



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

Resumen

La variación morfológica del complejo de especies *Calceolaria tripartita* fue evaluada usando un Análisis de Componentes Principales (PCA) de caracteres morfológicos. Catorce caracteres cuantitativos fueron medidos en más de 250 muestras de herbario. Los resultados sugieren el reconocimiento de 3 entidades basadas en caracteres florales, especialmente morfología estaminal. La distinción entre *C. mandoniana*, *C. chelidonioides* y *C. tripartita* s.s. no se ve apoyada por los datos. Las diferencias morfológicas entre *C. tripartita* s.s. y *C. chelidonioides* fueron también analizadas utilizando dos caracteres previamente empleados para distinguirlas. Su distinción no es confirmada usando estos caracteres. Finalmente, la variación morfológica de *C. tripartita* s.s. a lo largo de su distribución geográfica y a un nivel intra-poblacional fue también analizada. A pesar de que la especie es altamente variable, ninguna futura subdivisión es evidenciada morfológicamente. Se incluyen una sinopsis taxonómica y una clave para diferenciar las especies del complejo *Calceolaria tripartita*.

Palabras clave: Andes, morfología, morfométrica, Análisis de Componentes Principales, Scrophulariaceae, complejo de especies

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 Calceolariaceae (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, lacinate, 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).

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