

CHROMOSOME NUMBER OF *THEVETIA AHOUI*
(APOCYNACEAE: RAUVOLFOIDAE: PLUMERIEAE) WITH DISCUSSION
ON THE GENERIC BOUNDARIES OF *THEVETIA*

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ABSTRACT

The mitotic chromosome count ($2n = 20$) for *Thevetia ahouai* is the first reported chromosome count for *Thevetia* sect. *Ahouai*. The count together with a previous count in *Thevetia* sect. *Thevetia* (also $2n = 20$) provides an additional synapomorphy that further supports the monophyly of *Thevetia* as traditionally recognized. A discussion on the proposal to recognize *Thevetia* sect. *Thevetia* as the genus *Cascabela* is provided.

KEY WORDS: *Thevetia*, Apocynaceae, chromosome number, *Cascabela*, *Cerbera*, Plumerieae

RESUMEN

El recuento cromosomático mitótico ($2n = 20$) de *Thevetia ahouai* es el primero para *Thevetia* sect. *Ahouai*. Este recuento junto con otro previo en *Thevetia* sect. *Thevetia* (también $2n = 20$) aporta una sinapomorfía adicional que apoya la monofilia de *Thevetia* como se ha reconocido tradicionalmente. Se aporta una discusión de la propuesta de reconocer *Thevetia* sect. *Thevetia* como el género *Cascabela*.

Thevetia L. belongs to the Apocynaceae subfamily Rauvolfioideae tribe Plumerieae and comprises eight species of shrubs occurring from Central Mexico to northern South America (Gensel 1969; Williams 1996; Allorge 1998; Endress et al. 2007). According to various specialists in the Apocynaceae, the generic boundaries of *Thevetia* vary. In the concept of *Thevetia* sensu K. Schum. (Schumann 1895; Gensel 1969; Williams 1996; Allorge 1998; Alvarado-Cardenas 2004), eight species are sub-divided between two sections: sect. *Ahouai* K. Schum. with three species—*T. ahouai* (L.) A. DC., *T. amazonica* Ducke, and *T. bicornuta* Mull. Arg.—and sect. *Thevetia* K. Schum. with five species—*T. gaumeri* Hemsl., *T. ovata* (Cav.) A. DC., *T. peruviana* (Pers.) K. Schum., *T. pinifolia* (Standl. & Steyerf.) J.K. Williams, and *T. thevetiodes* (H.B.K.) K. Schum. In the concept of *Thevetia* sensu Lippold (Lippold 1980; Alvarado-Cardenas & Ochoterena 2007) the three species of sect. *Ahouai* are retained in *Thevetia*; the other five species of sect. *Thevetia* are segregated into the genus *Cascabela* Raf. Although Lippold (1980) and Alvarado-Cardenas and Ochoterena (2007) segregate *Thevetia* sensu K. Schum. into the two genera *Thevetia* and *Cascabela*, at no point do they argue against the genera's "close morphological relationship" (Alvarado-Cardenas & Ochoterena 2007). In fact, a recent morphological cladistic analysis (Fig. 1, Alvarado-Cardenas & Ochoterena 2007) nests all eight species of *Thevetia* sensu K. Schum. in a clade supported by six synapomorphies. In short, *Thevetia* sensu K. Schum. is clearly shown to be monophyletic. Nevertheless, Alvarado-Cardenas and Ochoterena (2007) argue for its paraphyly and choose instead to recognize the two sub-clades of the clade (Fig. 1) as distinct genera: *Thevetia* and *Cascabela*.

Chromosome numbers have proven useful in resolving generic relationships in the Apocynaceae (Van der Laan & Arends 1985; Williams 2007). To date, 73 of the 179 genera of the Apocynaceae s.str. (subfamilies Rauvolfioideae and Apocynoidioideae) have been counted (Van der Laan & Arends 1985; Goldblatt & Johnson 2003; Williams 2007). Although previous chromosome counts for sect. *Thevetia* (*T. peruviana*; $2n = 20$) exist, none have been reported for sect. *Ahouai*. The present paper provides the first reported chromosome count for a species of sect. *Ahouai* and discusses the utility of chromosome numbers in interpreting the systematic relationship of *Thevetia* and *Cascabela*.

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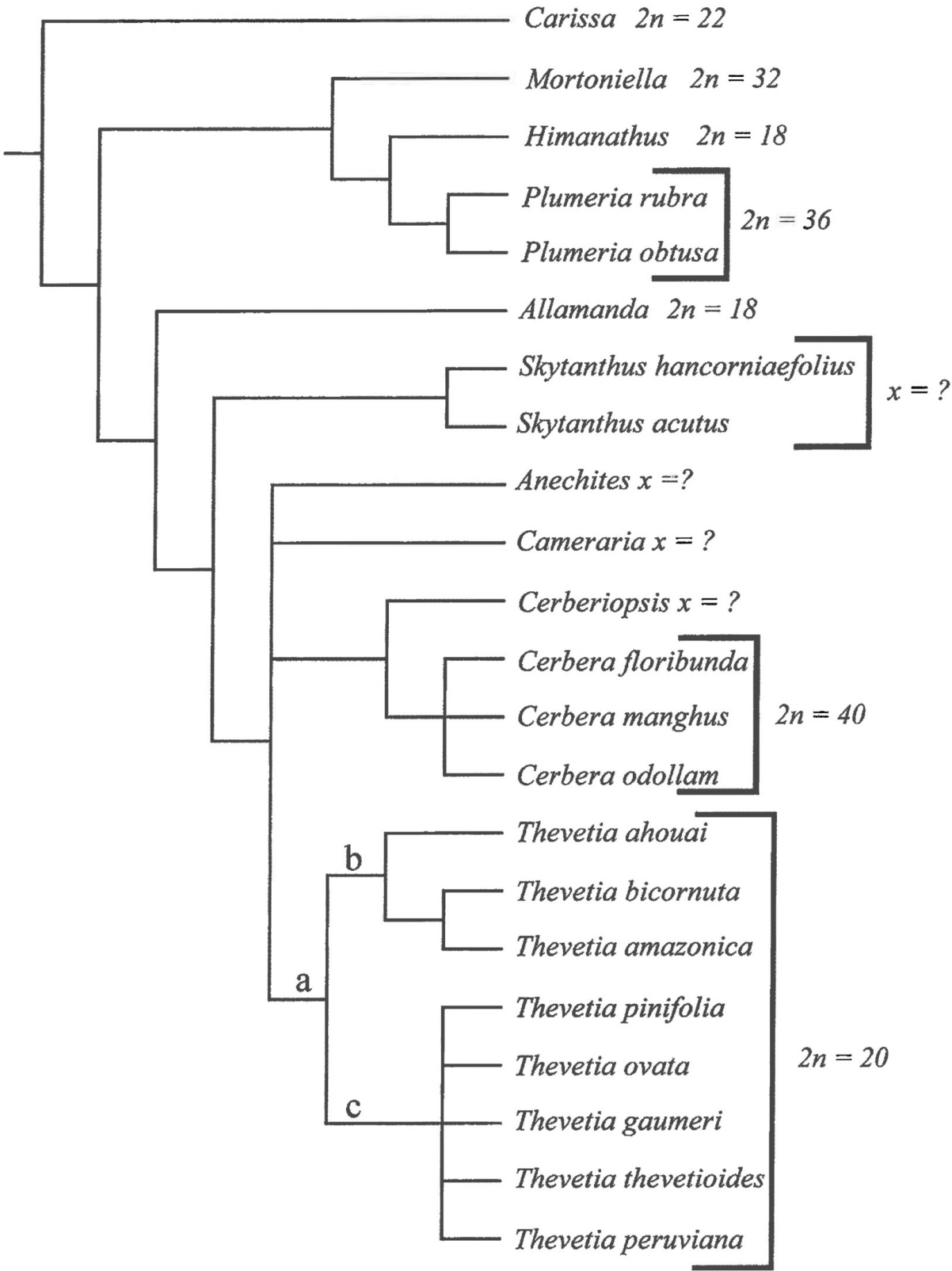


FIG. 1. Morphologically constructed dendrogram of "Plumerieae" clade (from Alvarado-Cardenas & Ochoterena 2007). a = *Thevetia* sensu K. Schum. and/or "Cascabela-*Thevetia*" clade of Alvarado-Cardenas and Ochoterena 2007. This clade is supported by seven synapomorphies. b = *Thevetia* sect. *Ahouai* and/or *Thevetia* sensu Lippold. This clade is supported by two synapomorphies. c = *Thevetia* sect. *Thevetia* and/or *Cascabela* Lippold. This clade is supported by four synapomorphies.

MATERIALS AND METHODS

Roots tips and voucher specimens were collected from a greenhouse specimen of *Thevetia ahouai* housed at the greenhouse of the Department of Biological Sciences, Sam Houston State University (Table 1). The root tips were fixed and analyzed for chromosome number using standard procedures (Raffauf 1964; Van der Laan & Arends 1985). A voucher specimen of the greenhouse plant was made and is preserved in the Warner Herbarium (SHST).

RESULTS

The format used for reporting chromosome numbers in this article follows that established by Strother and Nesom (1997). A mitotic chromosome number of $2n = 20$ was recorded for *Thevetia ahouai*. Van der Laan and Arends (1985) reported chromosome lengths in the Apocynaceae to be between 0.5–4.0 μm , with the average chromosome length between 1–2 μm . The length of the chromosomes in *T. ahouai* varied between 1–3 μm , consistent with most other chromosomes in the Apocynaceae. The base chromosome number ($x = 10$) for *Thevetia ahouai* is consistent with previous reports of $x = 10$ for *Thevetia* (*T. peruviana* $2n = 20$; Gadella 1977; Ugborogho 1983; Van der Laan & Arends 1985; Santhosh & Omanakumari 1997).

DISCUSSION

Van der Laan and Arends (1985) postulated a base chromosome number of $x = 11$ for the Apocynaceae s. str. based on its prevalence in the family and on the observation that many of the plesiomorphic taxa possess a base number of $x = 11$. A base chromosome number of $x = 10$ is found in four genera representing three of the 11 tribes recognized in the Rauvolfioideae (Endress et al. 2007): Hunterieae (*Gonioma* E. Mey.), Plumerieae (*Cerbera* L., *Thevetia*), and Vinceae (*Ochrosia* Juss.). Based on tribal circumscription (Endress et al. 2007) along with molecular evidence (Simões et al. 2007), $x = 10$ is reconstructed as having evolved independently at least three times in the Rauvolfioideae.

A cursory review of chromosome counts for the Apocynaceae (Van der Laan & Arends 1985; Goldblatt & Johnson 2003) reveals that at present the only chromosome counts for genera in the Plumerieae, and thus relatives to *Thevetia* ($2n = 20$), are for *Allamanda* L. ($n = 9$; $2n = 18$), *Cerbera* ($2n = 40$), *Himatanthus* Willd. ex Schult. ($2n = 18$), *Mortoniella* Woodson ($2n = 32$), and *Plumeria* L. ($2n = 36$). At present there are no chromosome counts for the remaining four genera in the Plumerieae: *Anechites* Griseb., *Cameraria* L., *Cerberiopsis* Vieill. ex Pancher & Sébert, and *Skytanthus* Meyen., and it is suggested here that effort be made to obtain count of these taxa. Figures 1 and 2 present cladograms of the Plumerieae constructed from morphological (Alvarado-Cardenas & Ochoterena 2007) and molecular evidence (Simões et al. 2007), respectively. Diploid counts for the respective genera included in the phylogenies are presented for both Figures 1 and 2.

Alvarado-Cardenas and Ochoterena (2007) presented six synapomorphies that described the *Thevetia* sensu K. Schum. clade (Fig. 1, branch a). The diploid count of $2n = 20$ presented here adds a seventh synapomorphy. When interpreting their data Alvarado-Cardenas and Ochoterena (2007) state that “(t)here is still no consensus regarding the question of whether one should recognize one genus with two (sections) or two distinct genera (Lippold 1980), given that *Cascabela* and *Thevetia* are sister taxa.” We would argue that the consensus in evolutionary systematics is to assign generic boundaries that reflect both monophyly and shared ancestry. The decision to divide a well supported clade into two separate genera may support monophyly; however, it excludes shared ancestry. Without prior knowledge, most botanists would be unaware that *Thevetia* and *Cascabela* are sister taxa that share seven synapomorphies. Instead, an evolutionarily more meaningful interpretation of the clade would be that *Thevetia* sensu K. Schum. is monophyletic and support is provided for the recognition of two sections as defined by Schumann (1895). In order to maintain systematic consistency as pertains to current trends in phylogenetic nomenclature we recognize *Thevetia* sensu K. Schum. and regard *Cascabela* and all taxa pertaining to the genus as synonyms of *Thevetia*.

TABLE 1. Voucher specimen for the chromosome number of *Thevetia ahouai*.

Taxon	Voucher specimen	Chromosome number (2n)
<i>Thevetia ahouai</i>	TEXAS: Sam Houston State University Department of Biological Sciences Greenhouse specimen, 22 Jan 2008 <i>Williams 2008-1</i> (SHST).	20

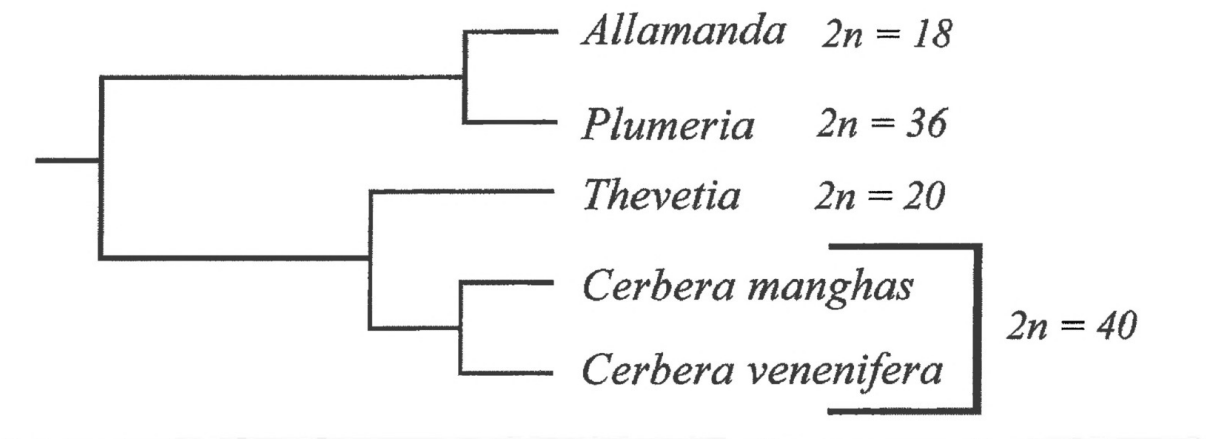


FIG. 2. Molecularly constructed dendrogram of "Plumerieae" clade (from Simões 2007).

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