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Assessing ploidy-level and gene flow between baobab (Adansonia digitata) fruit producers and poor producers in Limpopo

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2014-07-18
http://hdl.handle.net/10539/14928

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Abstract

The African baobab (*Adansonia digitata*) is a multi-purpose tree that is important among African villages as it provides food and a range of raw materials. Its fruits provide essential nutrients and are sold to generate income. As baobab fruits are important to the livelihoods of many people, it is important to understand the causes of differences in fruit production in order to maximise use and for conservation purposes. Many studies have examined fruit production to understand the causes of variation in fruit yields. In Venda, a region northern South Africa, differences in baobab fruit yield has been recorded for 8 years, thus classifying individual trees as either poor producers or producers (Venter and Witkowski, 2011). Poor producers are adult trees producing less than five fruits each year and some not producing at all. On the other hand, adult trees producing more than five fruits each year are referred as producers. Causes of this difference in fruit production have not been identified. Among other factors, the observed difference in fruit production could be related to differences in ploidy-level among baobab trees. Importantly, few or no studies to our knowledge have been carried out to confirm whether differences in fruit production among baobab trees are related to a difference in ploidy-level. The well-known and widespread mainland African baobab, *Adansonia digitata*, is known to be a tetraploid (four sets of chromosomes). Recently, a difference in ploidy-level has been revealed. A new diploid species, *Adansonia kilima*, has been identified in Africa (Pettigrew et al., 2012). Morphological characteristics (floral, pollen, and stomatal size and density), ploidy, and molecular phylogenetics suggest the presence of a new species. This new species has been reported to overlap the well-known and widespread tetraploid *A. digitata's* distribution in Venda. Consequently, the presence of a diploid species that reproduces with a tetraploid species could result in triploid progeny and contribute to the observed differences in fruit production in these baobab trees. The objectives of this study were (i) to assess if there is any difference in ploidy-level between the poor producer and producer baobab trees in Venda using flow cytometry, (ii) to assess if stomatal density and size correlate to differences in ploidy-level, and (iii) to use microsatellites to estimate levels of gene flow between these baobab trees. Morphological results showed that stomatal size and density were not significantly different between poor producer and producer trees and these features may not be true indicators of difference in ploidy-level for baobabs. Gene flow results showed that there was high mean genetic heterozygosity and low population differentiation expressed in all populations. This suggests that inbreeding was not responsible for the differences in fruit production between poor producer and producer trees. Low population differentiation observed among the populations

indicated that a large number of common alleles were shared among the populations. Therefore, the high gene flow observed among the populations suggests that poor producer and producer trees were sharing alleles, and what is causing the differences in fruit production remains unclear.

Keywords: African baobab, flow cytometry, fruit producers, gene flow, ploidy-level, poor producers, stomatal counts