# SEX DIFFERENTIATION IN BAOBABS: REPRODUCTIVE TRAITS AND FRUIT DISPARITY IN AFRICAN BAOBAB POPULATIONS

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## Research Rationale

The African baobab (*Adansonia* spp.) is a valuable resource to communities across Africa, where the baobab fruit is used for domestic and medicinal needs. Local people also generate an income from selling of baobab fruit that contributes significantly to households. Both the local people and researchers have observed a consistent fruit disparity within baobab populations across continental Africa, a phenomenon that to date has not been reported in other baobab species. Within baobab populations, there are trees that produce between 50 and 200 fruit per year (producers, locally referred to as “females”), whilst other trees produce less than five fruit per year (poor producers, locally as referred to as “males”). Previous studies have found that the fruit disparity is not due to differences in sex, environment or species; however, determining the mechanism behind the fruit disparity has remained unresolved.

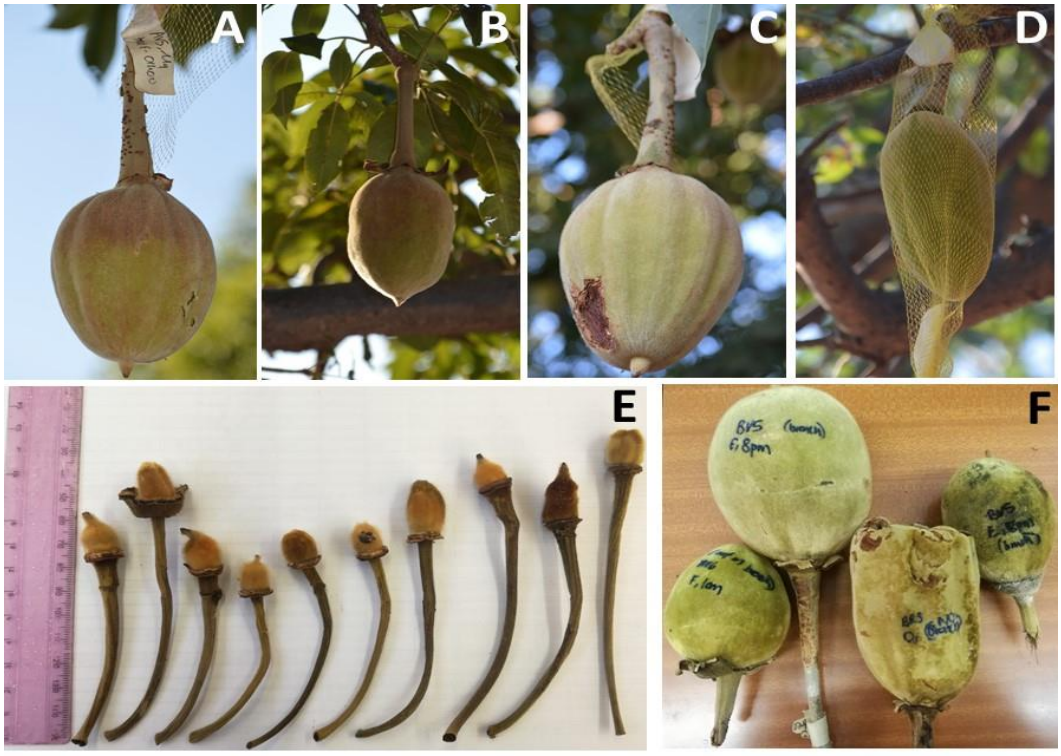


**Figure 1.** Photographs of fruit yielded by producers (A-D) and by poor producers (E-F) from hand-pollination treatments. Most fruit yielded by producers were large and mature, whilst poor producers aborted most fruit and only four of 38 flowers were mature fruit.

Thus, our research focused on investigating if reproductive traits differ between tree types and if that difference contributes to the fruit disparity within African baobab populations. We compared differences in reproductive traits namely, i) stigma morphology, ii) pollen and iii) flower-pollinator interactions between seven producer and seven poor producer trees from two baobab populations in Vhembe, Limpopo.

**Research Highlights**

We found that tree types function similarly until after pollination and fertilisation. Styles from both tree types had pollen tubes present when hand-pollinated (viewed via fluorescence microscopy). For all treatments, pollen tubes reached ovaries and appeared to facilitate fertilisation, indicating that despite the reduced stigmas and low receptivity of poor producers, they were able to support successful pollen germination. This implies that despite the reduced, waxy stamens in producers, the pollen yielded was viable. Based on similarities in pollen tube growth, we expected fruit production/set between tree types to be similar. However, producers yielded five times more mature fruit than poor producers (Fig. 1A–1D). Poor producers aborted almost all their fruit (Fig. 1E–1F), implying that factors affecting differences in fruit production are most likely post-zygotic. This difference in fruit set coupled with differences in reproductive organ size between tree types (sexual dimorphism) indicates that there are differences in resource allocation towards reproduction between tree types.

Producers allocate resources primarily to female reproductive fitness – indicated by large, highly receptive stigmas and high fruit set, and limit resources allocated to male fitness – indicated by reduced, waxy stamens and low pollen production. Poor producers allocated the majority of their resources to male fitness (with their large stamen balls and high pollen production), and limit the resources allocated to female fitness – indicated by their reduced and less receptive stigmas and low fruit production. These differences in resource allocation toward reproduction cause tree types to function differently, where producers act as functional females and poor producers act as functional males – indicating functional dioecy in a historically hermaphroditic species. This highlights the importance of producers' and poor producers' roles within populations and provides potential answers to a long-running question about an iconic species. It is the first study to highlight these differences within continental African baobab populations and has provided a variety of aspects to investigate in future studies.

**Impact of the Research on Tree Health**

With the effects of climate change becoming more severe and demand for baobab fruit increasing, understanding the factors affecting fruit production/fruiting patterns is important for

its conservation. Due to the external factors that negatively affect baobab productivity in protected areas (e.g. stripping of bark by elephants resulting in increased vulnerability to disease), populations in villages – where their value is recognised and protected – may be the best conserved. Thus, if we can understand the African baobab's fruiting patterns and the factors influencing fruit production, we can work with the local harvester community to establish conservation/sustainability strategies to maintain populations for years to come.

**Research Outputs for 2018 (including previously CTHB-funded projects)**

**Articles in Peer-Reviewed Journals**

Paumgarten, F, Locatelli, B, Witkowski ETF. 2018. Wild foods: safety-net or poverty trap? A South African case study. Human Ecology, 46(2), 183-195. https://doi.org/10.1007/s10745-018-9984-z

**Popular articles**

Cron, G.V. June 2018. Only one African baobab species – not two! Veld & Flora, June 104(2): 64-67.

**National Conference Presentations**

1) South African Association for Botanists 2018; (poster presentation – **best poster award**); 08–11 January.

Chetty, A., Cron, G.V., Glennon, K.L., Venter, S.M. & Witkowski, E.T.F. (2018) Do reproductive traits explain fruiting disparity within populations of the African baobab (*Adansonia digitata* L.)? Abstract published in: South African Journal of Botany, 115, 318.

2) South African Association for Botanists 2019 (verbal presentation); 06–09 January.

Chetty, A., Cron, G.V., Glennon, K.L., Venter, S.M. & Witkowski, E.T.F. (2019) Functional dioecy in the African baobab. Abstract may be published in South African Journal of Botany.

**International Conference Presentations**

Annual Meeting for the British Ecological Society 2018; 16–19 December 2019; Birmingham, UK (verbal presentation).

Chetty, A., Cron, G.V., Glennon, K.L., Venter, S.M. & Witkowski, E.T.F. (2018) Functional dioecy in the African baobab (*Adansonia digitata* L.)

**MSc Dissertation**

Chetty, A. (2019). Investigating reproductive traits in the African baobab (*Adansonia digitata* L.) as contributors to disparities in fruit production. MSc (with distinction), University of the Witwatersrand, Johannesburg. Submission date: 26 November 2018. Graduation date: 20 March 2019.