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A revision of *Smallanthus* (Asteraceae, Millerieae), the “yacón” genus

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Abstract

Smallanthus (Asteraceae, Millerieae), the “yacón” genus, comprises 23 species ranging from southeastern United States to central Argentina, with the greatest diversity in Peru and Mexico. Species of *Smallanthus* are herbs, shrubs or small trees with tuberous roots, opposite, trinerved or triplinerved leaves, paleate receptacle, ray corollas externally hairy at the base, pappus lacking, and marginal cypselae partially embraced by the inner phyllaries of the involucre. As a result of this revision: *Smallanthus araucariophilus* and *S. riograndensis* are considered synonyms of *S. macroscyphus*; lectotypes are designated for nine names; and the geographical distribution of *S. latisquamus*, *S. lundelli*, *S. riparius*, and *S. siegesbeckia* is extended. A comprehensive key to the species and detailed descriptions, geographical distribution, phenology, illustrations and distribution maps are provided for all taxa.

Resumen

Smallanthus (Asteraceae, Millerieae), el género del “yacón”, comprende 23 especies que se distribuyen desde los Estados Unidos hasta el centro de Argentina, con la mayor diversidad en Perú y México. El género se define por su hábito herbáceo, arbustivo o arbóreo, raíces tuberosas, hojas opuestas trinervadas o triplinervadas, receptáculo paleáceo, corolas del radio externamente pilosas en la base, papus ausente, y cipselas marginales parcialmente cubiertas por las filarias internas del involucre. Como resultado de esta revisión: *Smallanthus araucariophilus* y *S. riograndensis* se consideran sinónimos de *S. macroscyphus*; se designan los lectotipos de nueve nombres; y se amplía la distribución geográfica de *S. latisquamus*, *S. lundelli*, *S. riparius*, y *S. siegesbeckia*. Se provee una clave de especies y descripciones detalladas, distribución geográfica, fenología, ilustraciones y mapas de distribución para cada especie.

Introduction

The Andean region has been the cradle of some economically important crops, such as the potato, tomato, and maize races. Also many edible tubers and roots have been used as food for centuries by the Andean inhabitants. One of these, the “yacón”, a species of the genus *Smallanthus* Mackenzie (1933: 1406), is attracting global attention. *Smallanthus* (Asteraceae, Millerieae), with 23 species, ranges from southeastern United States to central Argentina, and has its greatest diversity in Peru and Mexico. Species of *Smallanthus* are herbs, shrubs or small trees with tuberous roots, opposite, trinerved or triplinerved leaves, paleaceous receptacle, ray corollas externally hairy at the base, pappus lacking, and marginal cypselae partially embraced by the inner phyllaries of the involucre. Because its high content of non-digestible oligosaccharides, roots of *Smallanthus sonchifolius* (Poeppig) H. Robinson (1978: 51), “yacón”, have been used as natural sweeteners and syrups. The traditional Andean populations attribute anti-diabetic properties to dry yacon leaves (Choque Delgado *et al.* 2013). There are other species of *Smallanthus* with edible and/or medicinal attributes, such as *Smallanthus connatus* (Sprengel) H. Robinson (1978: 49) (Bach *et al.* 2007) and *Smallanthus macroscyphus* (Baker ex Martius) A. Grau in Grau & Rea (1997: 205) (Coll Aráoz *et al.* 2008).

The genus *Smallanthus* was originally described by Mackenzie on the basis of just one North American species, *Smallanthus uvedalius* (Linné) Mackenzie (1933: 1406) based on *Osteospermum uvedalia* Linné (1753: 923). This species was transferred to *Polymnia* L. (1753: 926) (Wells 1965) and later re-incorporated to *Smallanthus* by Robinson (1978). Other 18 species of *Polymnia* were transferred to *Smallanthus* by Robinson (1978), who also described a new species. The number of species of the genus further increased to 24 with new combinations and the description of new species (Turner 1988, 2010, Zuloaga & Morrone 1999, Mondin 2004).

Smallanthus was morphologically related to *Rumfordia* Candolle (1836: 549) and *Polymnia* (Sanders 1977) and, in general, phylogenetic analyses on the tribe Heliantheae sensu lato (Karis 1993, Panero *et al.* 1999, Rauscher 2002) coincide in a sister or a close relationship of *Smallanthus* to *Rumfordia*.

The phylogenetic relationships among species of *Smallanthus* were first established by Rauscher (2002) with the use of molecular data and a sampling of 13 species. More recently, a phylogenetic analysis based on morphological data was carried out by Vitali and Viera Barreto (2014) sampling all species of *Smallanthus* on the basis of the information of Vitali (2014). In the analyses, this genus resulted monophyletic.

Despite the extensive literature on the yacón, *Smallanthus sonchifolius*, it is quite surprising that such an economically important genus still lacks a systematic study that includes its entire species. The objective of this contribution is to perform such study.