Revision of the *Calceolaria tripartita* s. l. species complex (Calceolariaceae) using multivariate analyses of morphological characters

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Abstract

The morphological variation of the *Calceolaria tripartita* species complex was evaluated using Principal Components Analysis (PCA) of morphological characters. Fourteen quantitative characters were measured on more than 250 herbarium specimens. The results suggest the recognition of three entities based on floral characters, especially stamen morphology. The distinction between *C. mandoniana*, *C. chelidonioides* and *C. tripartita s.s.* is not supported. The morphological differences between the closely related *C. tripartita s.s.* and *C. chelidonioides* were also analyzed using two characters previously used to differentiate them. Finally, the morphological variation of *C. tripartita s.s.* throughout its geographical range and at an intra-population level was also surveyed. Even though this species is highly variable, no further subdivision is supported morphologically. A taxonomic synopsis and a key to species of the *Calceolaria tripartita* species complex are provided.

Key words: Andes, morphology, morphometrics, Principal Component Analysis, Scrophulariaceae, species complex

Introduction

*Calceolaria* Linnaeus (1770: 286) is an American genus with ca. 250 species that ranges from Central Mexico to Chile and Southern Argentina, in Tierra de Fuego. It is composed of herbs or shrubs up to four meters tall with opposite leaves and usually yellow flowers. It has always been considered as a distinct genus although its relationships have been unclear until recently. *Calceolaria*, together with two smaller genera, *Porodittia* Don (1838: 608) and *Jovellana* Ruiz & Pavón (1798: 12), were considered to form the tribe Calceolarieae of Scrophulariaceae. When Scrophulariaceae were found to be polyphyletic (Olmstead & Reeves 1995, Olmstead et al. 2001), Calceolarieae were raised to family level, their relationships being closer to Gesneriaceae. Finally, molecular analyses encompassing all Calceolarieae (Andersson 2006, Cosacov et al. 2009) showed *Porodittia* nested within *Calceolaria* and the family was left with only two genera.
**Calceolaria tripartita** Ruiz & Pavón (1798: 14). Fig. 4–G-I.

Type (neotype designated by Molau 1981: 605):—PERU. Lima: Prov. Canta, along the Río Chillón, above Obrajillo, NE of Canta, 3100–3300 m, 13–23 June 1925, Pennell 14406 (F!, G!, NY!).

= Calceolaria chelidonioides Kunth (1818: 378), *syn. nov.* Type (lectotype designated by Pennell 1951: 192):—ECUADOR. Pichincha: Cerro Javirac (=Panecillo), Quito, ca. 2750 m, May 1802, Bonpland s.n. (F!).

= Calceolaria mandoniana Kraenzlin in Engler (1907: 30), *syn. nov.* Type (lectotype designated by Pennell 1945: 175):—BOLIVIA. La Paz: Prov. Larecaja, Carapi, nr. Sorata, 2900 m, March 1859, Mandon 460 (G!, K!).

[For a complete list of synonyms see Molau 1988, pp. 259, 261, 266.]

Perennial herb, 5–100 cm tall, stems succulent, green or purplish. Leaves petiolate; petioles 0.1–8.1 cm long, nodal wings 0–7.1 mm wide; lamina ovate or elliptic, 0.8–17.7 × 0.4–16 cm, laciniate, deeply lobed to pinnatisect with 1–7 pinnae, margins dentate to serrulate. Sepals ovate, 2–10 × 1–7 mm, green to purple. Corolla bright yellow, 4–29 × 1.9–19.5 mm; stamens with upper theca 0.5–2.5 mm long, lower theca aborted, connective 0.6–4.1 mm long, dorsal protuberance present or absent. Capsules ovoid, 5–7 mm long.

**Distribution:**—Central Mexico to north Chile and Argentina between (0)1000–3900 m. Introduced in other countries from Europe and Asia (see Molau 1981, p. 606).

**Acknowledgements**

I thank P. F. Stevens, P. M. Jørgensen, and P. M. Richardson for their helpful comments during this work. F. Luebert, M. Weigend, and an anonymous reviewer helped to improve this manuscript with their comments and suggestions. The following persons constituted an invaluable help during field work in Peru and Bolivia: F. Zapata, S. Altamirano, N. Altamirano, J. Terán, J. P. Altamirano, L. Valenzuela, Y. Vizcardo, E. Suclli, I. Sánchez-Vega, and J. Perez. The Missouri Botanical Garden in Peru facilitated field work in Cusco. The following institutions contributed financially to the completion of my masters degree and thus to this research: the Fulbright Commission in Lima, the Flora of North America project and the CCSD at the Missouri Botanical Garden, the Whitney Harris World Ecology Center and the Desmond Lee scholarship at the University of Missouri-St. Louis. I also thank I. Rocconi, J. Zarucho, O. M. Montiel, P. Osborne, and E. A. Kellogg from the different funding institutions for their support. I acknowledge J. Solomon and the curators of the following herbaria: MO, US, K, Z, NY, GH, F, G, PH, and LIL for facilitating plant collections. Finally, I thank my PhD advisor, H. Meimberg, for his continuous encouragement to publish this work.

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