

AGROSTIS LACUNA-VERNALIS (POOIDEAE: POEAE: AGROSTIDINAE),  
A NEW SPECIES FROM CALIFORNIA

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ABSTRACT

**Agrostis lacuna-vernalis** P.M. Peterson & Soreng, sp. nov., is described and illustrated. The new species occurs within or on the margins of vernal pools in Monterey County, California and is known only from the former Fort Ord Army Military Base. The new species is morphologically similar to *A. blasdalei* but differs by having an annual habit, shorter glumes (1.5–2.4 mm versus 1.8–4 mm), shorter lemmas (1.1–1.5 mm versus 1.5–3 mm), and longer paleas (0.4–0.7 mm versus  $\pm 0.3$  mm).

RESUMEN

Se describe e ilustra una nueva especie, **Agrostis lacuna-vernalis** P.M. Peterson & Soreng, sp. nov. La nueva especie ocurre dentro o en de los márgenes de piscinas vernaes en el condado de Monterey, California y se sabe solamente del anterior la Fort Ord Army Military Base. La nueva especie es morfológicamente similar al *A. blasdalei* pero diferencia teniendo un hábito anual, los glumas más cortos (1.5–2.4 mm contra 1.8–4 mm), los lemas más cortos (1.1–1.5 mm contra 1.5–3 mm) y los paleas más largos (0.4–0.7 mm contra  $\pm 0.3$  mm).

A small annual species of *Agrostis* L. had gone undetected on the former Fort Ord Army Military Base, now Fort Ord Public Lands (administered by the Department of Defense and the Department of the Interior, Bureau of Land Management) in Monterey County, California. Ellen Holmes, Nicolas Jensen, Randall Morgan, Dylan Neubauer, David Styer, and Vern Yadon initially collected this enigmatic grass but were unable to name it. Consequently, PMP and RJS were contacted for help, and based on their knowledge, it did not appear to be any previously described species of *Agrostis*. Since the new taxon is annual in habit, has narrow panicles, and has spikelets with awnless lemmas that are smooth and glabrous and relatively long paleas, there is nothing similar to it in the Flora of North America (Harvey 1993, 2007) and the second edition of the Jepson Manual (Peterson & Harvey in press). The possibility that the plant might be an introduction was considered, but it does not match any species from elsewhere in the world (Clayton et al. 2006). Earlier work on native coastal California *Agrostis* by Crampton (1967) recognized *A. clivicola* Crampton with two varieties, both now placed in synonymy of *A. densiflora* Vasey, and *A. blasdalei* var. *marinensis* Crampton, now placed in synonymy of *A. blasdalei* Hitchc. (Harvey 1993, 2007; Peterson & Harvey in press).

*Agrostis* is a member of the subtribe Agrostidinae and tribe Poeae in the subfamily Pooideae (Soreng et al. 2007). The Agrostidinae are distributed globally in temperate regions and tropical mountains, include 16 genera in some 550 species worldwide (Clayton & Renvoize 1986), and can be characterized by single-flowered

spikelets, glumes exceeding the lemma, lemmas with lateral veins extending to the apex, usually dorsal awns, hyaline paleas, membranous ligules, and caryopses with a punctiform hila and short embryos. The subtribe includes the diverse, ecologically important, and morphologically difficult genera: *Agrostis* (approximately 220 species), *Calamagrostis* Adans. (approximately 270 species), as well as other smaller genera (Saarela et al. 2010). In this paper we describe this unusual annual species as new to science.

***Agrostis lacuna-vernalis*** P.M. Peterson & Soreng, sp. nov. (**Fig. 1**). TYPE: U.S.A. CALIFORNIA. Monterey Co.: Fort Ord Army Military Base, Butterfly Valley, 2.8 km SSW of East Garrison and 9 km SW of Salinas, 36°37' 56.2"N, 121°44' 39.2"W, 140 m, 27 Apr–22 May 2010, R. Morgan, D. Styer & D. Neubauer s.n. (HOLOTYPE: US-3621794).

Ab *Agrostis blasdalei* plantis annuis, glumis 1.5–2.4 mm longis, lemmatibus 1.1–1.5 mm longis, paleis 0.4–0.7 mm longis, recedit.

Loosely tufted annuals; major roots 0.1–0.3 mm diam.; culms (1.5–)5–30 cm tall, slender (ca. 0.25 mm diam.), erect to decumbent at the base, or slightly geniculate, smooth; internodes 2 or 3 per culm, nodes yellowish-brown, smooth, glabrous. Vegetative shoots intravaginal, prophylls (within 1–3 cm of the base), flattened and papery, 2 keeled, smooth except on the keels. Leaves mostly cauline and basal; sheaths  $\frac{2}{3}$  to  $\frac{3}{4}$  as long as the internodes below, open to the base, margins broadly overlapping; ligules of upper leaves 1.2–1.7 mm long, hyaline, margins decurrent, abaxially lightly scabrous, apex acute to obtuse, erose, scabrous; blades 1.4–5(–11) mm long, 0.3–1(–1.5) mm wide, flat, folded to loosely involute on drying, thin and delicate, margins moderately minutely scaberulous, abaxially lightly scaberulous. Panicles 1–7.5 cm long, 1–6 mm wide, narrow, spicate, with 12–90(–110) spikelets, 1–3 branches per node; branches mostly 0.6–1.4 cm long, strict, appressed to suberect, capillary, moderately scabrous, hooks not in distinct lines; pedicels shorter or up to 2.5× longer than the spikelets, distally slightly expanded 0.2–0.3 mm just below the spikelet. Spikelets 1.5–2.4 mm long, 1-flowered; rachilla extension absent; glumes 1.5–2.4 mm long, longer than the floret, subequal (first slightly larger), ovate, herbaceous to scarious, greenish to distinctly purplish, 1-veined, laterally compressed, smooth to minutely muriculate below, scaberulous on the upper sides or only near the apex, more coarsely scaberulous along mid-vein from near the base, the minute hooks whitish under 10–50× magnification, apex mostly acute, scaberulous, margins lightly scabrous with slender hooks from near the middle to the apex; callus distinct, short, blunt, smooth, glabrous, disarticulation scar round; lemmas 1.1–1.5 mm long, subchartaceous, fragile, glossy, obscurely 5-veined, smooth, glabrous, clear to light green with a purplish blush near the vein tips and sometimes on the sides, unawned, keel vein extending to near the apex, the lateral veins faintly visible near the apex where there is commonly some purple coloration, margins broadly overlapping to within 0.15 mm of the base, smooth, apex obtuse to truncate, erose with age; paleas 0.7–1.1 mm long, about  $\frac{1}{2}$ – $\frac{2}{3}$  as long as the lemma, scarious-hyaline, smooth, obscurely 2 veined, the veins closely spaced, the outer margin broader than the inter-keel gap, apex obtuse and minutely erose; stamens 3, anthers 0.4–0.7 mm long, yellowish; lodicules 2, 0.4–0.5 mm long, hyaline, slightly acentrically s-shaped, elliptic-lanceolate, entire, glabrous; ovary glabrous with two terminal adjacent styles and two stigmas. Caryopses 0.9–1.2 mm long, sub-adherent to the palea, ellipsoid, ventrally longitudinally distinctly grooved, dorsiventrally compressed, light greenish-brownish, translucent, embryo about  $\frac{1}{8}$  the length of the fruit, hilum indistinct, endosperm slightly malleable (lipid present).

*Comments.*—The new species can be distinguished from other species of *Agrostis* in North America by the following combination of characters: annual habit, narrow spicate panicles, spikelets with a glabrous callus, unawned lemmas that are smooth and subchartaceous, and anthers 0.4–0.7 mm long. The species is named after the habitat, vernal pool; “lacuna” for pool, and “vernalis” for spring or ephemeral.

*Distribution and habitat.*—*Agrostis lacuna-vernalis* is known from Mima mound area in Butterfly Valley (Fort Ord Army Military Base) and Machine Gun Flats (Fort Ord Public Lands) on the Monterey Peninsula between 115–145 meters elevation. It grows within or on the margins of vernal pools and is associated with (\*= exotic/introduced): *\*Aira caryophyllea* L., *Allium hickmanii* Eastw., *\*Avena barbata* Link, *\*Briza minor* L., *Brodiaea terrestris* Kellogg ssp. *terrestris*, *\*Bromus hordeaceus* L., *Calochortus uniflorus* Hook. & Arn., *Castilleja ambigua* ssp. *insallutata* (Jeps.) T.I. Chuang & Heckard, *Cicendia quadrangularis* (Lam.) Griseb., *\*Cotula coro-*

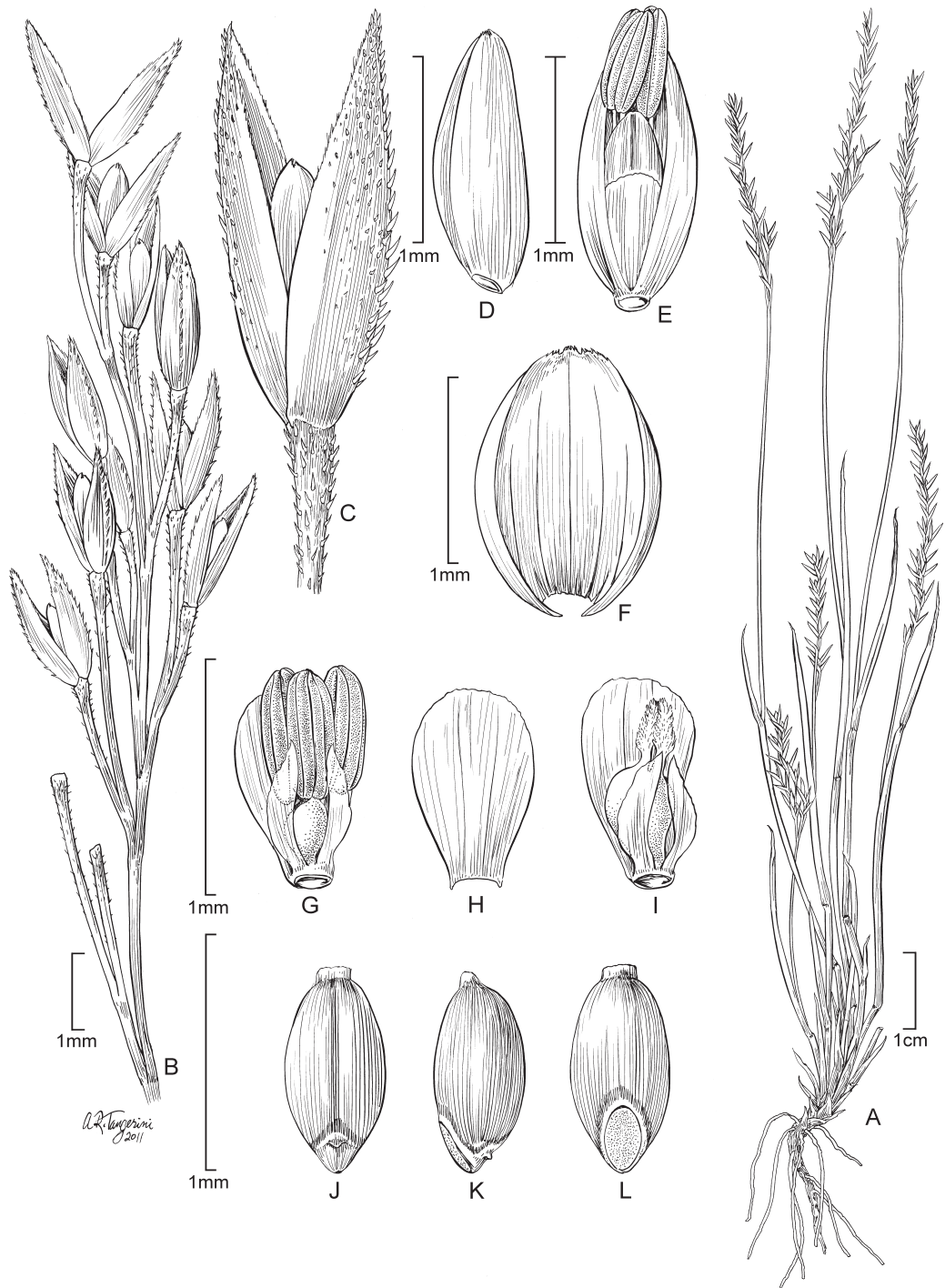


FIG. 1. *Agrostis lacuna-vernalis* [R. Morgan, D. Styer & D. Neubauer s.n. (US)]. A. Habit. B. Branch. C. Spikelet. D. Lemma, lateral view. E. Floret. F. Lemma, ventral view. G. Lodicules, stamens, pistil, and palea. H. Palea, dorsal view. I. Lodicules, pistil, and palea. J. Caryopsis, ventral view. K. Caryopsis, lateral view. L. Caryopsis, dorsal view.

*nopifolia* L., *Danthonia californica* Bol., *Deschampsia danthonioides* (Trin.) Benth., *Elatine brachysperma* A. Gray, *Eleocharis acicularis* (L.) Roem. & Schult., *Eryngium armatum* (S. Watson) J.M. Coult. & Rose, *Isoetes howellii* Engelm., *Juncus bufonius* (L.) var. *bufonius*, \**J. capitatus* Weigel, *Lasthenia conjugens* Greene, *Leptosiphon parviflorum* Benth., *Lilaea scilloides* (Poir.) Hauman, \**Lolium multiflorum* Lam., \**Lythrum hyssopifolia* L., *Microseris paludosa* (Greene) J.T. Howell, *Montia fontana* L., *Plagiobothrys chorisianus* var. *hickmanii* (Greene) I.M. Johnst., *Pilularia americana* A. Braun, \**Plantago coronopus* L., *P. elongata* Pursh, *P. erecta* E. Morris, *Psilocarphus chilensis* A. Gray, *Ranunculus californicus* Benth., *Sisyrinchium bellum* S. Watson, *Trifolium barbigerum* Torr., *T. buckwestiorum* Isely, *T. polyodon* Greene, *T. truncatum* (Greene) Greene, *T. variegatum* Nutt., and \**Vulpia bromoides* (L.) Gray.

Additional specimens examined. **U.S.A. California. Monterey Co.:** Butterfly Valley, 24 May 2011, D. Styer, C. Schneider, S. Hubbard, N. Wigington & K. Kasunich 1 (JEPS); D. Styer, C. Schneider, S. Hubbard, N. Wigington & K. Kasunich 2 (CAS); D. Styer, C. Schneider, S. Hubbard, N. Wigington & K. Kasunich 3 (US); D. Styer, C. Schneider, S. Hubbard, N. Wigington & K. Kasunich 4 (RSA); Machine Gun Flats, 27 May 2011, D. Styer s.n. (JEPS, US).

#### DISCUSSION

The new species can be distinguished from other species of *Agrostis* in North America and California by possessing the following combination of characters: annual habit, narrow spicate panicles, spikelets with a glabrous callus, unawned lemmas, palea  $\frac{1}{2}$ – $\frac{2}{3}$  the lemma, and anthers 0.4–0.7 mm long. *Agrostis lacuna-vernalis* is morphologically similar to three other California natives, *A. blasdalei*, *A. densiflora*, and *A. variabilis* Rydb. (Peterson & Harvey in press; Table 1). The new species differs from *A. blasdalei* by having an annual habit, shorter glumes (1.5–2.4 mm versus 1.8–4 mm), shorter lemmas (1.1–1.5 mm versus 1.5–3 mm), and longer paleas (0.4–0.7 mm versus  $\pm 0.3$  mm). It differs from *A. densiflora* by having an annual habit, narrower blades [0.3–1 (–1.5) mm versus 2–10 mm], shorter lemmas (1.1–1.5 mm versus 1.5–2 mm), and a glabrous callus (versus minutely hairy). It differs from *A. variabilis* by having an annual habit, shorter lemmas (1.1–1.5 mm versus 1.5–2 mm), well-developed paleas (0.4–0.7 mm versus absent or minute), and a glabrous callus (versus minutely hairy). The new species also resembles *Agrostis muelleriana* Vickery from Australia and New Zealand but differs by having both cauline and basal leaf blades (mostly basal in *A. muelleriana*), narrower leaf blades [0.3–1 (–1.5) mm versus 1–5 mm], shorter ligules (1.2–1.7 mm versus 2–3 mm), shorter glumes [1.5–2.4 mm versus (2–)2.2–3.5 mm], shorter lemmas 1.1–1.5 mm versus 1.3–2 (–3) mm], and longer paleas (0.4–0.7 mm versus vestigial or absent) [Jacobs 2009].

Although we consider the new species to belong to *Agrostis* s.s., generic concepts in *Agrostis* s.l. have only been superficially examined by DNA studies (Soreng et al. 2007; Saarela et al. 2010), and their taxonomy can be controversial. The Poaceae editor for the Jepson Manual: Vascular Plants of California, ed. 2 (JMVPC2) treats in *Agrostis* one annual we prefer to treat as *Bromidium tandilense* (Kuntze) Rúgolo, and two perennials we prefer to classify as *Lachnagrostis filiformis* (G. Forst.) Trin. and *Podagrostis thurberiana* (Hitcch.) Hultén. The separation of these genera from *Agrostis* was/is accepted in the Catalogue of New World Grasses (Soreng et al. 2003, 2011) and was accepted for the Flora of North America (Barkworth et al. 2007). Under the imposed JMVPC2 generic concept there are now five annual species of *Agrostis* in California. Below we present a modified key to these annuals, adding the new species to the *Agrostis* treatment of Peterson & Harvey (in press) in JMVPC2.

The new species is globally rare. It is locally frequent, but only known from within a 2.5 km<sup>2</sup> area, and then only within wetlands in that area. There are estimated to be between 1000 and 10,000 individuals. Its maximum potential range is limited; similar, more or less intact Mima mound/vernal pool habitat covers less than 5 km<sup>2</sup> in the region (estimated from Google, DigtalGlobe aerial photo projection). Possible threats include competition from exotic grasses and other plants, and destruction of habitat from road building, off road vehicles, domestic livestock grazing, and adverse changes to the drainage patterns.

TABLE 1. Morphological and habitat comparison of *Agrostis lacuna-vernalis* to similar California grasses *A. blasdalei*, *A. densiflora*, and *A. variabilis*.

Species	<i>A. blasdalei</i>	<i>A. densiflora</i>	<i>A. variabilis</i>	<i>A. lacuna-vernalis</i>
Longevity	perennial	perennial	short-lived perennial	annual
Lemma length (mm)	1.5–3	1.5–2	1.5–2	1.1–1.5
Lemma awn (mm)	occasionally present, 4–7.5, geniculate	occasionally present, < 3.5, straight	generally absent	absent
Lemma texture & vestiture	scareous, easily torn or punctured, mat to sub-lustrous, smooth, nerves distinct	scareous, easily torn or punctured, mat to sub-lustrous, smooth, nerves distinct	scareous, easily torn or punctured, mat to sub-lustrous, smooth, nerves distinct	subchartaceous, glossy, smooth, easily fractured, nerves obscure
Palea length (mm)	ca. 0.3	0.5–0.7	absent or minute	0.7–1.1
Palea/Lemma ratio	< 1/3	± 1/3	n/a or <1/10	1/2–2/3
Anther length (mm)	1–2	± 0.5	0.5–0.7	0.4–0.7
Callus	glabrous	minutely hairy	minutely hairy on the margins	glabrous
Panicle density	dense	dense	fairly dense	fairly dense
Panicle exertion	base generally included in upper sheath	well exerted	well exerted	well exerted
Longest branches (cm)	< 0.5	< 0.5	0.5–1.5	0.6–1.4
Elevation (m)	< 100	< 200	1600–4000	115–145
Habitat	coastal bluffs, dunes, scrub, gravelly soils	coastal bluffs, cliffs, scrub, sandy soils	meadows, talus slopes, subalpine forests, and alpine	vernal pools around Mima mounds

## KEY TO THE ANNUAL SPECIES OF “AGROSTIS” IN CALIFORNIA

1. Lemmas awnless \_\_\_\_\_ *A. lacuna-vernalis*
1. Lemmas awned from back or near the tip.
  2. Panicles open, generally oblong to ovate in outline; spikelets not crowded, panicle axes clearly visible \_\_\_\_\_ *A. eliottiana* Schult.
  2. Panicles dense, generally cylindrical; spikelets crowded, overlapping, panicle axes not clearly visible.
  3. Lemma teeth 4, two < 1 mm long, other two 1–1.5 mm; lemmas awned below middle; callus densely short-hairy  
\_\_\_\_\_ *A. tandilensis* (Kuntze) Parodi
  3. Lemma teeth 0 or 2, equal in length; lemmas awned at or above middle; callus generally sparsely hairy, hairs minute.
    4. Lemmas 2–4 mm long, awn 8–10 mm long \_\_\_\_\_ *A. hendersonii* Hitchc.
    4. Lemmas 1.5–2 mm long, awn 3.5–8 mm long \_\_\_\_\_ *A. microphylla* Steud.

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