

Insights into Gesneriaceae Relationships and Classification

The phylogenetic hypothesis presented here supports most of the recent rearrangement of the supraspecific classification of Gesneriaceae (Weber et al. 2013), with a few exceptions. There are also phylogenetic patterns that emerge from this mega-phylogeny approach that make novel contributions to our understanding of diversification patterns in the family. The three subfamilies currently recognized are supported, and have the same relationship to each other as previously found (Sanangoideae [Gesnerioideae + Didymocarpoideae]) (Suppl. Fig. 1). In Gesnerioideae, the monogeneric tribe Titanotricheae is here modestly supported (aLRT=74; MLBS=46) as sister to the Napeantheae tribe, as was found by Perret et al. (2013), albeit with weak support (PP=0.8). This is a different placement than suggested by the guide phylogeny of the revised classification of Gesneriaceae (Weber et al. 2013), where it was placed in an isolated position. Beslerieae tribe is currently split into two subtribes: Anetanthinae and Besleriinae. Our results suggest that Besleriinae is paraphyletic in relation to Anetanthinae (*Anetanthus* is strongly placed in a *Besleria* + *Cremosperma* clade; Suppl. Fig. 1; aLRT=95; MLBS=76). While we only have one exemplar of Anetanthinae included here, our results provide stronger support for these relationships than previous studies (Clark et al. 2010).

Three subtribes are now recognized within tribe Coronanthereae, but our results would suggest that subtribe Mitrariinae is paraphyletic in relation to the other two because of the position of *Sarmienta* sister to all of the other genera of the tribe. This is a weak placement in our analyses, and previous analyses provide greater support for a monophyletic Mitrariinae (Woo et al. 2011). The current circumscription of tribe Gesnerieae encompasses five subtribes that were previously treated at the tribal level: Gesneriinae (Gesnerieae s.s.), Gloxiniinae (Gloxinieae),

Columnneinae (Episcieae), Sphaerorrhizinae (Sphaerorrhizeae) and Ligeriinae (Sinningeae; Weber et al. 2013).

In Didymocarpoideae (Cyrtandroideae), 14 subtribes in two tribes are recognized (Weber et al. 2013). Both tribes are supported to be monophyletic (Suppl. Fig. 1). Three of the four subtribes of Epithemateae are monophyletic; however, the two samples of subtribe Loxoniinae are paraphyletic in relation to Epithematinae, albeit with only moderate support (aLRT=74; MLBS=79). Previous studies have provided stronger support for the monophyly of Loxoniinae (Möller et al. 2009). Of the 10 subtribes recognized in Trichosporeae, seven are well supported as monophyletic (Suppl. Fig. 1). There is moderately strong support for Ramondinae as paraphyletic to Leptoboeinae (aLRT=88; MLBS=71; Suppl. Fig. 1), based on the placement of *Haberlea rhodopensis*. The placement of this species has been unclear or weak in previous studies, and requires further study (Möller et al. 2009, 2011). Our phylogenetic hypothesis also suggests that the two genera of Didissandrinae are not closely related to each other, with moderate support for multiple nodes between the two genera (aLRT=71, 88; MLBS=67, 63; Suppl. Fig. 1). The relationship of these two genera has never been strongly supported (Middleton and Möller 2012), and how best to classify these two genera needs to be revisited.

Previous studies have found uncertain relationships among the currently recognized subtribes of Trichosporeae (Möller et al. 2009; Wang et al. 2010; Möller et al. 2011; Weber et al. 2011), but many of these relationships have better support in the phylogenetic hypothesis presented here (Suppl. Fig. 1). Further, one of the more interesting results of these phylogenetic analyses is the moderately strong support (aLRT=88; MLBS=63) for the sister relationship of Loxocarpinae (“Twisted-fruited advanced Asian and Malesian genera” sensu Möller and Clark 2013) and Streptocarpinae (“African and Madagascan genera” sensu Möller and Clark 2013). This is

interesting because both of these clades predominantly have fruits that are distinctly twisted. Despite this shared characteristic, previous phylogenetic studies have generally placed these two clades as steps in a grade of clades of the didymocarpoid lineages, not as sister groups.

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