

Rebutia and its allies — a phylogenetic study of South American cacti*

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Despite the fact that the great diversity of cacti has always fascinated botanists and enthusiasts molecular phylogenies in the Cactaceae are rather rare. The current classifications are mainly based on morphology and try to handle the flood of synonyms by uniting many taxa into larger genera. In this study we investigated the South American small globular cacti of the genera *Rebutia* sensu lato (including *Sulcorebutia* and *Weingartia*) and *Gymnocalycium* as well as the columnar cacti of southern South America usually classified in Browningieae, Cereeae and Trichocereae. We sequenced three non-coding chloroplast markers: the 5' region of the *atpB-rbcL* intergenic spacer (IGS), the *trnL-trnF* IGS and the *trnK-rps16* IGS. The phylogenetic reconstructions based on parsimony and Bayesian approaches clearly show that the tribes Trichocereae, Cereeae and Browningieae are not monophyletic, The large genera *Echinopsis* s.l. and *Rebutia* s.l. are polyphyletic. Within *Echinopsis* s.l. *Lobivia* is the only well-supported monophyletic group. *Rebutia* s.l. is divided into two clades: first, *Rebutia* sensu Backeberg which includes the type species is sister to *Sulcorebutia* and *Weingartia* and second, *Mediolobivia* and *Aylosteria* sensu Backeberg. *Sulcorebutia*, *Cintia* and *Weingartia* form a highly supported monophyletic group but within this clade these taxa cannot be separated from each other by the molecular phylogenetic analyses. The genus *Gymnacalycium* is a strongly supported and highly resolved monophylum, but neither the traditional classification based on seed morphology nor their geographic distribution are reflected in the phylogeny. The cephalia-bearing columnar cacti of the tribe Cereeae form a monophyletic group together with *Espostoa*, which has been classified into the Trichocereae but has lateral cephalia. Astonishingly, the genus *Espostoa* which also develops characteristic lateral cephalia is not included in this clade but clusters with the non-cephalia-bearing cacti like *Haageocereus* and *Oreocereus*. It is remarkable that *Espostoa* is the only cephalia-bearing genus with hairy pericarpels investigated in this study whereas all other cephalia bearing cacti have naked pericarpels. The existence of hybrids between *Espostoa* and *Haageocereus* (*Haagespostoa*) is another argument for the correct position of *Espostoa* in the molecular phylogeny.

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