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A new hybrid of *Echium* (Boraginaceae) from Tenerife, *Echium* x *bailaderensis*

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ABSTRACT: A new hybrid *Echium* (Boraginaceae) is reported and described from the southern Anaga mountains, Tenerife. *Echium* x *bailaderensis* Weller hybr. nov. grows in the transition zone between thermophilic shrub and lower laurel forest in association with *E. leucophaeum* and *E. strictum*, exhibiting intermediate characters of both species. The morphology with respect to the characteristics of parental species and chorological data are provided. This is the first case of hybridization between members of the sections Gigantea and Stricta for Tenerife and for the genus itself.

Key words: *Echium* / *Echium* x *bailaderensis* hybr. nov. / Boraginaceae / Anaga / Tenerife / Canary Islands / chorology / hybridization.

RESUMEN: Se informa y describe un nuevo híbrido *Echium* (Boraginaceae) desde las montañas del sur de Anaga, Tenerife. *Echium x bailaderensis* Weller hybr. nov. crece en la zona de transición entre arbustos termofílicos y bosque de laurel inferior en asociación con *E. leucophaeum* y *E. strictum*, exhibiendo caracteres intermedios de ambas especies. Se proporciona la morfología con respecto a las características de las especies parentales y los datos corológicos. Este es el primer caso de hibridación entre miembros de las secciones Gigantea y Stricta para Tenerife y para el género en sí.

Palabras clave: *Echium* / *Echium* x *bailaderensis* hybr. nov. / Boraginaceae / Anaga / Tenerife / Islas Canarias / corología / hibridación.

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INTRODUCTION

Among the most diversified vascular plant taxa of Macaronesia are the buglosses of the genus *Echium* L. (Boraginaceae). As in other phanerogame groups, adaptive radiations and isolation effects have contributed to the high rates of speciation and specialization in this genus (e.g., Garcia-Maroto, 2009), with more than half of all known species (about 60 pending on the taxonomic concept) being endemic to this biogeographic region. The members have been traditionally classified by trichome development and anatomy (Lems & Holzapfel, 1968; Bramwell, 1972), wood anatomy (Carlqvist, 1970), general habitus, leaf characteristics and flower morphology (Bramwell, 1972, 1975), and, more recently, by chemosystematics (Böhle *et al.*, 1996; Guil-Guerrero *et al.*, 2000) and molecular traits (Mora-Vicente *et al.*, 2009; García-Maroto *et al.*, 2009).

Within the Canary Islands, pending on the taxonomic concept 26 to 27 species are currently recognized, of which 18 to 19 represent multi-branched (candelabra) trees, 4 woody-based monocarpic-rosette trees and 4 annual to perennial herbs with a woody stem basis (Bramwell & Bramwell, 2001; Arechevaleta *et al.*, 2010; Schönfelder & Schönfelder, 2012). All tree-like members are endemic to one or more islands, exhibiting narrow to broad distribution ranges. On Tenerife, a total of 11 species are found including 6 candelabra-shaped taxa belonging to the sections Gigantea (*E. aculeatum* Poir., *E. giganteum* L. f., *E. leucophaeum* [H. Christ] Webb ex Sprague & Hutch.), Virescentia (*E. sventenii* Bramwell, *E. virescens* DC.) and Stricta (*E. strictum* L. f.), respectively (Lems & Holzapfel, 1971; Bramwell 1972).

Members of *Echium* are generally diploid (2n) (Aldridge 1981). In addition, as a number of Canarian taxa occur sympatric and can be abundant within their - sometimes restricted - ranges, hybridization events may be facilitated (Werner, 2002). Apart from a number of ornamentally grown hybrids, with either one or both parental species belonging to the section Simplicita (e.g., *E. pininana* Webb & Berth. x *E. wildpretii* Pearson ex Hook. f.), a few cases of natural hybridization have been described until present from the western islands mostly involving the sections Descainea, Gigantea, Stricta and Virescentia (Table 1). For example, from La Gomera hybrids of E. *acanthocarpum* Svent. (Virescentia) are known with *E. aculeatum* and *E. strictum* (Marrero Gómez *et al.*, 2006). For La Palma, the putative hybrid between *E. brevirame* Sprague & Hutch. (Gigantea) and *E. webbii* Coincy (Virescentia) was initially described as *E. bond-spraguei* (Sprague & Hutchinson, 1914; *cf.* Santos Guerra, 1983). On Gran Canaria, hybridization has been observed between species of three sections (Decaisnea, Gigantea, Virescentia) (Bramwell, 1972; Schönfelder & Schönfelder, 2012; Jardín Canario, 2016), and further cases may

exist in that island (Weller, unpubl. data). To the best of author's knowledge, no hybrids involving the section Gigantea, or between Gigantea and Stricta, have been described yet from Tenerife.

Table 1. Natural hybrids (x, ♦) of *Echium* (Boraginaceae) in the Canary Islands, ordered by origin and section. References: Sprague & Hutchinson, 1914; Bramwell, 1972; Wolff & Rosinski, 1999; Werner, 2002; Marrero Gómez *et al.*, 2006; Schönfelder & Schönfelder, 2012; Jardín Canario, 2016; ♦: this study.

Island	Section	Decaisnea	Gigantea				Stricta	Virescentia					Simplicita	
	Species	*descaisnei*	*aculeatum*	*brevirame*	*leucophaeum*	*triste*	*strictum*	*acanthocarpum*	*hierrense*	*onosmifolium*	*virescencens*	*webbii*	*simplex*	*wildpretii*
Gran Canaria	*decaisnei*					x	x		x					
	onosmifolium	x												
	strictum	x												
	triste	x												
Tenerife	*leucophaeum*						♦							
	simplex						x							
	strictum				♦							x		
	virescens												x	
	wildpretii									x				
La Gomera	*acanthocarpum*		x				x							
	aculeatum						x							
	strictum						x					x		
La Palma	*brevirame*										x			
	webbii			x										
El Hierro	*aculeatum*							x						
	hierrense		x											

RESULTS

In the course of field observations during three study excursions on Tenerife undertaken in April 2007, June–July 2015 and June 2019, the author became aware of a candelabra-shaped *Echium* with an unusual combination of flower and leaf morphology located in the southern Anaga mountains. A single flowering individual (from which the type originated), which could not be determined at the moment of discovery, was first recorded and photographed by the author during an excursion on 30 April 2007 in the upper Barranco de las Huertas, in the vicinity of a parking

lot just aside TF-12 (Fig. 1). The plant grew in close proximity to two *Echium* species, *E. leucophaeum* and *E. strictum*. After thorough morphological analysis and comparison to the latter two species and other congeners of this habitus type (*aculeatum*, *giganteum*, *virescens*) native in the Anaga range, to other woody genus members present on Tenerife and to herbarium specimens deposited in the botanical collections of Universidad de La Laguna (TFC), Jardín Botánico de La Orotava, Puerto de la Cruz (ORT) and in the author's collection (see Appendix), it turned out to be of hybrid origin and is described as follows:

Figure 1. *Echium x bailaderensis* WELLER, hybr. nov. at type locality along the roadside of TF-12, Anaga mountains, Tenerife, 30 April 2007. Note the pale purplish flowers and silvery-green, lanceolate leaves. Photograph by the author.

Echium x *bailaderensis* WELLER, hybr. nov. (*E. leucophaeum* x *strictum*)

Diagnosis. Frutex ad 1.2 m cum griseo-brunneis truncum, medium genus inter parentis in folia et floris: foliis lanceolatis ad 10 cm longis et ad 2 cm lata, utrinque pilis rigidis, apice obtusis; corolla pallide roseum an alba ad basim, plerumque 6.5 ad 10 mm.

Holotype. SPAIN: Canary Islands, Santa Cruz de Tenerife, Macizo de Anaga, Barranco de Las Huertas, carretera San Andrés – Taganana (TF-12) km 8.9, *ca.* 1 km south of Bailadero, 500 m a.s.l., 30 April 2007; TFC 53626 (Fig. 2), leg./det. André-A. Weller.

Figure 2. Holotype of *Echium x bailaderensis* WELLER, hybr. nov. (TFC 53626) from upper Barranco de las Huertas, Macizo de Anaga, Tenerife. Photograph by the author.

Description of holotype. Multi-branched shrub, height *ca.* 1,2 m; *leaves* lanceolate, above strongly hispid, below mostly on nerves, with very short setae ascending from discs of various size (up to 1 mm), 24–71 x 3–11 mm; *inflorescence* dome-shaped, dense, more loosely branched during anthesis, 60 x 55 mm, branches up to 115 mm; flowers almost sessile or very shortly stalked (up to 0.7 mm); *calyx* strongly hispid, 5-partite, divided almost to the base, lobes lanceolate, 6-7 mm, prolonged during anthesis (9–10 mm); *corolla* pubescent, 8–9 mm, pale purple with whitish base (Fig. 1), lobes *ca.* 2.5–3 mm deep, obtuse; *pistil* exserted, 8–14 mm, pubescent, with protruding, silky hairs (0,3–1 mm) below stigma, the latter becoming strongly bifurcate during anthesis; *stamen* exserted, 9–15 (18) mm, with purple filaments; *nutlets* (from paratype We 21507-Em1-TE) dark-brown, wrinkled with four humps, 2–2,5 mm.

Etymology. Named after the region of origin near El Bailadero, southern slope of Anaga mountains, southeast Tenerife.

Morphological variation. As shown in Table 2, the hybrid is in most diagnostic characters intermediate between its parental species. However, some variation among the type specimens may be related to seasonal and/or individual variation. The holotype was collected in the main flowering season of the species (30 April 2007). The paratype specimen (We 21507-Em1-TE) collected in July 2015 at the end of anthesis, has different dimensions in mensural data (tending larger) and partly distinct color characters. As typical for *Echium* species, the inflorescence was significantly extended towards the early and mid flowering phase, with branches of up to 115 mm (i.e., *ca.* four times as long as in the type), and the leaves are elongated as well (up to 100 x 20 mm). Corolla lengths vary from 6.5–10 (occasionally up to 13.5) mm. Flowers in the paratype tend to be paler than in the holotype, being basally more whitish with purplish stripes and pale-blue margins.

Observations. After the first observation in April 2007, the plant was preliminarily considered either as aberrant individual of *Echium leucophaeum*, unknown species, or of hybrid origin, the latter being most plausible as it was growing near some *E. leucophaeum* bushes and close to one individual of *E. strictum*. A revisit of the location on 1 July 2015, a humid gutter in the vicinity of a canal escape at the roadside and just above a steep slope, yielded that the putative hybrid individual was still existent and being in the very terminal phase of flowering. At the same date, two juveniles (single shouts) were registered in the undergrowth of tree heath (*Erica arborea*, Ericaeae) shrub, where a small bush (~ 1 m height) of *E. strictum* was detected. While the latter was still present during another visit on 19 June 2019, the juvenile hybrid shoots could not be located any longer, probably due to overgrowing by a thicket of *Rubus ulmifolius* (Rosaceae) and tree heath, respectively. Although the - at least temporary - existence of juvenile plants indicates a certain fertility of

Table 2. Main diagnostic characters of parental species and their hybrid, *Echium bailaderensis* (see Figure 1 for color characters) summarized after Bramwell (1971) and personal observations (this study). For *E. strictum*, only ssp. *strictum*, native to the Anaga range, has been considered.

Character	*E. leucophaeum*	*E. x bailaderensis*, hybr. nov.	*E. strictum*
General habitus	candelabra-shaped, up to 2 m	candelabra-shaped, 1.2 m	candelabra-shaped, up to 1 m
Stem	whitish, barely hispid, setae very short, appressed	greyish-brown, hispid, setae very short, appressed	brownish, slightly to hispid, besides short setae with appressed long, whitish hairs
Leave shape and hardness	lineal to lanceolate, apex obtuse; fairly rigid	lanceolate, apex obtuse;slightly rigid	lanceolate to ovate, apex acute; flexible, papery to slightly rigid (under arid conditions)
Leave dimensions (length x width, mm)	70–120 x 5–7	24–100 x 3–20	70–180 x 25–70
Leave color and indumentum	silvery-green, densely hairy, with very short, simple, appressed setae	dark silvery-green, veins pronounced, with very short, simple, appressed setae	variable, grassy-green, veins pronounced, with very short hairs and sparsely distributed longer (ca. 1 mm) appressed hairs
Inflorescence	dense, short, usually < 10 cm, rarely branched	rather dense to lax (during anthesis), up to 15 cm, unbranched	rather dense to lax, up to 30 cm, unbranched
Corolla (mm)	entirely white, 10–12	variable, basally whitish with purplish veins and bluish margins, or mostly pale purple, 6.5–10 (13)	variable, pinkish to pale blue, basally whitish, 5–8

the hybrid form, the type locality is impacted by natural (i.e., risk of periodic flooding, erosion) and anthropogenic factors (road construction), both threatening the persistence of *E.* x *bailaderensis*.

Chorology. Echium x *bailaderensis* occurs in the transition zone of upper thermophilic shrub with the passat-influenced *fayal brezal-laurisilva* (Fig. 3), which has its lower limits on the southern slopes of Anaga around 450–500 m a.s.l. (pers. obs.). The hybrid has been found associated with *Laurus novocanariensis* (Lauraceae), *Erica arborea*, *Rubus ulmifolius*, *Viburnum rugosum* (Adoxaceae), *Echium leucophaeum* and *E. strictum* ssp. *strictum* (Boraginaceae). To my knowledge, this is the first event of natural hybridization among two representatives of *Echium* ob-

served on Tenerife as well as the first one involving *E. leucophaeum*. The latter species is a local endemic and restricted to the Anaga mountains (Bramwell, 1972; Bramwell & Bramwell, 2001), being sociologically associated with Kleinio-Euphorbietalia canariensis (Riv.God. et Esteve 65) Santos 76 (KLE-I) (Hohenester & Welss, 1993), ascending to the edge of lower laurel forest (pers. obs.). In contrast, *E. strictum* is widespread within the Canary archipelago, being the only shrubby genus member to occur on more than one island (except for Fuerteventura, Lanzarote). The species is most abundant in xerophytic communities and a characteristic member of the Aeonio-Euphorbion canariensis Sund. 72 (incl. KLE I-2a) (Hohenester & Welss, 1993), inhabiting rather open and/or degraded habitats including clearings of laurel forest and roadsides (pers. obs.). As recently shown for Tenerife (Bacaro et al., 2015), the spread of potentially invasive species along natural or anthropogenic corridors, such as roads, may impact the local biodiversity, and yet these circumstances may have triggered the occurrence of hybridization within a zone of immediate local contact of the parental species.

Figure 3. Habitat aspect of *Echium x bailaderensis* hybr. nov. (lower right) in tree heath shrub (*Erica arborea*), within the transition zone of upper thermophilic shrub to lower *laurisilva* forest, 1 July 2015, Anaga mountains, Tenerife. Photograph by the author.

Further remarks. Hybridization is not uncommon among the Canarian members of the genus, and is so far known from the section Simplicita as well as from the woody-based clades of Decaisnea, Gigantea and Virescentia (e.g., Bramwell, 1972; Schönfelder & Schönfelder, 2012; *cf*. Table 1). The described case is the first one among the sections Gigantea (*leucophaeum*) and Stricta (*strictum*), and the third one of hybridization for the genus on Tenerife; another record from this island involving *E. strictum* (x *simplex*) was described by Werner (2002). Moreover, in the course of this study there has been indication for another hybrid supposed to be *E. leucophaeum* x *virescens* in the TFC *Echium* collection, based on specimens already collected in 1972 from the central southern Anaga mountains that were originally labeled as *E.* cf. *leucophaeum* (see Appendix). However, the author was unable to locate this population, referred to two collecting sites named as "Canal de Tesoro" and "Lomo Mejiniar," (see Appendix; corr.: Mejimar), respectively, during his field work in June 2019. Thus a proper proof of the identity of the concerning specimens has not been possible during the preparation of this work and must be postponed to future study.

During extensive surveys made by the author in all major biogeographic regions of Tenerife (e.g., PR Cordillera Dorsal, PR Teno, PN del Teide) in the past 15 years and in the course of this study, no evidence has been found that *E. leucophaeum* occurs outside of Macizo de Anaga. One specimen record indicated as *E.* cf. *leucophaeum* from northwestern Tenerife (TFC 34.009, see Appendix) may not belong to this species. Nevertheless, *Echium* plants with aberrant phenotypic features have been observed, for example, in the regions of Teno and Anaga (pers. obs.), requiring further study of the genus' chorology, distribution and taxonomy on Tenerife. Finally, confusing morphological variation within certain clades such as Gigantea, Stricta and Virescentia should be object of a robust phylogenetic analysis based on refined molecular data, including all members of this emblematic genus distributed in the Canarian archipelago.

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APPENDIX

Study specimens of *Echium* deposited in herbarium collections of Universidad de La Laguna (TFC) and of the author (We), with locality (after original label), altitude a.s.l. (if provided), date and collector(s), ordered by collecting date.

Echium x *bailaderensis*, hybr. nov., SPAIN: Tenerife, Anaga, Barranco de las Huertas, TF-12 km 8.9 (*ca.* 500 m): holotype TFC XXX, 30 April 2007, A.-A. Weller; paratype, We 21507-Em1-TE, 1 July 2015, A.-A. Weller.

Echium leucophaeum, SPAIN: Tenerife, Anaga: TFC 172, Barranco de Tahodio, 19 April 1969, A. Santos & P.L. Pérez de Paz; TFC 608, Cercanias del Roque de An-

tequera, 19 April 1971, W. Wildpret & A. Santos; TFC 814, Laderas soleadas detras del Pico de Izogue, 26 February 1972, W. Wildpret et al.; TFC *sine* no., Lomo Mejiniar, 8 April 1972, E. Beltrán Tejera; TFC 4.670, Las Bodegas, March 1974, P.L. Perez de Paz; TFC 20.330, San Andrés, 3. April 1974, W. Wildpret; TFC 32.114, Barranco de San Andrés, 22 April 1979; TFC 34.936, Anaga *sine loc*., March 1979, E. Valdés et al.; TFC 38.987, Las Casillas, Bco. Ijuana, 550 m, 21 March 1996, R. Riccardo; TFC 42.068, Cuenca de Valle Vega, Bco. de Tahodio, 8 April 1999, S. Becher & T. Himstedt; We 20705-Em2-TE, north of Chinamada, on footpath to Mirador Aguaide, 15 April 2007, A.-A. Weller; TFC 50.034, Barranco de Las Huertas de San Andrés, 418 m, 4 May 2011, F. Lens et al.; TFC 50.838, Barranco de las Huertas de San Andrés, 213 m, 13 May 2013, M. del Arco & F. Lens; TFC 52.286, Barranco Huertas de San Andrés, 30 March 2016, M. del Arco & L. Chacón.

Echium cf. *leucophaeum*, SPAIN: Tenerife: TFC 4.046, Canal de Tesoro, 8 April 1972, E. Beltrán Tejera; TFC 4.072, 4.074, 4.075, Lomo de Mejiniar, 8 April 1972, E. Beltrán Tejera; TFC 21.878, Canal de Tesoro, Carretera de Bailadero, 8 April 1972, E. Beltrán Tejera; TFC 34.009, El Guincho, Garachico, 15 June 1983, E. Beltrán Tejera & L. Gonzáles Clemente.

Echium strictum, SPAIN: Tenerife: TFC 831, Laderas de los Roques de Enmedio y de Las Animas, Anaga, 18 March 1972, A. Santos & P.L. Pérez de Paz; TFC 4.414, Ladera de Güímar, 13 April 1975, E. Rodríguez Hebriques; TFC 6.464, 6.459, Teno, 11 February 1977, C. León et al.; TFC 10.556, La Cumbrilla, Peninsula de Anaga, 700 m, 16. April 1979, J. Fernández Casas; TFC 19.127, La Furnia, Icod, 450 m, 6 May 1985, F. Ardévol González; TFC 19.991, entre Buenavista y La Punta de Teno, Los Frailes, 7 March 1984, A. Charpín & C. León Arencibia; TFC 20.975, El Fraile, Teno bajo, 28 March 1981, J.R. Acebes Ginovés et al.; TFC 23.420, Camino del Pico de Izoque, 26 March 1972, E. Beltrán Tejera; TFC 27.608, La Ladera (Canal), 600 m, 4 May 1984, A. Charpín & O. Rodríguez Delgado; TFC 27.609, La Ladera (Ctra.), 23 April 1984, O. Rodríguez Delgado; TFC 50.837, carretera dorsal entre El Bailadero y Casa Forestal de Anaga, 727 m, 13 May 2013, M. del Arco & F. Lens; We 21506-Em1-TE, El Fraile, *ca.* 1 km W of Buenavista, Teno, 200 m, 27 June 2015, A.-A. Weller (cf. ssp. *exasperatum*).

Echium cf. *strictum*, SPAIN: Tenerife: TFC *sine* no., Alrededores del Roque de Enmedio, 18. March 1972, P.L. Pérez de Paz et al.