Oryx

Oh, hi! Seeds of endangered ‘ōhai discovered after three decades

By Dustin Wolkis, 30th November 2023

When a jar of 30-year-old seeds were found in herbarium PTBG of the National Tropical Botanical Garden (NTBG) in 2021, we seed bankers were naturally curious as to whether the seeds were still viable. The seeds in question were from the Hawaiian endemic ‘ōhai *Sesbania tomentosa*, a shrub to small tree in the legume family (Fabaceae), mostly occurring in coastal habitats. The seeds were collected between 1990 and 1994 from across the Hawaiian Islands – specifically, Hawai‘i, Kaua‘i, Moloka‘i, Nīhoa (the Northwest Hawaiian Island located closest in proximity to the eight main windward Hawaiian Islands), and O‘ahu. ‘Ōhai is listed as endangered in the USA and has been proposed for categorization as Vulnerable on the IUCN Red List as there are fewer than 1,000 individuals remaining, with an ongoing estimated decline of 10% in 10 years.

‘Ōhai habit and flowers: A) Located on the sea cliffs of Kaho‘olawe; B) Growing at Polihale, Kaua‘i; C) Flowers growing ex situ at NTBG headquarters. Photos: A & B: Ken Wood; C: Dustin Wolkis.

Fortunately, whoever placed these seeds in the jar three decades ago had the foresight to do so very carefully, writing passport data (including details such as provenance and collation date) on each paper envelope containing seeds. The jar also contained silica, a commonly used desiccant, but worryingly its colour indicated ambient humidity of about 55%. This high humidity combined

with an ambient temperature of around 20 ˚C provides inappropriate conditions for conventional seed banking. Could these endangered seeds have survived these conditions for such a long period of time? To find out, Emily Saling, who was a member of the Kupu Conservation Leadership Development Program at the time, took on the task of assessing the viability of each of the 12 seed lots.

Left: Re-creation of the jar of ʻōhai seed lots discovered by Tim Flynn, Curator of the Herbarium of the National Tropical Botanical Garden (PTBG). Right: Seeds of the Hawaiian endemic ʻōhai Sesbania tomentosa (Fabaceae). Photos: Emily Saling (left) and Raffaela M. Abbriano (right).

Like many legume seeds, ʻōhai has a water-impermeable seed coat. The unique anatomy of this outer layer allows for the loss of water from the seed (desorption), but means that no water is able to be absorbed until the seed coat is damaged. Emily therefore cut each seed with a small razor, enabling absorption, before rehydrating them in a moist environment. She then watered the seeds and transferred them to a germination chamber where temperature and lighting conditions resembled those that ʻōhai seeds would experience in nature. It was then a matter of waiting for the seeds to sprout—and, to our surprise, we didn't have to wait long! Despite the high ambient humidity indicated by the desiccant inside the jar when it was found, it is likely that humidity was much lower when the jar was originally sealed. And thanks to their waterproof coat, the ʻōhai seeds remained relatively dry, which could explain their high viability, even after having been stored for 30 years.

Germination was not only quick—starting after just 7 days and ending by day 34—but also highly successful: the vast majority of the seeds sprouted, up to 100% in some cases! As a result, all the remaining seeds from each of the 12 seed lots were accessioned into the NTBG Seed Bank and Laboratory, adding more than 11,600 seeds to our vital conservation collection. All seedlings arising from our experiment were transferred to the NTBG Conservation Nursery for further propagation. As of September 2023, at least three plants per accession had survived, and most of them were already flowering.

Left: Kupu Conservation Leadership Development Program Member Emily Saling practising tree climbing to access seeds for future collection efforts. Right: One ʻōhai plant that originally germinated from this study and was transferred to the NTBG Conservation Nursery. Along with many other individuals, it has already started to flower. Photo: Rhian Campbell.

My lab at NTBG is housed in the same building as our herbarium, making it well suited for this type of research. For example, in 2019 we published results investigating seed viability of ʻōhiʻa *Metrosideros polymorpha* (Myrtaceae), and in 2022 we investigated the germination potential of 81 seed plant taxa with fewer than 50 individuals remaining in the wild (managed by the Plant Extinction Prevention Program), harvested from herbarium PTBG specimens. However, unlike the ʻōhai seeds in our current study, germination rates in the two previous studies were very low. The high germination result in the present study therefore raises our hopes in resurrecting species from seeds stored in overlooked repositories. Nonetheless, the clock is ticking, and such resurrection experiments should be carried out sooner rather than later, before viability declines further. Seed banking is the most efficient and cost-effective way of practicing ex situ conservation and we therefore recommend depositing seeds into seed banks where facilities and expertise can optimize the longevity and viability of these vital resources.

The article ʻViability of ʻōhai *Sesbania tomentosa* seeds after 3 decades of ambient conditionsʻ is available open access in *Oryx—The International Journal of Conservation.*

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