CHUCOA ILICIFOLIA, A SPINY *ONOSERIS* (ASTERACEAE, MUTISIOIDEAE: ONOSERIDEAE)

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ABSTRACT

Molecular phylogenetic studies of several members of Mutisioideae show that the type species of the genus *Chucoa* of northern Peru is a member of the genus *Onoseris*. The combination ***Onoseris ilicifolia*** is proposed. The disposition of the second species of *Chucoa* awaits molecular studies. *Phytologia 91(3): 537-541 (December, 2009).*

KEY WORDS: *Chucoa*, *Onoseris*, Onoserideae, Mutisioideae, Andes, Peru.

Mutisioideae, a taxon first circumscribed based on molecular phylogenetic analysis (Panero and Funk 2008), includes approximately 44 genera and 630 species. The subfamily contains three main lineages recognized at the tribal level: Mutisieae, Nassauvieae and Onoserideae. The monophyly of Mutisioideae has not been confirmed, as a few genera that share morphological features found in this taxon have not yet been included in molecular analyses, and hence our understanding of their relationships remains tentative. Among these unsampled taxa is the genus *Chucoa*, a seldom-collected species endemic to the Santiago de Chuco region of La Libertad Department in northern Peru.

Chucoa was described by Cabrera (1955), who allied the genus to *Gochnatia* and *Stifftia*. The same year, Ferreyra named the genus *Weberbaueriella* to accommodate an unusual specimen of Asteraceae originally identified as an *Onoseris*. Ferreyra (1955) allied his new genus *Weberbaueriella* to *Gochnatia*, *Onoseris* and *Chuquiraga*. *Chucoa* and *Weberbaueriella* were published in the same year but Ferreyra (1980) acknowledged the priority of the genus

Chucoa by placing *Weberbaueriella* in its synonymy. Both Ferreyra and Cabrera speculated that *Chucoa* is closely related to *Gochnatia*. However, morphological studies of *Gochnatia* and related genera suggested that *Chucoa*, because of its pubescent styles and acute anther appendages, is not closely related to *Gochnatia* (Freire et al., 2002). Katinas et al. (2008, Fig. 2) placed *Chucoa* in an informal group of 22 genera within their concept of tribe Mutusieae, which includes all members of Mutisieae and Onoserideae, sensu Panero and Funk (2008), but did not speculate further as to the sister taxon. Included in this group, because they share a similar style and anther morphology, were also the genera *Catamixis*, *Oldenburgia*, *Hyaloseris* and *Dinoseris*. However, these four genera have been shown to belong to other lineages of Asteraceae (Panero and Funk, 2008; Panero, 2008).

Given these multiple hypotheses of relationship based on morphological studies, we decided to include *Chucoa ilicifolia* in a phylogenetic analysis of Mutisioideae using chloroplast DNA so as to provide molecular evidence bearing upon the phylogenetic relationship of *Chucoa*.

MATERIALS AND METHODS

DNA was extracted from 0.25g dried leaf material of *Chucoa*, *Onoseris onoseroides* and *Urmenetea* using Qiagen's DNeasy Plant Mini Kit following the manufacturer's protocol for dried leaf material. Efficacy of the DNA extract was tested empirically using standard polymerase chain reaction (PCR) protocols and primers detailed in Panero and Crozier (2003) and Panero and Funk (2008) for the following chloroplast loci: *mat*K, *ndh*D, *ndh*F, *rbc*L and *rpo*B. PCR reactions were screened using agarose gel electrophoresis. Reactions with visible results were cleaned using QIAquick PCR purification columns and 4 microliters of each used as template DNA in cycle sequencing reactions following the protocols of the ABI Big Dye Terminator 3.1 Cycle Sequencing Kit. Cleaning of the sequencing reactions using the Millipore MultiScreen 96-Well Filtration Plate and sequencing was performed by the University of Texas ICMB Core DNA Facility on an ABI 3730 DNA analyzer. Raw sequence data were proofread using Sequencher 4.8 (Gene Codes Corporation). *Chucoa*, *Onoseris onoseroides* and *Urmenetea* sequences were aligned

by eye with a subset of 19 taxa of Mutisioideae of the 108-taxon *mat*K, *ndh*D, *ndh*F, *rbc*L and *rpo*B alignments used in previous phylogenetic studies (Panero and Funk, 2008).

Phylogenetic trees were constructed for the 22-taxon *mat*K, *ndh*D, *ndh*F, *rbc*L and *rpo*B data sets in combination using the maximum parsimony criterion implemented in PAUP*4b10. Branch support was assessed using a full heuristic bootstrap analysis with 1000 replications. The genus *Acicarpha* (Calyceraceae) served as outgroup.

RESULTS AND DISCUSSION

Parsimony analysis of the multi-locus data matrix produced a single tree (Fig. 1) that placed *Chucoa ilicifolia* neither close to *Chuquiraga* nor *Stifftia* nor *Gochnatia*. Instead, *Chucoa* was found sister to *Onoseris onoseroides* (Mutisioideae-Onoserideae) with strong (100%) bootstrap support, highlighting Ferreyra's observation.

The *Onoseris* clade, including the type species of *Chucoa* and *Onoseris*, is also statistically supported (100% bootstrap), warranting the inclusion of *Chucoa* in the genus *Onoseris*. To formalize this transfer, the following combination is proposed:

Onoseris ilicifolia (Cabrera) Panero, **comb. nov.** Basionym ***Chucoa ilicifolia*** Cabrera, Bol. Soc. Argent. Bot. 6: 40. 1955. Type: Peru: La Libertad, Prov. Santiago de Chuco, Angasmarca-Tulpo, *A. López Miranda 1090* (holotype: LP).

A second species of *Chucoa*, *C. lanceolata*, has been recently proposed (Sancho et al., 2005). The placement of this taxon awaits molecular studies.

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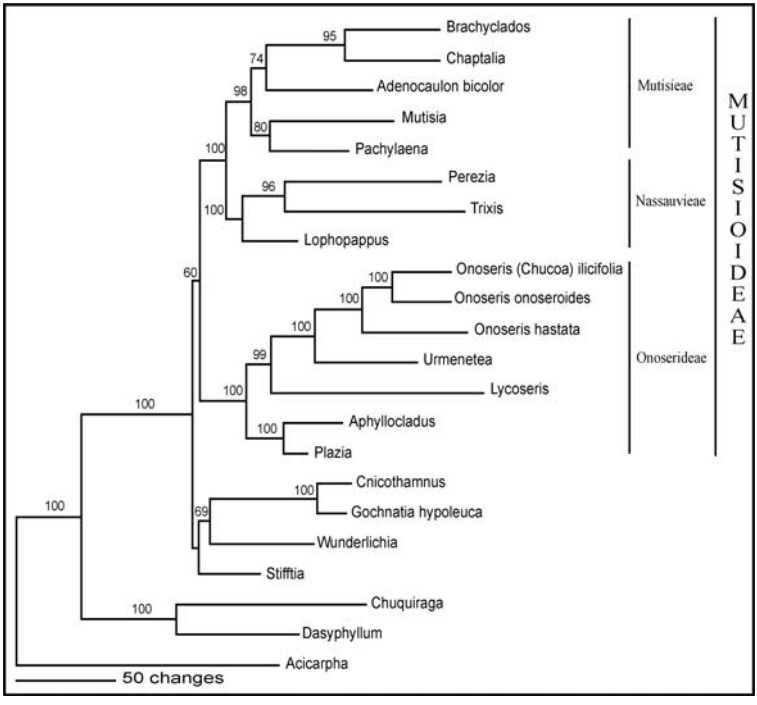

Fig.1. Single most parsimonious tree based on the MP analysis of five concatenated chloroplast genes. 422 of the 13,209 nucleotide sites were parsimony informative. Numbers above branches indicate percent bootstrap support values.

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Appendix 1. Voucher information and GenBank Accession numbers for sequences of *Onoseris ilicifolia*, *Onoseris onoseroides*, and *Urmenetea*. Voucher information listed in the following order: taxon name, collection, country of origin, herbarium. Genbank numbers listed in the following order: *mat*K, *ndh*D, *ndh*F, *rbc*L, *rpo*B. *Onoseris ilicifolia* (Cabrera) Panero, Sagástegui et al. 16626, Peru, F. GQ890332, GQ890335, GQ890338, GQ890341, GQ890344. *Onoseris onoseroides* (H.B.K.) B. L. Rob., McVaugh 22341, Mexico, TEX. GQ890333, GQ890336, GQ890339, GQ890342, GQ890345. *Urmenetea atacamensis* Phil., Panero & Crozier 8446, Chile, TEX. GQ890334, GQ890337, GQ890340, GQ890343, GQ890346.