Agrostis meyenii Trin. (Poaceae, Agrostidinae): first records from Peru, including taxonomic notes and an identification key

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Abstract
The grass Agrostis meyenii Trin. (Poaceae, Agrostidinae) is newly recorded from Peru and is found in high-Andean puna grasslands of the departments of Ancash, Ayacucho, and Huánuco, marking the northernmost known limit of this species. A revised species description, images, taxonomic notes, and a key are also presented to differentiate A. meyenii from similar species in Peru with congested, spike-like panicles and absent or reduced (measuring less than ½ the length of the lemma) paleas (i.e., A. breviculmis Hitchc., A. foliata Hook.f., and A. tolucensis Kunth).

Keywords
Andes, Gramineae, grass, identification key, puna grassland, taxonomy

Introduction
The grass genus Agrostis L. belongs to tribe Poeae R.Br., subtribe Agrostidinae Fr. (Soreng et al. 2017) and is morphologically defined by taxa with membranous ligules, paniculate inflorescences composed of one-flowered, laterally compressed spikelets, glumes usually amply surpassing the florets, florets lacking a rachilla extension emerging from under the palea, and calluses glabrous or short pilose, among other characteristics. The taxonomy of Agrostis is continuing to undergo upheaval as more molecular and morphological data becomes available and, while traditionally considered to contain many genera (e.g. Podagrostis (Griseb.) Scribn. & Merr., Lachnagrostis Trin.) (Clayton and Renvoize 1986; Watson and Dallwitz 1992) many of these have since been considered distinct (e.g. Soreng et al. 2017; Sylvester et al. 2020a).

Within Peru, besides species protologues, the only taxonomic treatment available on Agrostis is the country-wide treatment of the grasses of Peru by Tovar (1993), who cited 15 species. Oscar Tovar Serpa also helped with the checklist for Peru, published in the same year (Davidse et al. 1993), that confusingly cites 18 species, including many, but not all, of those from Tovar’s (1993) treatment, with some of these being placed in synonymy and other species of Bromidium Nees & Meyen being considered under Agrostis (e.g. Bromidium anomalum (Trin.) Döll, B. tandilense (Kuntze) Rügolo), as well as A. magellanica Lam., and A. nigritella Pilg. (= A. foliata Hook.f.). Davidse et al.’s (1993) checklist is also replicated in the W3TROPICOS-Peru Checklist (2020), although many of the names have since been placed in synonymy.
or transferred to other genera (Soreng et al. 2003, 2003 and onwards; Sylvester et al. 2020a). Despite ca 27 years since the publication of the aforementioned checklist and taxonomic treatment (Davidse et al. 1993; Tovar 1993), no new records or discoveries of new species of *Agrostis* have been made for Peru until now. During herbarium research at the United States National Herbarium (US), specimens of *Agrostis meyenii* Trin., a species recorded further south in Bolivia, Argentina, and Chile (Reinvoize 1998; Rúgolo de Agrasar 2012; Jørgensen et al. 2014), were encountered and mark the northernmost distribution of this species recorded to date. With the addition of *A. meyenii*, and including taxa previously circumscribed in *Bromidium* based on indications from recent phylogenetic research (Tkach et al. 2020), it is currently estimated that 13 species of *Agrostis* are present in Peru (A. breviculmis Hitchc.; A. foliata Hook.f.; A. gigantea Roth; A. hyemalis (Walter) Britton, Sterns & Poggenb.; A. imberbis Phil.; A. koelerioidea E.Desv.; A. mertensii Trin.; A. meyenii; A. perennis (Walter) Tuck.; A. stolonifera L.; A. subrepens (Hitchc.) Hitchc.; A. tandilensis (Kuntze) Parodi; A. toloacensis Kunth) (Davidse et al. 1993; Tovar 1993; Soreng et al. 2003 and onwards; Plants of the World Online 2020; Sylvester et al. 2020a). However, a taxonomic reappraisal of Peruvian *Agrostis* is urgently needed, with our research contributing to this.

**Methods**

Accepted species follow Soreng et al. (2003 and onwards). Herbarium acronyms follow Thiers (2020). The US herbarium was visited during the study. The identity of the *A. meyenii* voucher specimens for Peru was verified by morphological comparison with type specimens at the US herbarium and on JSTOR Global Plants (https://plants.jstor.org/) and other specimens collected from Argentina and Chile, while ascertaining that morphological characteristics coincide with those stated in type protologues and taxonomic literature (Rúgolo de Agrasar 1997; Reinvoize 1998; Rúgolo de Agrasar 2012). The presence of *Agrostis* species in Peru was checked against the Catalogue of the Flowering Plants and Gymnosperms of Peru (Davidse et al. 1993), additions to this (Vásquez et al. 2002; Ulloa Ulloa et al. 2004; Smith et al. 2005; Rodriguez et al. 2006; Salvador et al. 2008; Linares et al. 2010; Humantupa et al. 2014; Gonzáles et al. 2011, 2016; Sylvester et al. 2016, 2017), and online checklists for Peru (Plants of the World Online 2020; W3TROPICOS-Peru Checklist 2020). In this treatment, glabrous means without pubescence (in the sense of slender, relatively soft hairs unless otherwise stated). Smooth indicates no prickly-hairs with broad bases and/or hooked or pointed apices (i.e., pubescence can occur on a smooth surface, and a rough or scabrous surface can be glabrous).

*Bromidium* is likely a synonym of *Agrostis* (Tkach et al. 2020) but *B. anomalum* and *B. tandilense*, which are stated to occur in Peru (Davidse et al. 1993; Tovar 1993) and have congested inflorescences and florets lacking a palea, have not been included in the identification key. These can be easily differentiated from other *Agrostis* taxa by the lemma apex terminating in four scabrous setae, lemma surface often pilose, lemma with a well-developed geniculate awn inserted in the lower third and surpassing the glumes, calluses pilulose, caryopsis thin, with liquid endosperm (vs lemma apex entire or finely dentate with short teeth at the end of each lateral vein, lemma surface glabrous (rarely with a few hairs in *Agrostis castellana* L.), lemmas muticous, with a short straight awn 0.2–1 mm long, or with a long geniculate and twisted awn to 6+ mm long, inserted basally, medi- or in the upper half of the lemma, not surpassing to greatly surpassing the glumes, calluses usually glabrous or with hairs restricted to lateral lines continuous with the basal lemma margins, caryopsis usually rounded, with hardened endosperm in *Agrostis* taxa from Peru).

**Results**


**Type.** Chile. Colchagua: Cordilleras ad St. Fernando, sin. col., s.n. (holotype: LE-TRIN-1623.01 (photo SGO); isotype: BAA (BA000001357 fragm. ex LE-TRIN [image])).


New records. PERU—Ancash • Prov. Recuay, Cordillera Blanca, 35 km NE of Catac on road towards Chavin de Huantar, [09°38′38.69″S, 077°12′6.72″W], 4140 m alt., large granitic boulders with *Polylepis* and *Buddleja*, 21 Mar. 1997, P.M. Peterson et al. 13837 (US00844194).—Ayacucho • Lucanas province, 39 km S of Putajasa, 14°20′12.9″S, 074°21′18.6″W, 4080 m alt., rocky flats with *Deyeuxia [Cinnagrostis]*, *Festuca* and *Myriocarpa*, 24 Feb. 2002, P.M. Peterson et al. 16207 (US00844234).—Huánuco • Huamalies province, 21 km N of Pinos on road towards Ponto, 09°24′40.1″S, 076°56′02.2″W, 4450 m alt., open grassy slopes with *Calamagrostis [Cinnagrostis]*, *Agrostis* and *Poa*, 23 Mar. 2004, P.M. Peterson 17920 (US00844265).

Additional material examined. ARGENTINA—Chilecito • Prov. de La Rioja, Sierra de Famatina, camino a La Mejicana, 3500 m alt., 5 Feb. 1927, L.R. Parodi 7952 (US1298751).—Mendoza • Malargue, Andes, Rio Salado headwaters, Valle de las Lenas, 36 km NW of Las Lena son Hwy 222, 65 km NW of Malargue, 2740 m alt., 5 Mar. 2006. P.M. Peterson 19194 (US00093121).—Neuquen • Colorado, 1650 m alt., 19 Feb. 1940, Diem 256 (US1910171); Parque Nacional Nahuel Huapi, filo entre Mineo y Tres Marias, 25 Feb. 1953, O. Boelcke 7220 (US2929788) • Rio Negro, Bariloche, Parque Nacional Nahuel Huapi, along trail and slopes to waterfall at Cerro Tronador, 1050 m alt., 29 Jan. 2003, P.M. Peterson 17337 (US00786717).—Santa Cruz • Lago Buenos Aires, 77 km SW of Los Antiguos on road towards Paso
Habitat and ecology. Throughout its range, _A. meyenii_ tends to grow in humid sites among pampa and high-elevation puna grasslands, such as in damp rock crevices and swamps, or forming lawns near rivers and streams. In Peru, the species is known to grow in open or rocky humid puna grassland alongside species of _Cinnagrostis_ Griseb., _Festuca_ L., and _Poa_ L., as well as growing in _Polylepis_ Ruiz & Pav. and _Buddleja_ L. woodland.

Phenology. _Agrostis meyenii_ appears to flower principally from January to March. In Peru, flowering is known from February to March, which is towards the end of the rainy season.

Similar species. _Agrostis toluicensis_ is similar in its overall appearance, usually being tufted and with rhizomes, having similar ligules and filiform or flat leaf blades, and having a condensed spike-like panicle with spikelets of similar size. _Agrostis toluicensis_ can usually be differentiated from _A. meyenii_ by the presence of an awn inserted in the lower third of the lemma, 2–3.5 mm long, twisted and bent and exerted from the glumes (vs muticous or, if awn present, inserted in the middle or upper third of the lemma, to 1.3 mm long, straight or slightly flexuous in _A. meyenii_). _Agrostis glomerata_, a species described from Peru and here tentatively considered a synonym of _A. toluicensis_, also has muticous lemmas or with a short straight awn inserted in the upper half of the lemma, but can be differentiated from _A. meyenii_ by the plants being generally taller, 20–60 cm tall, with flat blades to 5 mm wide, and condensed panicles often >10 cm long that are often interrupted and with the central inflorescence axis notably wider compared to the lateral branches. The pedicels, panicle branches, and sometimes the central inflorescence axis of _A. toluicensis_ and _A. glomerata_ are also notably scabrous while those of _A. meyenii_ are usually smooth or lightly scabrous (but see below). Some specimens of _A. meyenii_ from Argentina (Peterson 19194 (US00093121)) and Chile (Boelcke 2445 (US2919945)) were found to have many spikelets in the inflorescence slightly shorter than normal, to 2 mm long, which could make them be mistaken for _A. breviculmis_, but these had extravaginal branching and folded, filiform, leaf blades.

Identification key differentiating _Agrostis meyenii_ from other species of _Agrostis_ in Peru with condensed spike-like panicles and reduced or absent paleas <½ the length of the lemma (updated descriptions for taxa mentioned can be found in Sylvester et al. 2020b)

1. Lemma muticous, mucronate, or exceptionally with a short straight awn to ca 1.3 mm long, subapical or inserted above the middle of the lemma, weak and falling easily, not or barely exerted from the glumes ........................................... 2

1’. Lemma with a dorsal awn, (1.6–)2–6 mm long, persistent, twisted and bent, exerted from the glumes 4

2. Spikelets 1.5–2.1 mm long (–2.5 mm in Bolivia sensu Renvoize 1998); leaf blades convolute, involute, or strongly conduplicate, usually recurved, rigid,
0.5–2(–3) mm wide when opened out; tillers intra-vaginal, without cataphylls, not stooling and without notable lateral tending or ascending rhizomes; plants 3–12(–15) cm tall ........................................... 2′. Spikelets 2–4.1 mm long; leaf blades filiform, flat, conduplicate or laxly rolled, straight or flexuous, lax and soft, 1–5 mm wide when opened out (sometimes involute, recurved and/or rigid in basal leaves of \( A. tolucensis \)); tillers extravaginal with cataphyllous shoots present, often with notable lateral tending or ascending rhizomes or stooling; plants 2–35+ cm tall ................................. 3

3. Panicle branches, pedicels, and central inflorescence axis usually smooth or very lightly scaberulous; culms (3–)5.5–51(–80) cm tall, often > 15 cm tall; panicles (1−)2–15 cm long, often >10 cm long, interrupted; spikelets 2–3(−3.5) mm long; glumes equal or subequal, keels and often surfaces scabrous at least in the distal half; lemma 1.4–2 mm long ................................. \( A. tolucensis \) Kunth

(= syn. \( Agrostis glomerata \) (J. Presl) Kunth)

4. Leaf blades 2–6 mm wide, flat or folded, sometimes somewhat involute towards their apices, subcoriaceous to coriaceous, usually scabrous throughout; flag ligules 4–7 mm long; panicle 1–1.7(–2.5) cm
wide, with primary lateral branches up to 7 cm long; spikelets (3–)3.5–4.2 mm long; floret usually ca ½ the length of the glumes, rarely slightly longer .......................... *A. foliata* Hook.f. 4’. Leaf blades 1–3(–5) mm wide, filiform, flat or folded, sometimes involute or convolute, lax to firm but not (sub-)coriaceous, scabrous in the margin and veins or smooth throughout; flag ligules 2–4(–6.2) mm long; panicle 0.1–1.5 cm wide, with primary lateral branches 0.5–1.5 cm long; spikelets 2–3(–3.6) mm long; floret ½−2(½−¾) the length of the glumes .......................... *A. tolucensis* Kunth

**Discussion**

*Agrostis meyenii* is here presented as a new country record for Peru and is not mentioned in any of the checklists (Davidse et al. 1993; Ulloa Ulloa et al. 2004; Rodriguez et al. 2006; Plants of the World Online 2020; W3TROPICOS-Peru Checklist 2020). The species was previously known from high-elevation puna grassland and pampa of Argentina, Chile (Rúgolo de Agrasar 2012), and Bolivia (Renvoize 1998; Jørgensen et al. 2014) (Fig. 2). In Peru, *A. meyenii* is found in dry high-Andean puna grassland as far north as the Huamallees province of Huánuco department, being also found close by in the Cordillera Blanca of Ancash department (Fig. 2). These collections are ca 1200 km to the northwest of the previously northernmost collection in Murillo, district of La Paz, Bolivia (Renvoize 1998; Jørgensen et al. 2014). The species is also found further south in Peru, in the Lucas province of Ayacucho department, and it is likely to extend across the puna grassland biome of the central Andes, but has so far been unrecorded.

*Agrostis meyenii* has also been mentioned in a key for a selection of Ecuadorian and Colombian *Agrostis* species with contracted inflorescence at maturity with more or less appressed branches (Palacio et al. 2020), although specific reference to the species being a new country record for either Ecuador or Colombia was not stated. However, while at the US National Herbarium we have not encountered specimens of *A. meyenii* from Ecuador or Colombia, with all specimens at the US determined as *A. meyenii* being reetermined as *A. glomerata* (J. Presl) Kunth, here considered a synonym of *A. tolucensis* (see “Similar species” above). Nevertheless, the apparent affinity of *A. meyenii* for humid sites within the pampa and puna makes it plausible that it may occur in humid Jala and páramo grasslands farther north. This notion is further supported by the large ecological amplitude exhibited by the species, with it being found from sea level in the Tierra Del Fuego (Rúgolo de Agrasar 2012) to over 4450 m altitude in high-Andean dry puna. The species was previously known to 4200 m altitude (Rúgolo de Agrasar 2012) with the Peruvian collection from Huánuco, *P.M. Peterson* 17920 (US00844265), marking the highest elevation recorded for the species.

*Agrostis meyenii* also exhibits a large amount of phenotypic variability that requires further study. While Rúgolo de Agrasar (2012) stated that the panicle branches and pedicels in *A. meyenii* are completely smooth or exceptionally scaberulous, specimens from Argentina (e.g. Boelcke 7220 (US2929788), Peterson 17222 (US00765622), 17274 (US00787134), 19194 (US00093121)), and Chile (Boelcke 2445 (US2919945), Pfister 7515 (US2150305)) bore most characteristics of *A. meyenii* but had moderately scabrous panicle branches and pedicels. Further study is needed to clarify the variation in this character and whether these bear more affinity to *A. tolucensis*. Panicle branches and pedicels of specimens studied from Peru were usually smooth or very lightly scaberulous. *Peterson* 13837 (US00844194) exhibits slight differences from the current circumscription of the species, being found 35–40 cm tall, and with culm blades to 9.5 cm long and panicles 8.5–13 cm long. The spikelets of this specimen also differed slightly, with the lower glume keels being scabrous in the upper two-thirds, while the upper glume was often smooth. *Peterson* 17920 (US00844265) also had particularly long leaf blades to 11 cm long. Specimen *Peterson* 16207 (US00844234) is typical of *A. meyenii* from Austral South America.

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**Authors’ Contributions**

SPS designed the study, reviewed herbarium specimens, made the identifications, and wrote the manuscript; MDVPS contributed to writing the manuscript and preparing the figures.

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