

Phylogenetics of *Bauhinia* subgenus *Phanera* (Leguminosae: Caesalpinioideae) based on ITS sequences of nuclear ribosomal DNA

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Abstract. The pantropical legume genus *Bauhinia* is currently subdivided into four subgenera. Subgenus *Phanera*, with ca. 150 species, is the largest. A parsimony analysis was conducted on ITS sequence data from 38 species, with representatives from all four subgenera, and species sampled from nine of 11 sections of subgen. *Phanera*, and including two *Cercis* species as the outgroup. The well-resolved strict consensus tree suggests that subgen. *Phanera* and the monotypic subgen. *Barklya* together form a monophyletic group. In the *Phanera*-*Barklya* clade, the African (sect. *Tylosema*), American (sect. *Caulotretus*), and Australasian (subgen. *Barklya*, subgen. *Phanera* sect. *Lysiphyllum*) species are the first (paraphyletic) lineages, while the Asian taxa (except species of sect. *Lysiphyllum*) form a monophyletic group. The ITS tree also revealed that sects. *Phanera* and *Lasiobema* are not monophyletic. Monophyletic groups supported by the phylogenetic analysis include ser. *Fulvae* and ser. *Corymbosae* of sect. *Phanera*, sect. *Tubicalyx*, and the Asian-Australasian sect. *Lysiphyllum*.

Keywords: *Bauhinia*; Caesalpinioideae; ITS; Leguminosae; Phylogenetic analysis; subgen. *Phanera*.

Introduction

Bauhinia L., a pantropical genus of about 300 species (Wunderlin et al., 1987) of trees, shrubs or lianas with bifoliolate, bilobed or simple entire leaves, has always been controversial in its taxonomy, including whether or how it could be divided into small genera.

According to Wunderlin et al. (1981, 1987), the ancestor of the genus gave rise to two main phyletic lines, one to the mostly arborescent or shrubby subgenera *Bauhinia*, *Elayuna* and *Barklya*, the second to subgenus *Phanera*, which mostly comprises lianas. A morphological cladistic analysis of the genus by Zhang (1995) and a survey of the *rpL2* chloroplast intron for 78 species by Lai et al. (1997), however, both yielded results not fully compatible with the conclusions of Wunderlin et al.

Subgenus *Phanera*, comprising about 150 species, is the largest subgenus in *Bauhinia*. Pantropical in distribution, but with most of its species occurring in continental Asia and the Malesia region, the subgenus is subdivided into 11 sections (Wunderlin et al., 1987). Several of these sections are further subdivided into subsections or series.

In their recent phylogenetic analysis of the subfamily Caesalpinioideae based on chloroplast *trnL* intron sequences, Bruneau et al. (2001) suggested that the sub-

genus *Phanera*, as well as the whole genus *Bauhinia*, might not be monophyletic.

Although taxonomic and floristic studies on the genus *Bauhinia* in general, and on subgen. *Phanera* in particular, have helped improve our knowledge of the group (Chen, 1988; Larsen and Larsen, 1973, 1983, 1991, 1996; Larsen et al., 1980, 1984; Zhang, 1993), systematic studies on the genus are still hampered by its large number of species, prevalence of morphological convergence, and difficulties in obtaining material. In this study, we newly sequenced nuclear ITS regions from representative species of *Bauhinia*, with the aim of assessing the monophyly of subgen. *Phanera* as currently defined, and of clarifying the intra-subgeneric relationships within the group.

Materials and Methods

Taxon Sampling

A total of 38 species were included in this molecular study (Table 1). For the ingroup we sampled 40 accessions representing 32 species of subgen. *Phanera*, as well as two species of subgen. *Bauhinia*, one species of the monotypic subgen. *Barklya*, and one species of subgen. *Elayuna*. The ingroup taxa chosen covered all four subgenera recognized by Wunderlin et al. (1987). The 32 species of subgen. *Phanera* represented nine of the 11 sections (Wunderlin et al., 1987). Most of the species chosen were from the two larger sections that are apparently polymorphic, viz., sect. *Lasiobema* and sect. *Phanera*. For some sections, e.g., sects. *Palmatifolia*, *Tubicalyx*, and

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