SYNOPSIS OF *GALVEZIA* (PLANTAGINACEAE: ANTIRRHINEAE), INCLUDING A NEW CRYPTIC SPECIES FROM SOUTHERN PERU

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ABSTRACT

A generic synopsis is provided for *Galvezia* Dombey ex Juss. (Plantaginaceae: Antirrhineae), a genus of shrubs with red to white, tubular flowers endemic to coastal Ecuador and Peru and the Galapagos Islands (Ecuador). **Galvezia elisensii** M.O. Dillon & Quipuscoa, a new cryptic species, is described from southern Peru, bringing the total number of species to four.

RESUMEN

Se presenta la sinopsis del género *Galvezia* Dombey ex Juss. (Plantaginaceae: Antirrhineae); se trata de un género pequeño, compuesto por arbustos con flores de rojo a blanco, tubulares, endémico del lado occidental de Ecuador y Perú y de las Islas Galápagos (Ecuador). Se describe además, una nueva especie, **Galvezia elisensii** M.O. Dillon & Quipuscoa, procedente del Sur de Perú, haciendo un total de cuatro especies en la actualidad.

INTRODUCTION

Galvezia Dombey ex Juss. (Plantaginaceae: Antirrhineae) is a genus of shrubs with tubular flowers distributed along the coast of Ecuador and northern to southern Peru, and one species confined to the Galapagos Islands (Elisens 1989, 1992; Wiggins & Porter 1971; Brako & Zarucchi 1993; Jørgensen & León-Yanez 1999). With the addition of the new species described here, the genus is comprised of four species. The North American taxa previously attributed to *Galvezia* are now placed in *Gambelia* Nutt., e.g., *G. speciosa* Nutt. (Sutton 1988; Elisens & Nelson 1993). The phylogeny of the tribe Antirrhineae, including *Galvezia* and *Gambelia*, has been investigated with molecular techniques (Ghebrehiwet et al. 2000; Medhanie et al. 2000; Oyama & Baum 2004; Vargas et al. 2004); however, a more robust sampling will be necessary before relationships can be resolved with confidence.

During the strong El Niño year of 1983, the senior author collected a specimen of *Galvezia* from the *Lomas de Atiquipa* in Department of Arequipa in southern Peru. A duplicate of that collection (*M. Dillon & D. Dillon 3776*) was forwarded to Dr. Wayne Elisens for identification and he indicated that it was potentially a new species, distinct from its northern congeners. He subsequently visited southern Peru and made collections (*Elisens 844, 845, 847*, all OKL) that were included in his study of genetic divergence in *Galvezia* (Elisens 1992). While not included in his 1992 study, the sample of *M. Dillon & D. Dillon 3776* was included in his analysis of *Gambelia* (Elisens & Nelson 1993, p. 456) and termed "*G. sp. nov.*"

The overall morphological variation in the continental species is not profound, with differences typically confined to corolla size, anther filament pubescence, and leaf shape. Attention has been drawn to differences in habit, but these are not useful in species recognition. Authors of recent floras have adopted a broad species concept for *Galvezia* by placing several species into the synonymy of *G. fruticosa* J.F. Gmel (Brako & Zarucchi 1993; Jørgensen & León-Yánez 1999). However, data supporting narrower species circumscriptions have been convincingly presented (Elisens 1992; Elisens & Nelson 1993), even though they prove difficult to quantify and qualify (i.e., cryptic species). Cryptic species represent a situation where speciation has already broken the gene flow between populations, but where evolution has not progressed to a point where easily recognizable adaptations are visually obvious (Bickford et al. 2007; Schlick-Steiner et al. 2007).

In his discussion of results from allozyme divergence patterns in *Galvezia*, Elisens argued that data supported the taxonomic distinctness of the Galapagos endemic, *G. leucantha* Wiggins, and three mainland species: *G. fruticosa*, *G. grandiflora* (Benth.) Wettst. (as *G. ballii* Munz + *G. lanceolata* Pennell), and a "*sp. nov.*" based upon his collections from southern Peru (referenced above). He stated that the pattern of allozyme variation suggested *G. fruticosa*, *G. leucantha*, *G. sp. nov.*, and *G. grandiflora* (as *G. ballii*) had undergone a gradual genetic divergence following their reproductive isolation. He stated that the recognition of *G. lanceolata* in central coastal Ecuador by Pennell (1946) and Sutton (1988) was not supported by his electrophoretic and morphological data. Rather, the data were most concordant with recognition of only one species in northern Peru and coastal Ecuador (the name *G. grandiflora* has priority). Finally, Elisens suggested that, "systematic data support delimitation of an undescribed species, *G. sp. nov.* In addition to unique leaf and floral characters and an allopatric distribution, *G. sp. nov.* is differentiated from other species in *Galvezia* by three marker alleles."

Elisens (1992) accepted three mainland species, *G. fruticosa*, *G. grandiflora* (i.e., *G. ballii* + *G. lanceolata*) and an additional taxon (*sp. nov.*) described here, based upon southern Peruvian material from the Departments of Ica and Arequipa. We accept Wettstein's (1891) transfer of Bentham's *Galvezia limensis* (Dombey ex Chav.) Benth. var. *grandiflora* Benth. as *Galvezia grandiflora* (Benth.) Wettst. All specimens cited here have been examined unless otherwise indicated (n.v.).

TAXONOMIC HISTORY

Pennell (1946) provided a detailed discussion of the taxonomic history of *Galvezia*, but a summation of the pertinent literature is merited. *Galvezia* was originally proposed by Joseph Dombey, the French botanist who accompanied Ruiz and Pavón during their explorations of Peru and Chile. Dombey left South America in 1784, before Ruiz & Pavón, and, in clear violation of stated protocols, Dombey began publishing selected new taxa he had encountered. The generic description for *Galvezia* appeared in J.F. Gmelin's edition of Linnaeus' Systema Naturae (2: 937) in 1791, where Dombey proposed the genus *Galvezia* in honor of Don José de Gálvez y Gallardo, marqués de Sonora and minister of the Council of the Indies (b. 1720–d. 1787). A note with Dombey's specimen at Kew suggests that his plant was gathered in 1779 near Lima. The alternate spelling, *Galvesia*, has been accepted by some databases, but is here rejected given the origin of the generic name.

Ruiz and Pavón did not accept *Galvezia sensu* Dombey, and believing it to be a species of *Dodartia* L., a Palaearctic genus. They published new name, *Dodartia fragilis* in 1798 based upon the Dombey publication in Jussieu (1789). They considered that the generic name *Galvezia* was open and they described another *Galvezia* in Florae Peruvianae et Chilensis Prodromus, 56 in 1794 in the Rutaceae. Chavannes in his Monographie des Antirrhinees (1833), accepted the generic concept of *Galvezia*, but with Ruiz and Pavón's genus evidentially occupied, he proposed *Agassizia* (p. 180) and described *A. limensis* for Dombey's plant collected near Lima. He provided an illustration (Plate XI) clearly representing *G. fruticosa*.

When Bentham treated the Scrophulariaceae for DeCandolle's Prodromus in 1846, he adopted Dombey's name and attributed it to Jussieu. He also established a varietal name, *Galvezia limensis* ß *grandiflora,* for material gathered further north near the port city of Paita and cited *F. Hall 10* (K000528872). *Galvezia* was accepted in Wettstein's treatment of the Scrophulariaceae in Engler and Prantl's Pflanzenfamilien (1895). Wettstein attempted to provide a new combination for Bentham's variety; however, he appears to attribute the original authorship to "(Kell.)" and mentioned California. These errors led Munz to reject the combination by Wettstein and provide a new name for Bentham's variety, *Galvezia ballii* and citing the type locality as Paita (as Payta), Peru. He based his superfluous name upon *J. Ball s.n.* (US1323500, US251553). In 1946, Pennell described *G. lanceolata* from the region of Manabí, Ecuador, and provided a key to allow for discrimination of *G. fruticosa*, *G. lanceolata*, and *G. ballii*.

TAXONOMY

Galvezia Dombey ex Juss., Gen. Pl. 119. 1789. Type: *G. fruticosa* J.F. Gmel., Syst. Nat. 2:937. 1791. Non *Galvezia* Ruiz & Pav., Fl. Peruv. Prodr. 56. 1794.

Much-branched shrubs to 2 m tall, erect, arching or pendent; glabrous to pubescent. **Leaves** opposite, or occasionally 3 at a node, simple, the blades ovate-lanceolate to elliptic, pinnate-nerved, the margins entire, the bases cuneate to subcordate, the apices acute. **Inflorescences** paniculate. **Flowers** axillary; calyx 5-merous, ovate to lanceolate, the apices acute; corollas red to white, tubular, bilabiate, the tube elongate, subcylindric, the base expanded to subgibbose, the upper lip erect, bilobed, the lobes ovate, the lower lip trilobed, the lobes plane to reflexed; stamens didynamous, 4 fertile, one aborted; anthers bilocular; ovary ovoid to spheric. **Fruit** capsules, globose to subglobose, cartaceous, chambers dehiscent by 1–2 pores, seeds oblong-truncate. Chromosome number: unknown.

Galvezia Dombey ex Juss. is a genus of small shrubs with tubular flowers. Four species are recognized with the addition of this new species from southern Peru; three confined to western Ecuador and Peru and one endemic species to the Galapagos Islands (Ecuador). All continental species possess deep red to crimson corollas, whereas the island species have variously colored corollas (see discussion below).

Wiggins (1968) addressed the difference or loss of floral coloration in some of the island species and attributed the shift to white corollas to the absence of hummingbirds within the islands; however, it has never been fully documented that hummingbirds were the pollination vectors in the mainland species. Information on pollination vectors is now available and possible vectors could be members of the Sphingidae, Lepidoptera (Cock & Boos 2006).

KEY TO *GALVEZIA* SPECIES

The following key will allow for identification of *Galvezia* species (adapted from Pennell 1946)

1. Galapagos Islands, Ecuador _____ **G. leucantha**Wiggins
1. Mainland Ecuador and Peru.
   2. Cauline leaves elliptic to elliptic-lanceolate, 15–25 mm long, 3–5 mm wide, pedicles 8–12 mm long, stout, straight to slightly curved, corollas 8–9 mm long (southern Peru) _____ **G. elisensii** M.O. Dillon & Quipuscoa
   2. Cauline leaves ovate-lanceolate to lanceolate, 20–25 mm long, 5–15 mm wide; pedicles 8–20 mm or longer, filiform, distally coiled or strongly incurved, corollas 12–22 mm long (central Peru to Ecuador).
      3. Corolla 12–14 mm long, the lips about ⅓ length of tube; pedicels as long as, or longer than, the subtending leaves, leaf-blades about 2 cm long, on petioles ca. 2 mm long; shrubby (central to northern Peru) _____ **G. fruticosa** J.F. Gmel.
      3. Corolla 14–22 mm long, the lips about ½ length of tube; pedicels shorter than the subtending leaves, leaf-blades and bracts lanceolate; suffrutescent to herbaceous throughout (northern Peru to Ecuador) ____ **G. grandiflora** (Benth.) Wettst.

1. Galvezia elisensii M.O. Dillon & Quipuscoa, sp. nov. (**Figs. 1–3**). TYPE: PERU. AREQUIPA. CARAVELÍ: Lomas of Atiquipa, ca. 10.5 km N of turn-off to Atiquipa, km 584 S of Lima, 150–200 m, 1 Nov 1983, *M. Dillon & D. Dillon 3776* (HOLOTYPE: F; ISOTYPES: CPUN, GH, HUT, K, MO, NY, OKL, TEX).

Galvezia fruticosa J.F. Gmel. simile, sed foliis brevioribus et angustioribus et pedicellis brevioribus.

Much branched shrubs; branches erect to arching, 0.8–1.2 m long; young stems green, maturing reddish. **Leaves** opposite, the blades elliptic to elliptic-lanceolate, (10–)15–25(–30) mm long, (2–)3–5(–15) mm wide, the base narrowly cuneate, the apex acute, glabrous, semisucculent, occasionally sparsely puberulent; petioles (0.5–)1–2.5(–3) mm long, ca. 0.3 mm in diameter. **Inflorescences** paniculate. **Flowers** axillary; the pedicles stout, (5–)8–12(–18) mm long, glabrous, straight to slightly curved; calyx lobes ovate to lanceolate, c. 2.5 mm long, c. 1.5 mm wide, apices obtuse, glabrous; corollas tubular, (7–)8–9(–10) mm long, 2.5–3 mm wide, outside puberulent, red, slightly ampliate, the limb bilabiate, superior lip 3–4.5 mm, bilobed, erect, purberulent, the lower lip trilobate, 2.5–3.5 mm long, base of lower lip folded, glandular-puberulent; stamens didynamous, dorsal pair 5.5–7 mm long; ventral pair, 7–9 mm long, filaments glabrous distally, glandular-papillate basally; anthers thecae 1–1.4 mm long; fifth stamen sterile, c. 1 mm long; ovary ovate, 1.5–2 mm long, 1–1.5 mm wide, puberulent. **Fruit** subglobose, glabrous, 4–6 mm long, 4.5–7 mm in diameter, deep red at maturity; seeds (40–)140–175 per capsule, subtruncate, black, c. 1 mm long.

Etymology.—This species is dedicated to Dr. Wayne J. Elisens, Professor and Curator of the Robert Bebb Herbarium on the campus of the University of Oklahoma, Norman. His recognition of this taxon, as reflected in its allelic profiles, has led to its description here.

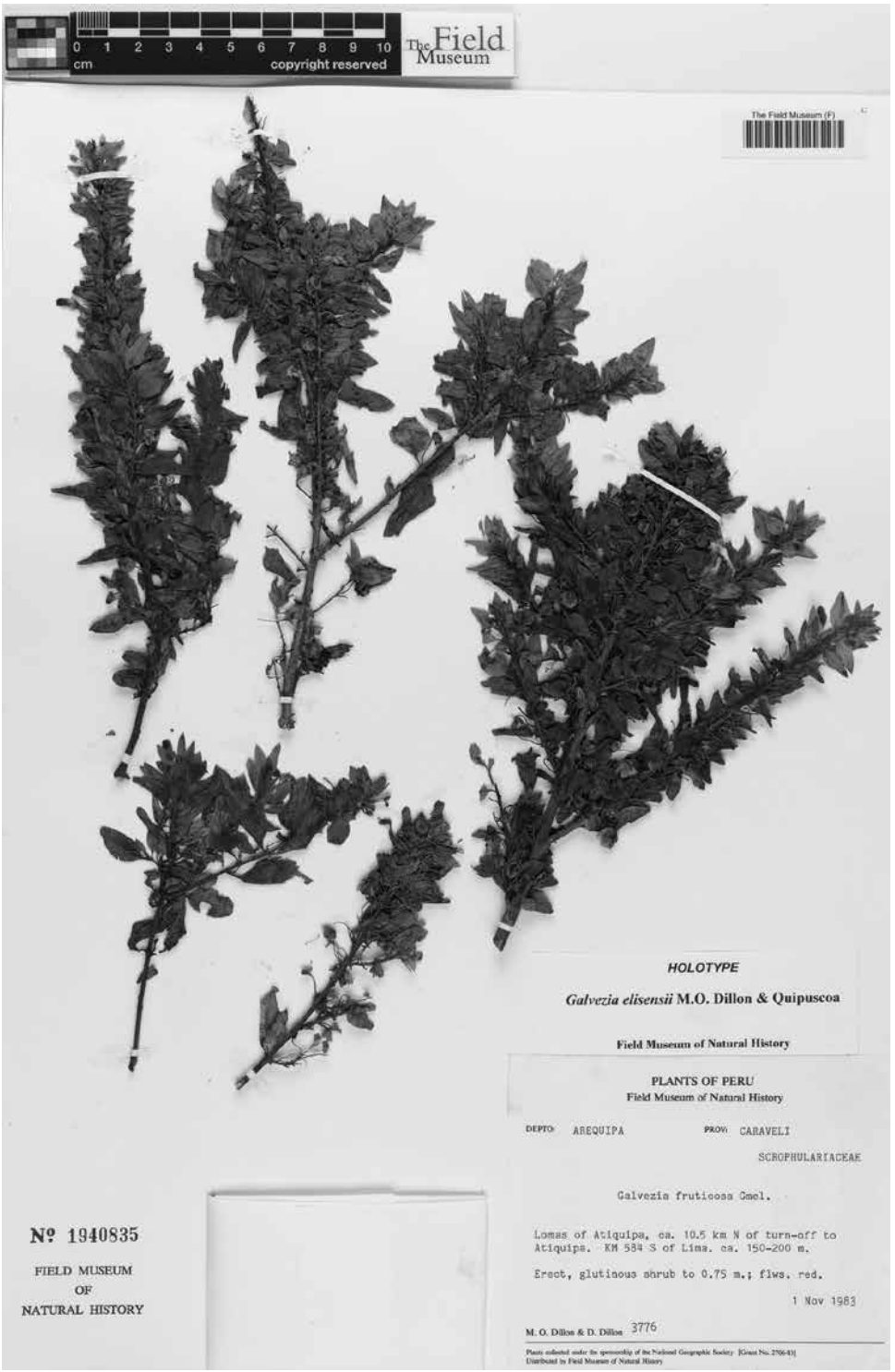

Fig. 1. *Galvezia elisensii*. Photograph of holotype collection, *M. Dillon & D. Dillon 3776* (F1940835).

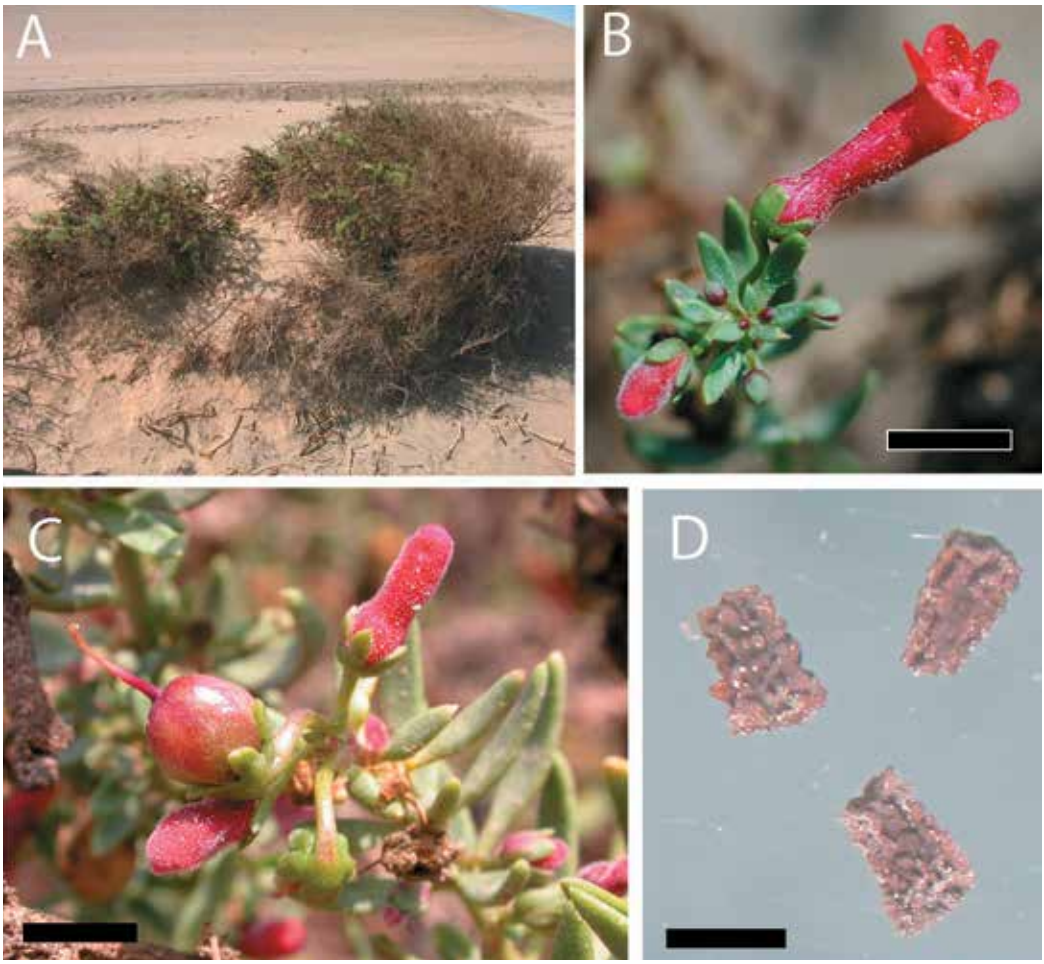

Fig. 2. *Galvezia elisensii*. **A.** Habit in coastal desert of Department of Arequipa, Peru. **B.** Flower at anthesis, bar = 5 mm. **C.** Maturing gynoecium, bar = 2 mm. **D.** Seeds, bar = 1 mm.

Distribution & Biogeography.—The type locality of this new species is in the area of the *Lomas de Atiquipa* (15°48'S, 74°22'W, Department Arequipa), but its distribution extends northward to Palpa (Department Ica).

The presence of endemic taxa in southern Peru is a common pattern. From studies of the distribution of *lomas* plants in coastal Peru and Chile, floristic sectors have been recognized, including a northern Peru unit (7°55'S–12°00'S latitude), a south Peru unit (12°S–18°S), and a north Chile unit (20°S–28°S) (Rundel et al. 1991; Dillon et al. 2009). This pattern is found in several groups, including *Nolana* (Dillon et al. 2009) and hypotheses of pattern formation remain to be tested. Dillon et al. (2009, 2011) discussed the sectoring of coastal environments. Long-term climatic changes have been associated with glacial cycles (13,000–200,000 year cycles); and there have been at least 20 glacial cycles during the Pleistocene, each of approximately 200,000 years. The formation of glaciers on mountains and poles caused sea levels to fluctuate dramatically. Estimates of sea level fluctuation range between 400–750 ft (120–230 m) and this lowering would have significantly changed the position of the seashore 18,000 years ago, in relation to that today. This drop would have exposed a considerable area of the continental shelf and displaced *lomas* formations, especially between 5°S to 15°S latitude. Glacial cycles would also have had a profound influence on the flora of the coastal deserts by provid-

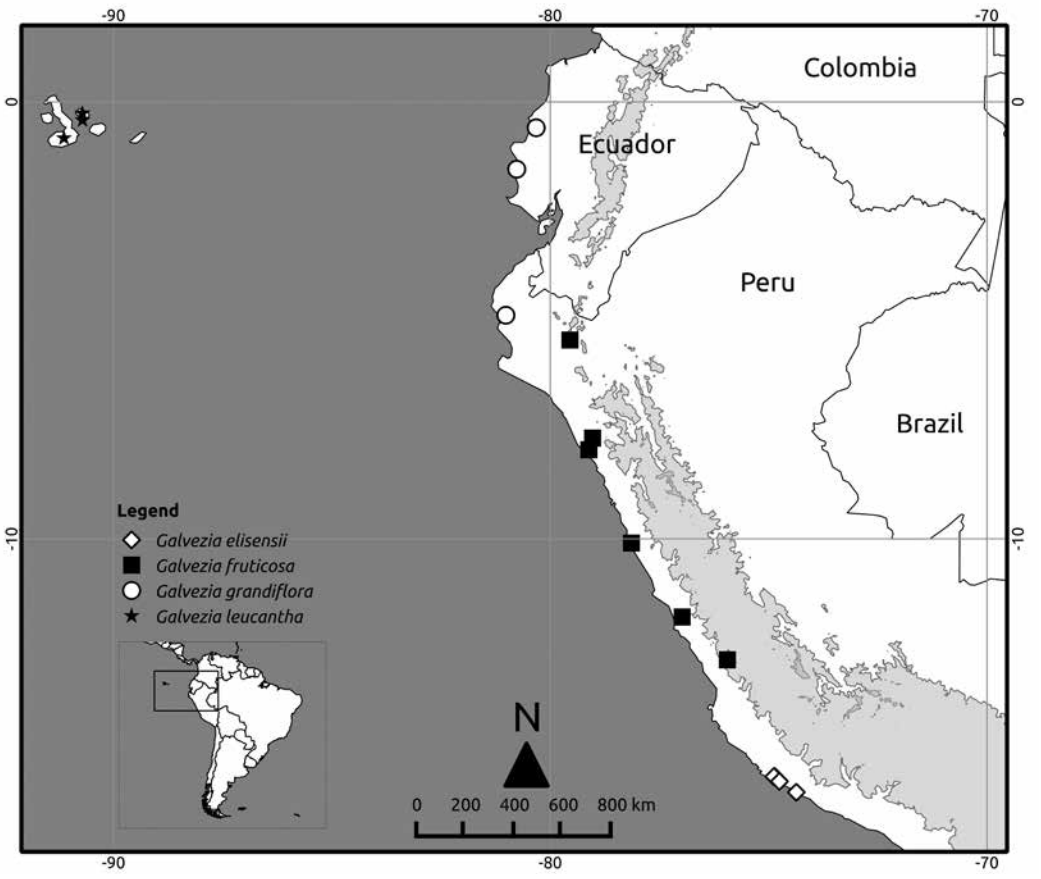

Fig. 3. Distribution of *Galvezia* in western Ecuador and Peru and the Galapagos Islands (Ecuador).

ing geographic isolation at certain times, and at other times, opportunities for merging species, thereby allowing for gene exchange. Paradoxically, this would have also allowed for fragmenting populations, shifting their ranges in relation to the near-ocean environments, adapting to changing conditions *in situ*, or undergoing range reductions and extinction.

The situation in *Galvezia* seems to conform to the pattern of other species reflecting sectoring and influence of past climate changes. The close relationship between *G. fruticosa* (northern sector) and *G. elisensii* (southern sector) suggests a north to south pattern. The relationship with the northern Peruvian and Ecuadorian populations included in *G. grandiflora* (i.e., *G. lanceolata* + *G. ballii*) suggests a pattern influenced by the most recent climatic change during the last glacial cycle (Weng et al. 2006).

Evolutionary Relationships.—Elisens (1992) admitted, that while isozyme data could not resolve evolutionary relationships among *G. fruticosa*, *G. elisensii* (as *G. sp. nov.*), and *G. leucantha*, the close affinity of these species was supported by several shared, advanced, morphological characters, a large number of shared alleles and separation from *G. grandiflora* (as *G. ballii* and *G. lanceolata*) in all networks.

Additional material examined: **PERU. Arequipa:** Provincia Caravelí, Sur de Nazca entre Km 518 y Km 590, 15°26'S, 74°52'W, 80 m, 13 Nov 2005, *M.O. Dillon, V. Quipuscoa, E. Ortiz, M. Corrales & G. Castillo 8792, 8796* (HUSA, F); Distrito Bella Unión: ca. Km 544 Panamericana Sur, entre División Puerto Lomas y Chaviña, 15°33'06.2"S, 74°45'11.4"W, 57 m, 09 Jun 2012, *V. Quipuscoa S., S. Montesinos R., L. Apaza Ch. & F. Miauri Ch. 5058* (HUSA, F, USM, HAO, HUT). **Ica:** Provincia Ica. ¼ mi W of Pan-American Hwy, 15°26'30.5"S, 74°52'50.7"W, 280 m, 19 Feb 1994, *T. Anderson, J. McAulifee, K. & F. Katterman, C. Diaz, C. Ostolaza, G. Lombardi, & W. Hodgson 7874* (ASU0047094, F2144517). Provincia

Nazca, Marcona: Sur de Nazca entre Km 518 y Km 590, 15°26'S, 74°52'W, 80–310 m, 13 Nov 2005, *M.O. Dillon, J. Wen, V. Quipuscoa, E. Ortiz, M. Corrales, & G. Castillo 8792* (F2276589), *8796* (F2276592); Panamericana Km 424 (ca. 2 km S of Mirador Maria Reiche on the Nazca geoglyphs), 700–750 m, 1 Oct 1997, *M. Weigend & H. Förther 97/631* (F2184045). Provincia Pisco, 1 km before Puente Huaytará (Km 73 road Pisco-Ayachucho), 1450 m, 29 Sep 1997, *M. Weigend & H. Förther 97/586* (F2184124).

2. Galvezia fruticosa J.F. Gmel., Syst. Nat. 2:937. 1791. (**Fig. 3**). Type: PERU. Lima: 1779, *J. Dombey 7* (holotype: MPU020307; isotypes: BM, K000528873).

Dodartia fragilis Ruiz & Pav., Syst. Veg. Fl. Peruv. Chile 1:97. 1798. Type. PERU. Lima: *Ruiz López & Pavón s.n.* (holotype: MA815219, based upon *Galvezia* Dombey ex A.L. Jussieu).

Agassizia limensis Dombey ex Chav., Monog. Antirrh. 180, tab 11, 1833. Type. PERU. Lima: *J. Dombey 7* (holotype: MPU020307; isotypes: BM001010978, K).

Galvezia limensis (Dombey ex Chav.) Benth., in DC., Prodr. 10:296. 1846.

Galvezia fruticosa is distributed along coastal Peru from Lima, north to Piura. It exhibits considerable environmental latitude with populations ranging to interior habitats along the western versant of the Andes. Overall, the dimensions of leaves are larger, and the blades wider and ovate to lanceolate with distinct petioles. A few isolated populations in the north have leaf morphologies approaching those exhibited by *G. elisensii* to which it is putatively most closely related (Elisens 1992).

Specimens examined: **PERU. Ancash:** Provincia Casma, ca. 48 km N of Pativilca on PanAmericana Hwy, 10 m, 13 Oct 1984, *M.O. Dillon & M. Whalen 4007* (F1953250). Provincia Huarmey, Panamericana Norte Km 660, 47 m, 10 Oct 2000, *M. Weigend, H. Förther, & N. Dostert 2000/667* (F2229797). Provincia Recuay, Km 46 on road from Pativilca to Recuay, ca. 580 m, 27 Jan 1983, *M. Dillon, U. Molau, & P. Matekaitis 3073* (F1932856). **Cajamarca:** Provincia Contumazá, Ascope – Algarrobal, 150 m, 29 Dec 1983, *A. Sagástegui A. & J. Mostacero L. 11332* (F1942599); El Portachuelo, 780 m, 20 Apr 1984, *A. Sagástegui A. 11388* (F1949672); Rupe – Huertas, 1200 m, 17 Jun 1994, *A. Sagástegui A., S. Leiva G., & P. Lezama A. 15362* (F2145086); Contumazá, La Paloma, 950 m, 5 May 1984, *I. Sánchez Vega 3390* (F1953515); San Miguel, entre Quindén y Platanar, 650–1100 m, 6 Oct 2001, *E. Rodríguez R., E. Alvítez I., E. López M., J. Cabrera C. & J. Chávez G 2411* (F2230009). **La Libertad:** Provincia Trujillo, base Cerro Campana, 150 m, 9 Jun 1985, *J. Mostacero L. et al. 696* (F1994334). **Lima:** Provincia Canta, Canta Valley, 26 km N of Lima, 350 m, 4 Aug 1957, *P.C. Hutchison 1001* (F1569722). Provincia Yauyos, road from Pacaran to Yauyos, Km 35.8 after Pacaran, 1500 m, 12°46'12"S, 77°56'41"W, 6 Oct 2002, *M. Weigend, M. Ackermann, A. Cano, M. I. La Torre 7209* (F2247324).

3. Galvezia grandiflora (Benth.) Wettst., Nat. Pflanzenfam. 4(3b):61. 1891. (**Fig. 3**). *Galvezia limensis* var. *grandiflora* Benth. In: DC., Prodr. 10:296. 1846. Type. PERU. Piura: Payta [Paita], *F. Hall 10* (Holotype: K000528872).

Galvezia ballii Munz, Proc. Calif. Acad. Sci. ser. 4, 15:379. 1926. nom. illeg., superfluous renaming.

Galvezia lanceolata Pennell, Notul. Natl. Acad. Nat. Sci. Philadelphia 179:5. 1946. Type: ECUADOR. Manabí: above Aguas Blancas, on the road from Puerto López to Los Peñas, 9 Jul 1942, *O. Haught 3386* (holotype, PH, n.v.; isotype: US1708104, image 00122131).

Galvezia grandiflora encompasses the species diversity exhibited over a wide range of habitats extending from northern Peru (Province Paita, Department Piura) to central Ecuador (Prov. Manabí, 1°32'S, 80°44'W). It is unclear what factors have maintained genetic differentiation between *G. grandiflora,* with its southernmost distributional terminus in northern Piura, and *G. fruticosa,* which extends north to the Sechura Desert (Elisens 1992).

Munz (1926, p. 379–380) discussed the validity of Wettstein's combination, but rejected it as confusing, and to eliminate confusion, he proposed *Galvezia ballii* Munz with collections by *J. Ball s.n.* types (US251553, image 00122129, US13223550, image 00122130). With the acceptance of Bentham's name as combined by Wettstein, *G. ballii* Munz becomes a superfluous renaming. The acceptance of Bentham's variety at the level of species also encompases the taxa formerly treated under *G. lanceolata* Pennell.

Specimens examined: **ECUADOR. Manabí:** between Bahía de Caráquez and San Agustín, 0–150 m, 9 May 1980, *G. Harling & L. Andersson 18957* (F1930417). **PERU. Piura:** Paita, Amotape, 4°53'S, 81°1'W, 18 Feb 1984, *C.P. Cowan 4487* (F2038375).

4. Galvezia leucantha Wiggins, Occas. Pap. Calif. Acad. Sci. 65:1. 1968. (**Fig. 3**). Type: ECUADOR. Galápagos Islands: Isla Isabela, 29 Jan 1967, E side of ridge near foot of Tagus Cove Mountain, NE of Caleta Tagus (Tagus Cove), ca. 1.5 to 2 km from the beach, about 95 m, *I.L. Wiggins & D. Porter 247* (holotype: CAS633842, image 002778; isotype: K).

Galvezia leucantha, including its various subspecies, is restricted to the Galapagos Islands (Ecuador) and has been discussed and mapped (Elisens 1989; McMullen & Elisens 2000; Tye & Jäger 2000; Jaramillo-Díaz et al. 2014).

Wiggins (1968) described *G. leucantha* subsp. *leucantha* stating (p. 4) the following, "The most striking feature differentiating this species from those heretofore placed in *Galvezia* is the waxy white corolla. All the species of *Galvezia* described previously have deep red corollas, none of the shades within their range even approaching pink or white." However, far from being a discriminating character, corolla color is variable. McMullen (pers. comm.) has observed that on Rabida Island *Galvezia* are described as possessing "... outside of the corolla is completely reddish purple, while the insides ranges from pink to white." (McMullen & Elisens 2000). Further, Tye and Jäger (2000) described the *Galvezia* on Santiago Island with the following corolla description "... exterior magenta with the tips of the upper lobes white, while the interior is pink and white striped." Wiggins went on to state that "... the calyx lobes of *G. leucantha* are considerably more slender, longer in relation to their width, and long in *toto* than those in *G. fruticosa*. Whereas the calyx and pedicles of *G. fruticosa* are closely glandular-puberulent, the calyces and pedicles of *G. leucantha* are wholly glabrous." Obviously, for the discrimination of these subspecies, it is best to rely upon comparative morphology or geography of collections rather than their corolla color.

Galvezia leucantha subsp. **leucantha** Wiggins

Galvezia leucantha subsp. **porphyrantha** Tye & H. Jäger, Novon 10:165. 2000. Type: ECUADOR. Galápagos Islands: Isla Santiago, Cerro entre Bahía Ladilla y Cabo Nepean, 13 Nov 1998, ca. 40 m, *H. Jäger y A. Tye 53* (holotype: CAS1084133, bcode#0002779; isotype: CAS1084015, image 0002780).

Galvezia leucantha subsp. **pubescens** Wiggins, Occas. Pap. Calif. Acad. Sci. 65:6. 1968. Type: ECUADOR. Galápagos Islands: Isla Rábida (Jervis Island), occasional near the shore and from 500–950 ft, 20 Dec 1905, *A. Stewart 3441* (holotype: CAS, n.v.).

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REFERENCES

Bentham, G. 1846. Scrophulariaceae, *Galvezia*. In: DC. Prodr. 10:295–296.

Bickford, D., D.J. Lohman, N.S. Sodhi, P.K.L. Ng, R. Meier, K. Winker, K.K. Ingram, & I. Das. 2007. Cryptic species as a window on diversity and conservation. Trends Ecol. Evol. 22:148–155.

Brako L. & J. Zarucchi. 1993. Catalogue of the flowering plants and gymnosperms of Peru. Monogr. Syst. Bot. Missouri Bot. Gard. 45: 1–1286.

Cock, M.J.W. & J.O. Boos. 2006. Observations on Sphingidae (Lepidoptera) from Talara, North central Perú. Rev. pera. Entomol. 45:75–78.

Chavannes, E.J. 1833. *Agassizia limensis* Dombey ex Chav., Monogr. Antirrhin. 180.

Dillon, M.O., T. Tu, L. Xie, V. Quipuscoa S., & J. Wen. 2009. Biogeographic diversification in *Nolana* (Solanaceae), a ubiquitous member of the Atacama and Peruvian Deserts along the western coast of South America. J. Syst. Evol. 47:457–476.

Dillon, M.O., S. Leiva G., M. Zapata C., P. Lezama A., & V. Quipuscoa S. 2011 (2012). Floristic Checklist of the Peruvian *Lomas* Formations – Catálogo florístico de las *Lomas* peruanas. Arnaldoa 18(1):7–32.

Elisens, W.J. 1989. Genetic variation and evolution of the Galápagos shrub snapdragon. Natl. Geogr. Res. 5:98–110.

Elisens, W.J. 1992. Genetic divergence in *Galvezia* (Scrophulariaceae): Evolutionary and biogeographic relationships among South American Galápagos species. Amer. J. Bot. 79:198–206.

Elisens, W.J. & A.D. Nelson. 1993. Morphological and isozyme divergence in *Gambelia* (Scrophulariaceae): species delimitation and biogeographic relationships. Syst. Bot. 18:454–468.

Ghebrehiwet, M., B. Bremer, & M. Thulin. 2000. Phylogeny of the tribe Antirrhineae (Scrophulariaceae) based on morphological and *ndh*F sequence data. Pl. Syst. Evol. 220:223–239.

Jaramillo-Díaz, P., A. Guézou, A. Mauchamp, & A. Tye. 2014. CDF checklist of Galapagos flowering plants - FCD Lista de especies de plantas con flores de Galápagos. In: F. Bungartz, H. Herrera, P. Jaramillo, N. Trado, G. Jiménez-Uzcátegui, D. Ruiz, A. Guézou, and F. Ziemmeck, eds. Charles Darwin Foundation Galapagos species checklist - Lista de especies de Galápagos de la Fundación Charles Darwin. Charles Darwin Foundation / Fundación Charles Darwin, Puerto Ayora, Galapagos: http://www.darwinfoundation.org/datazone/checklists/vascular-plants/magnoliophyta/ Last updated 21 Jan 2014.

Jørgensen, P.M. & S. León-Yánez. 1999. Catalogue of the vascular plants of Ecuador. Monogr. Syst. Bot. 75:1–1181.

McMullen, C.K. & W.J. Elisens. 2000. Variation in the Galápagos shrub snapdragon: is there another subspecies of *Galvezia leucantha*? Not. Galápagos 61:21–22.

Medhanie, G., B. Bremer, & M. Thulin. 2000. Phylogeny of the tribe Antirrhineae (Scrophulariaceae) based on a morphological and *ndh*F sequence data. Pl. Syst. Evol. 220:223–239.

Munz, P.A. 1926. The Antirrhinoideae-Antirrhineae of the New World. Proc. Calif. Acad. Sci., Ser.4, 15:323–397.

Oyama, R.K. & D.A. Baum. 2004. Phylogenetic relationships of North American *Antirrhinum* (Veronicaceae). Amer. J. Bot. 91:918–925.

Pennell, F.W. 1946. Species of *Stemodia* and *Galvezia* (Scrophulariaceae) on the coast of Ecuador and northern Peru. Notul. Natl. Acad. Nat. Sci. Philadelphia 179:1–6.

Ruiz López, H. & J.A. Pavón. 1794. *Galvezia*. Fl. Peruv. Prodr. 56.

Ruiz López, H. & J.A. Pavón. 1798. *Dodartia fragilis*. Syst. Veg. Fl. Peruv. Chil. 97.

Rundel, P.W., M.O. Dillon, B. Palma, H.A. Mooney, S.L. Gulmon, & J.R. Ehleringer. 1991. The phytogeography and ecology of the coastal Atacama and Peruvian deserts. Aliso 13:1–50.

Sutton, D.A. 1988. A revision of the tribe Antirrhineae. Oxford University Press, London, U.K.

Schlick-Steiner, B.C., B. Seifert, C. Stauffer, E. Christian, R.H. Crozier, & F.M. Steiner. 2007. Without morphology, cryptic species stay in taxonomic crypsis following discovery. Trends Ecol. Evol. 22:391–392.

Tye, A. & H. Jäger. 2000. *Galvezia leucantha* subsp. *porphyrantha* (Scrophulariaceae), a new shrub snapdragon endemic to Santiago Island, Galapagos, Ecuador. Novon 10:164–168.

Vargas, P., J.A. Rosselló, R. Oyama, & J. Güemes. 2004. Molecular evidence for naturalness of genera in the tribe Antirrhineae (Scrophulariaceae) and three independent evolutionary lineages from the New World and the Old. Pl. Syst. Evol. 249:151–172.

Weng, C., M.B. Bush, J.H. Curtis, A.L. Kolata, T.D. Dillehay, & M.W. Binford. 2006. Deglaciation and Holocene climate change in the western Peruvian Andes. Quatern. Res. 66:87–96.

Wettstein, R. 1891. Scrophulariaceae. Nat. Pflanzenfam. 4(3b):61, 39–107.

Wiggins, I.L. 1968. A new species and subspecies of *Galvezia* (Scrophulariaceae) from the Galápagos Islands. Occas. Pap. Calif. Acad. Sci. 65:1, f. a–l.

Wiggins, I.L. and D.M. Porter. 1971. Flora of the Galápagos Islands. Stanford University Press, Stanford, CA, U.S.A.