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Patterns of Genetic and Morphometric Diversity in Baobab (*Adansonia digitata*) Populations Across Different Climatic Zones of Benin (West Africa)

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• *Background and Aims* Baobab (*Adansonia digitata*) is a multi-purpose tree used daily by rural African communities. The present study aimed at investigating the level of morphometric and genetic variation and spatial genetic structure within and between threatened baobab populations from the three climatic zones of Benin.
• *Methods* A total of 137 individuals from six populations were analysed using morphometric data as well as molecular marker data generated using the AFLP technique.
• *Key Results* Five primer pairs resulted in a total of 217 scored bands with 78·34 % of them being polymorphic. A two-level AMOVA of 137 individuals from six baobab populations revealed 82·37 % of the total variation within populations and 17·63 % among populations ($P < 0{\cdot}001$)· Analysis of population structure with allele-frequency based *F*-statistics revealed a global F_{ST} of $0{\cdot}127 \pm 0{\cdot}072$ ($P < 0{\cdot}001$). The mean gene diversity within populations (H_S) and the average gene diversity between populations (D_{ST}) were estimated at $0{\cdot}309 \pm 0{\cdot}000$ and $0{\cdot}045 \pm 0{\cdot}072$, respectively. Baobabs in the Sudanian and Sudan-Guinean zones of Benin were short and produced the highest yields of pulp, seeds and kernels, in contrast to the ones in the Guinean zone, which were tall and produced only a small number of fruits with a low pulp, seed and kernel productivity. A statistically significant correlation with the observed patterns of genetic diversity was observed for three morphological characteristics: height of the trees, number of branches and thickness of the capsules.
• *Conclusions* The results indicate some degree of physical isolation of the populations collected in the different climatic zones and suggest a substantial amount of genetic structuring between the analysed populations of baobab. Sampling options of the natural populations are suggested for *in* or *ex situ* conservation.

Key words: *Adansonia digitata*, baobab, population structure, morphometric variation, climatic zones.

INTRODUCTION

Baobab (*Adansonia digitata*) is a multi-purpose tree with medicinal properties, numerous food uses of various plant parts, and bark fibres that are used for a variety of applications (Codjia *et al*., 2001, 2003; Sidibé and Williams, 2002).

Baobab and its related species belong to the family Bombacaceae and the genus *Adansonia*. The family includes about 30 genera, six tribes and about 250 species. *Adansonia digitata* is related to seven other species of *Adansonia* that are not well studied except for their descriptions in floras (Baum *et al*., 1998).

The different published chromosome numbers ($2n = 96$, Riley, 1960; $2n = 128$, Schröder and Wickens, 1982; $2n = 144$, Miège, 1974; Baker and Baker, 1968; Miège and Burdet, 1968) suggest *Adansonia digitata* to be cytologically hypervariable and has been interpreted as indicating a polyploid series in the species (Miège, 1974; Morawetz, 1986) based on $x = 8$. Baum and Oginuma (1994) reviewed the chromosome number in Bombacaceae and hypothesized that the African baobab is an autotetraploid originating from aneuploid reduction from $4x = 176$, and they suggested that additional research was needed to clarify the cytology of the Bombacaceae.

Baum *et al*. (1998) argued that the genus *Adansonia* originated in Madagascar and migrated to Africa by long-distance dispersal before the breaking of West Gondwana blocks at the beginning of the Cretaceous. African baobab is associated with the savannah, especially the drier parts, and occurs naturally in traditional agroforestry systems (Wickens, 1982). Some trees have been reported to be over 1000 years old (Wickens, 1982).

The flowering time varies significantly; in general, flowering can occur at any time except during the peak of the dry season, and whether leaves are present or not (Baum *et al*., 1998). Flowers are large, pendulous, solitary or paired in leaf axils, and hermaphrodite (Baum, 1995*a*). The African baobab is known to be bat-pollinated (van der Pijl, 1936; Jaeger, 1945, 1954; Harris and Baker, 1959; Start, 1972;Baum, 1995*a*) like other species/genera of Bombacaceae, such as *Adansonia grandidieri* and *Adansonia suarezensis*, both endemic in Madagascar (Baum, 1995*a*), and *Ceiba pentandra* (Lobo *et al*., 2005). Although its breeding behaviour has not been studied extensively, baobab was classified by Ouedrago (2000) as generally outbreeding.

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