In the summer of 1989 NTBG’s future Breadfruit Institute Director Dr. Diane Ragone collected seeds from the critically endangered papala (Charpentiera densiflora), at Kahanu Garden on Maui, marking this as the oldest known collection in Hawai‘i.

At that time, the Kew Millennium Seed Bank was still seven years from establishment, and the Svalbard Global Seed Vault wouldn’t be constructed until 2008, the same year NTBG’s Juliet Rice Wichman Botanical Research Center and future site of the NTBG Seed Bank and Laboratory was completed. NTBG has banked seeds every year since, and conserving these early collections for future use showed incredible forethought by NTBG staff.

Seed banking, especially at botanical institutions, would not hit the mainstream for at least another decade. But what would the shelf life of these collections be, and at what intervals should they be re-collected? The term “seed storage behavior” describes the physiological response to storage methods. If seeds tolerate desiccation and freezing, they are considered to have “orthodox behavior.”

Until the early 2000s, it was assumed that because of Hawai‘i’s tropical location, the conventional storage methods of desiccating and freezing seeds would prove lethal to the majority of the Hawaiian flora, and therefore seeds from most species were not orthodox and could not be banked.
Fortunately, in 1995 Alvin Yoshinaga, then Seed Conservation Laboratory Manager at the Harold L. Lyon Arboretum at the University of Hawai'i at Mānoa, had the tremendous foresight to initiate real time seed longevity experiments that would eventually transform the way we view seed storage behavior in Hawai‘i.

The experimental design was simple, but would take great fortitude to carry out. Yoshinaga’s experiment determined initial viability, then preserved the same seeds at different environmental conditions over the collection’s lifetime. These differences often take many years to detect, and are described by the seed storage behavior category “freeze sensitive.” It became clear that the time had come to make sense of these data and help inform seed conservation in Hawai‘i and globally.

With efforts led by Yoshinaga’s successor Dr. Marian Chau (currently owner of Kalehua Seed Conservation Consulting and Hawai‘i Seed Bank Partnership Coordinator for Laukahi Plant Conservation Network), and collaborators from around the state of Hawai‘i including NTBG and others, results from these experiments were published open access in September in the American Journal of Botany2.

The study utilizes over 20 years of real-time germination data pooled from the partner seed labs, including tests for freeze sensitivity and re-collection intervals for 197 and 295 native Hawaiian plant species, respectively. We found that species in Campanulaceae (lobelia, bellflower), Cyperaceae (sedge), Rubiaceae (coffee), and Urticaceae (nettles) families, and other genera exhibit freeze sensitive storage behavior.

We also presented a new metric and a simple protocol to determine freeze sensitivity, which can often take two to five years to detect. Interestingly, Hawai‘i has a greater proportion of its flora exhibiting freeze sensitive seed storage behavior than any regional flora assessed. Longevity varied from less than one to twenty plus years.

To give managers an idea of how long each species’ seeds might last in storage, we established a threshold of 70 percent of the maximum germination for each collection. After seeds drop below 70 percent, their viability often continues to decline quickly. The number of species that have reached this threshold for each collection is a model for other tropical, subtropical, and/or island ecosystems looking to use seed banking as a means of on-site plant conservation.

Read the full article open access at https://doi.org/10.1002/ajb2.1351 or search for “Seed freeze sensitivity and ex situ longevity of 295 species in the native Hawaiian flora.”

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**FREEZE SENSITIVE SEEDS OF ENDANGERED, ENDEMIC HAWAIIAN SPECIES IN THE LOBELIA FAMILY; CLOCKWISE FROM TOP LEFT: BRIGHAMIA ROCKII, CLERMONTIA LINDSEYANA, DELISSEA KAUAÎENSIS, AND LOBELIA OHUENSIS. PHOTOS BY MARIAN CHAU**