by Finot et al. (2004), also from Costa Rica, Honduras, Panama, Colombia, Venezuela, Ecuador, and Peru; *T. rosei* Merr. from Huehuetenango from near Volcán Santa María, also extending into México; *T. pringlei* (Scribn. ex Beal) Hitchc. from Huehuetenango and Tonicapán, also found in México, Costa Rica, and Panama; and *T. spicatum* (L.) K. Richt. with a wide distribution in the Americas (Swallen 1955; Pohl 1980; McVaugh 1983; Hernández-Torres 1988; Pohl & Davidse 1994; Finot 2003b; Finot et al. 2004, 2005a, 2005b).

In Ecuador, the following four species of *Trisetum* have been reported: *T. andinum* Benth., endemic to Ecuador; *T. spicatum* and *T. oreophilum* Louis-Marie var. *oreophilum* ranging from Ecuador to Perú and Bolivia (Finot et al. 2005b); and *T. howellii* here trans-

ferred to *Peyritschia*. Species of *Peyritschia* found in Ecuador are: *P. deyeuxioides* and *P. pringlei* (Finot 2003a).

Preliminary phylogenetic analyses using morphological characters within *Trisetum* s.l. (including *Trisetum* s.s., *Peyritschia*, and *Sphenopholis*) [Finot 2004], depicts a well-supported clad (bootstrap of 95 %) that includes *Peyritschia koelerioides*, *P. pringlei*, *P. deyeuxioides*, *P. conferta*, and *T. howellii* Hitchc. This clade is supported by three synapomorphies: terete lemmas in lateral view, two stamens, and ornamentation of the lemma.

In this paper we make two new combinations, *Peyritschia pinetorum* (Swallen) Finot & P.M. Peterson, from Volcáns Atitlán and Santo Tomás, Guatemala, and *P. howellii* (Hitchc.) Finot & P.M. Peterson, from Galápagos, Ecuador. In addition, we include a key to distinguish all seven species, a table comparing their salient morphological features, and a new illustration, description, and SEM photo of the lemmatal surface of *P. pinetorum*.

Peyritschia howellii (Hitchc.) Finot & P.M. Peterson, comb. nov. (Table 1). *Trisetum howellii* Hitchc., Proc. Calif. Acad. Sci., ser. 4, 21(24):296. 1935. TYPE: ECUADOR. GALÁPAGOS ISLANDS: Indefatigable Island, Mt. Crocker, 9 May 1932, J.T. Howell 9208 (HOLOTYPE: CAS-211262; ISOTYPE: US-1611545).

Perennials; culms 35–60 cm tall, weak; internodes glabrous, 5–6 nodes per culm, nodes glabrous. Leaf sheaths shorter than the internodes, glabrous, striate; ligules 0.5–1.5(–2) mm long, apex obtuse, not ciliate, sometimes denticulate, glabrous; blades 8–15 cm × 2 mm, flat, glabrous, smooth, margins sometimes scabrous. Panicles 8–18 cm long, (0.5–)10–20 mm wide, contracted, narrow, lax, somewhat open, exerted or sub-included in the upper sheath; rachis and pedicels glabrous; spikelets 4.5–5.5 mm long, (1–)3-flowered; rachillas 1.5 mm long, copiously pilose, the hairs ca. 1.5 mm long, as long as the rachilla; glumes almost covering the florets, isomorphic, linear to linear-lanceolate, narrow, somewhat scabrous on the keel, the margins hyaline, apex acute, purplish; first glumes 4.3–4.7 × 0.3 mm, 1-nerved; second glumes 4.7–5.5 × 0.4 mm, 1–3-nerved; first lemmas 4–4.5 × 0.5 mm, linear-cylindrical to linear-lanceolate, glabrous, smooth, or scaberulous only towards the apex, purple towards the apex, rounded on the back, the margins enclosing the palea, 5-nerved, awned, the awn 5.5–7 mm long, twisted, geniculate, somewhat scabrous, borne on the upper third of the lemma, at 1–1.5 mm below the apex, the apex bidentate, toothed, acute with the intermediate and marginal nerves conspicuous towards the apex; callus obtuse, with stiff hairs, the hairs 0.5 mm long; paleas 3–4.3 mm long, shorter than the lemmas, 2-nerved, the nerves scabrous towards the apex, apex acute, hyaline; ovary glabrous; lodicules 0.6 mm long, linear, entire; stamens 2, anthers about 0.8 mm long. Caryopses 2 mm long, glabrous; endosperm liquid.

Phenology.—Flowering from September to January. Matures fruits are found from February to March.

Distribution and habitat.—*Peyritschia howellii* is an endemic species from Ecuador. Most of the studied collections come from Isla Santa Cruz (Indefatigable), Galapagos, growing between 480–1000 m; *Jeppesen* 76 (AAU) is the first collection of the species made from Isla San Cristóbal (Chatham).

Comments.—*Peyritschia howellii* was included by Valencia et al. (2000) in the Red Book of the endemic plants of Ecuador (as *Trisetum howellii*).

Additional specimens examined. **ECUADOR. Galápagos Islands:** Isla Santa Cruz, in area that includes W slope of Media Luna, E slope of Cerro de los Caminos and flat plain between, 4 Sep 1975, D.A. & D.B. Clark 447 (AAU); Puntudo, 17 Mar 1977, A. & H. Adersen 1413 (QCA); ca. 600 m, 8 Nov 1966, U. & I. Eliasson 557 (S); sur de Mt. Crocker, 710 m, 17 Oct 1966, U. & I. Eliasson 284 (S); Norte de Bella Vista, 480 m, 19 Oct 1966; U. & I. Eliasson 356 (S); no date, Fagerlind & Wibon 2957 (S); no date, Fagerlind & Wibon 3320 (S); highest mountain top, 860 m, 23 May

TABLE 1. Salient morphological characteristics to distinguish among the seven species of *Peyritschia*.

	<i>P. conferta</i>	<i>P. deyeuxioides</i>	<i>P. howellii</i>	<i>P. humilis</i>	<i>P. pinetorum</i>	<i>P. koelerioides</i>	<i>P. pringlei</i>
Panicle shape	narrow, contracted	lax, somewhat open and nodding	narrow, somewhat open (1-3)	narrow, contracted	narrow, contracted	spiciform somewhat open	narrow,
Number of florets per spikelet	2	2 or 3		2	2	2	2 or 3
Spikelet length (mm)	5.0-5.5	4.5-8.0	4.5-5.5	4	5-7	3-5	4-5.5
Glumes, shape	oval-lanceolate	linear	linear to lanceolate	lanceolate	ovate-lanceolate slightly shorter	lanceolate to ovate-lanceolate longer	lanceolate
Glumes, size versus spikelet	longer	equal, shorter or longer	equal	longer			as long as the florets or longer
Glumes, length (mm)	5.2-5.5	(3.5-4-5.5 (-8)	4.3-5.5	4	4.5-6	3-5	4-5.3
Lemna, length (mm) (lower floret)	3.5-5.0	4-6	4-4.5	3-3.5	5-6	2.5-4	3-4.3
Lemna, apex	bilobed, lobes obtuse	entire or bilobed to bidentate	bidentate, toothed, acute	bilobed, lobes obtuse	bifid, toothed, acute	bilobed, lobes obtuse	bilobed, lobes obtuse
Rachilla, indument	sparsely pilose	copiously pilose	copiously pilose	sparsely pilose	copiously pilose pubescent	glabrous to sparsely pilose	sparsely pilose
Awn, position	basal	median	upper third	middle or lower third	median	apical if present (as a short mucro)	basal
Awn, shape	geniculate, twisted	geniculate, twisted	geniculate, twisted	geniculate, twisted	geniculate, twisted	straight or absent	geniculate, twisted
Awn, length (mm)	6-7	4.5-8(-12)	5.5-7	4-5	7-12	0-1	4.5-7
Callus indument	short pubescent	short pubescent	short pilose	sparsely pilose	pilose	glabrous to short pubescent	short pubescent

1959, *Harling* 5764 (S); 1850 ft, 27 Jul 1974, *van der Werff* 1330 (S); Mt. Crocker, 840 m, 18 Feb 1967, *Wiggins & Porter* 652 (S); fern-sedge zone along trail to Mt. Crocker, 500 m, 6 Feb 1964, *Wiggins* 18577 (S); Isla San Cristóbal, El Junco, 650 m, 28 Feb 1976, *Jeppesen* 76 (AAU).

Peyritschia pinetorum (Swallen) Finot & P.M. Peterson, comb. nov. (**Fig. 1**, Table 1). *Trisetum pinetorum* Swallen, *Phytologia* 4:424. 1953. TYPE: GUATEMALA. QUEZALTENANGO: Volcan Santo Tomás, on pine-*Abies*-clad slope, 2500-3700 m, 22 Jan 1940, *J.A. Steyermark* 34824 (HOLOTYPE: F-1048257; ISOTYPES: MO fragm. ex FI, US-2240525 ex FI, US-2236478 fragm. ex FI).

Perennials; culms 33-70 cm tall, weak, internodes glabrous, 3-4 nodes per culm, nodes glabrous. Leaf sheaths shorter than the internodes, glabrous, striate; ligules 1.5-3 mm long, truncate, dentate-laciniate, glabrous; blades 5-10 cm long, 1-1.5(-2) mm wide, flat, glabrous above and below. Panicles 5-15 cm long, 5-10 mm wide, contracted, narrow, somewhat lax, somewhat interrupted, exerted or sub-included in the upper leaf sheath; rachis glabrous; pedicels scabrous or glabrous. Spikelets 5-7 mm long, 2-flowered; rachillas ca. 1 mm long, copiously pilose, the hairs about 1-2 mm long; glumes slightly shorter than the florets, sub-isomorphic, lanceolate to ovate-lanceolate, the keel smooth to slightly scabrous towards the apex, apex acute; first glumes 4.5-6 × 0.7-0.8 mm, a little shorter and narrower than the second glumes, 1-nerved; second glumes 5-6 × 0.7-0.8 mm, 1- or 3-nerved; first lemma about 5-6 mm long, lemmas glabrous, awned, rounded on the back with involute margins on the lower 1/2 enclosing the palea, the awn 7-12 mm long, twisted, geniculate, and inserted on the median portion of the back, the apex deeply bifid with acute teeth, each tooth with two short awns derived from the prolongation of the marginal and intermediate nerves; callus obtuse, with short hairs, the hairs ca. 1 mm long; paleas about 3.5-4 mm long, shorter than the lemmas, 2-nerved, the nerves scabrous towards the apex, apex acute; lodicules about 0.5 mm long, linear, sometimes with a little lateral lobe near the median portion, the apex subacute; stamens 2, anthers 0.9-1.5 mm long; ovary glabrous. Caryopses not seen.

Lemma micromorphology. Long cells rectangular, 3-12 times longer than wide; anticlinal walls parallel and highly undulate, the undulations U- or V-shaped; periclinal walls flat; silica cells about 10 µm in diameter, short, elliptical; stomata absent; prickly hairs about 45 µm long, ovate-elliptical, restricted to the keel and with a short apical barb; long cells about 10-12.5 µm in diameter, alternating with bordered hooks; macrohairs absent (Fig. 2).

Phenology.—Flowering in January.

Distribution and habitat.—Known only from southwestern Guatemala in Departamentos Quetzaltenango and Sololá. Apparently, *P. pinetorum* is restricted to volcanic soils since the only two localities are from higher elevations (2500-3700 m) on slopes of Volcán Atitlán and Santo Tomás.

Comments.—This new combination can be distinguished from all other known species of *Peyritschia* by having lemma apices that are deeply bifid, and these apices end in four hyaline setae derived from the apical extension of the marginal and intermediate nerves (Table 1). The presence of these setae suggests that *P. pinetorum*, in a phylogenetic sense, lies very near *Trisetum*. Nevertheless, because of the shape of the lodicules (entire in *Peyritschia* and bilobed or toothed in *Trisetum*), the lemmas rounded on the back (versus keeled in *Trisetum*), the awn inserted on the median portion of the lemma (inserted on upper 1/3 in *Trisetum* except in *Trisetum* subgen. *Deschampsioideum* (Louis-Marie) Finot), paleas that are tightly enclosed by the margins of the lemma (gaping in *Trisetum*

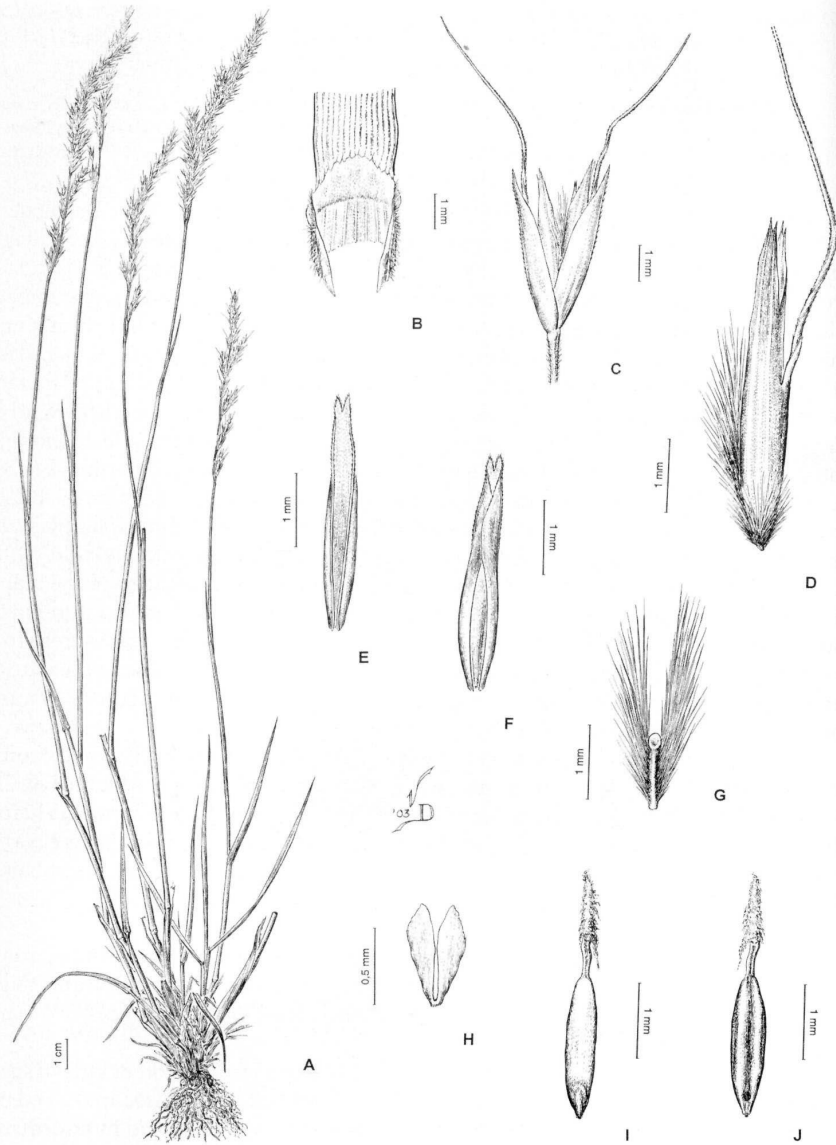


FIG. 1. *Peyritschia pinetorum* A. Habit. B. Sheath, ligule, and portion of the blade. C. Spikelet. D. First floret. E. Palea, dorsal view. F. Palea, ventral view. G. Rachilla. H. Lodicules. I. Ovary/developing caryopsis, dorsal view. J. Ovary/developing caryopsis, ventral view.

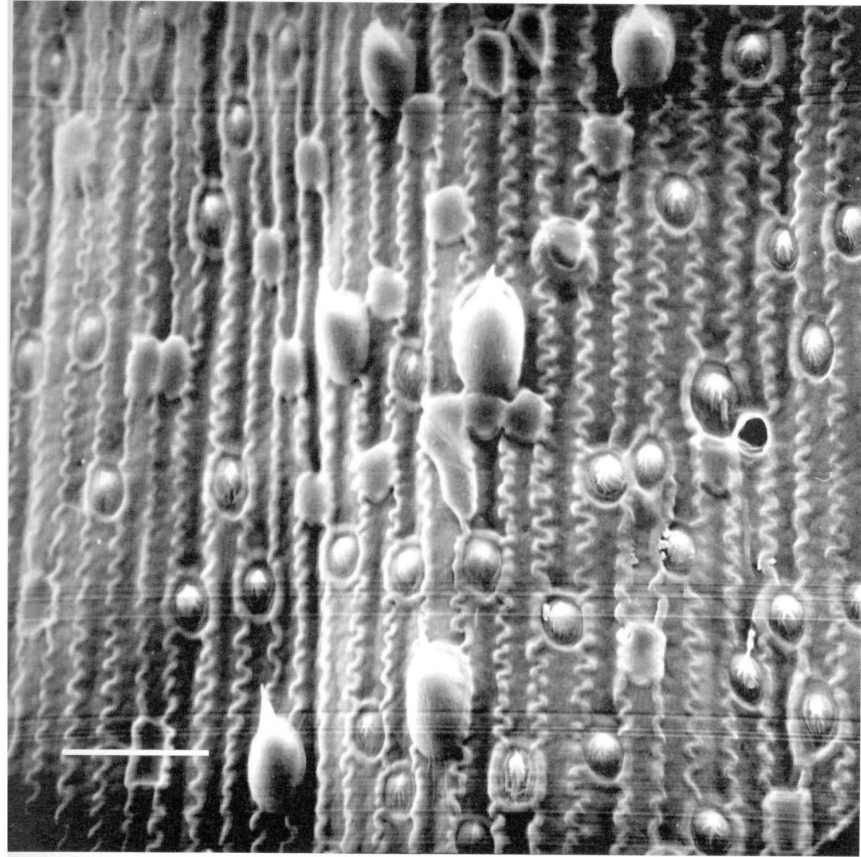


FIG. 2. SEM photograph of the lemma epidermis ($\times 400$) of *Peyritschia pinetorum* (Steiermark 34824) showing bordered hooks alternating with long cells. Scale bar = $55\mu\text{m}$.

and not tightly enclosed by the margins), an androecium with two stamens (3 stamens in *Trisetum*), and lemmatal epidermis with bordered hooks alternating with long cells (verses epidermis without bordered hooks, the hooks not alternating with long cells in *Trisetum*) [Fig. 2.], we place the new species in the genus *Peyritschia*.

Additional specimen examined. **GUATEMALA. Sololá:** Volcán Atitlán, crater ($14^{\circ}35'58.8''\text{N}$ - $91^{\circ}11'9.6''\text{W}$), 11650 ft (3540 m), 23 Jan 1907, W.A. Kellerman s.n. (US-2181368).

KEY TO THE SPECIES OF PEYRITSCHIA

1. Lemma without a dorsal awn, apex muticous or with a subapical mucro _____ ***P. koelerioides***
1. Lemma with a dorsal awn, the awn geniculate and extended beyond the glumes.
 2. Rachilla copiously pilose, the hairs 1–3 mm long; awn borne on the middle or the upper third of the back of the lemma.
 3. Lemma with the apex deeply bifid; panicles 5–15 cm long, contracted, narrow _____ ***P. pinetorum***

3. Lemma with the apex entire or shortly bidentate or bilobate; panicles 8–35 cm long, lax, somewhat open.
4. Rachillas with hairs 2–3 mm long; glumes linear 5.2–5.5 mm long; awn borne on the middle portion of the lemma _____ **P. deyeuxioides**
4. Rachillas with hairs about 1.5 mm long; glumes linear to linear-lanceolate 4.3–5.5 mm long; awn borne on the upper third of the lemma _____ **P. howellii**
2. Rachilla pubescent, the hairs 0.2–0.8 mm long; awn borne near the base of the lemma.
5. Culms 5–12 cm tall; leaf blades 2.3–3.5 cm long; panicles about 2.5 cm long, 0.5 cm wide _____ **P. humilis**
5. Culms 20–200 cm tall; leaf blades 5–15 cm long; panicles 5–20 cm long, 1–4(–4) cm wide.
6. Spikelets 2- or 3-flowered, 4–5.5 mm long; glumes 4–5.3 mm long; lemma 3–4.3 mm long _____ **P. pringlei**
6. Spikelets 2-flowered, 5–5.5 mm long; glumes 5.2–5.5 mm long; lemma 3.5–5 mm long _____ **P. conferta**

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REFERENCES

- CHIAPELLA, J. 2000. Taxonomy, morphology, phylogeny and biogeography of *Deschampsia* (Poaceae-Aveneae). Universidad San Carlos de Bariloche, Doctoral thesis.
- ESPEJO-SERNA, A., A.R. LÓPEZ-FERRARI, and J. VALDÉS-REYNA. 2000. Poaceae. In: A. Espejo-Serna and A.R. López-Ferrari (eds.). Las Monocotiledóneas Mexicanas. Poaceae Barnhart. Una Sinopsis Florística. Partes IX–XI. Pp. 8–236.
- FINOT, V.L. 2003a. *Peyritschia*. P.478. In: Soreng, R.J., P.M. Peterson, G. Davidse, E.J. Judziewicz, F.O. Zuloaga, T.S. Filgueiras, and O. Morrone. 2003. Catalogue of New World grasses (Poaceae): IV. subfamily Pooideae. Contr. U.S. Natl. Herb. 48:1–730.
- FINOT, V.L. 2003b. *Trisetum*. In: Soreng, R.J., P.M. Peterson, G. Davidse, E.J. Judziewicz, F.O. Zuloaga, T.S. Filgueiras, and O. Morrone. 2003. Catalogue of New World grasses (Poaceae): IV. subfamily Pooideae. Contr. U.S. Natl. Herb. 48:659–676.
- FINOT, V.L. 2004. Sistemática del género *Trisetum* Pers. (Poaceae: Aveneae) en América. Una aproximación filogenética basada en datos morfológicos. Universidad de Concepción, Doctoral thesis.
- FINOT, V.L., P.M. PETERSON, R.J. SORENG, and F. ZULOAGA. 2004. A revision of *Trisetum*, *Peyritschia*, and *Sphenopholis* (Poaceae: Pooideae: Aveninae) in México and Central America. Ann. Missouri Bot. Gard. 91:1–30.
- FINOT, V.L., P.M. PETERSON, R.J. SORENG, and F.O. ZULOAGA. 2005a. A Revision of *Trisetum* and *Grapphephorum* (Poaceae: Pooideae: Aveninae) in North America. Sida 21:1419–1453.

- FINOT, V.L., P.M. PETERSON, F.O. ZULOAGA, R.J. SORENG, and O. MATTHEI. 2005b. A Revision of *Trisetum* (Poaceae: Pooideae: Aveninae) in South America. Ann. Missouri Bot. Gard. 92:533–568.
- FINOT, V.L., C.M. BAEZA, and O. MATTHEI. 2006. Micromorfología de la epidermis de la lemma de *Trisetum* y géneros afines (Poaceae: Pooideae). Darwiniana. In press.
- FOURNIER, E. 1886. Mexicanas plantas II. Gramineae 1–xix, 1–160, pl. 1–10. Paris.
- HERNÁNDEZ-TORRES, I. and S.D. KOCH. 1987. The status of the genus *Peyritschia* (Gramineae: Pooideae). Phytologia 61:453–455.
- HERNÁNDEZ-TORRES, I. and S.D. KOCH. 1988. Revisión taxonómica del género *Trisetum* (Gramineae: Pooideae) en México. Agrociencia 71:71–102.
- HITCHCOCK, A.S. 1927. The grasses of Ecuador, Perú, and Bolivia. Contr. U.S. Natl. Herb. 24: 291–556.
- HITCHCOCK, A.S. 1935. The Templeton Crocker expedition of the California Academy of Sciences, 1932, No. 24, new species of grasses from the Galapagos and the Revillagigedo Islands. Proc. Calif. Acad. Nat. Sci., ser. 4 21:25–300.
- KOCH, S.D. 1979. The relationships of three Mexican Aveneae and some new characters for distinguishing *Deschampsia* and *Trisetum* (Gramineae). Taxon 28: 225–235.
- MCVAUGH, R. 1983. Gramineae. Flora Novo-Galiciana 14:1–436.
- PARODI, L.R. 1949. Las gramíneas sudamericanas del género *Deschampsia*. Darwiniana 8: 415–475.
- POHL, R.W. 1980. Gramineae. In: W. Burger, ed. Flora Costaricensis. Fieldiana Bot. n.s. 4:1–608.
- POHL, R.W. and G. DAVIDSE. 1994. *Trisetum* Pers. In: G. Davidse, M. Sousa, and A.O. Chater (eds). Fl. Mesoamer. 6:233–235.
- SWALLEN, J.R. 1955. Gramineae. In: P.C. Standley and J.A. Steyermark, eds. Flora of Guatemala, Part II: Grasses of Guatemala. Fieldiana Bot. 24:1–390.
- VALENCIA, J.I. 1941. Especies críticas de *Trisetum* que deben pasar al género *Deschampsia*. Revista Argent. Agron. 8:122–130.
- VALENCIA, R., N. PITMAN, S. LEÓN-YÁNEZ, and P.M. JØRGENSEN (eds.). 2000. Libro Rojo de las Plantas Endémicas del Ecuador 2000. Pontificia Universidad Católica del Ecuador, Quito.