The Value of Long Term Studies

Editorial

Long term agricultural field experiments at Rothamstead, England, are notable because when they began in 1843, the founders could not possibly have predicted what might be discovered over the following 160 years. The conservation value of long term studies of orchids was discussed in 1990 by the late Carl Olof Tamm, Uppsala, Sweden, when he presented his observations of individual plant behaviour at the International Orchid Symposium. His conclusion after some 40 years of observation was simple: long term observations are essential to conservation and that individual plant tracking of selected orchid taxa was recommended.

Two papers have recently been published that demonstrate the conservation potential of decades-long studies. Joyce and Allan Reddoch summarized what has been learned from some four decades of monitoring 22 species in Gatineau Park, QC, Canada (Reddoch & Reddoch, 2014). Wesley Knapp and Richard Weigand have documented the precipitous decline of 19 of 21 species in Maryland, USA, over a 41-year study, attributing this to herbivory by deer (Knapp & Weigand, 2014). Such lengthy, detailed observations by individuals are uncommon because continuity is a challenge. It may be time to open discussion as to how to manage continuity of such studies.

Marilyn H. S. Light, Editor

Endangered Hawaiian endemic, Peristylus holochila, initiates anthesis in vitro and ex vitro

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Only three orchid species are native to the Hawaiian archipelago: Anoectochilus sandvicensis (Hawaiian Jeweled Orchid, ke kino o kanaloa), Liparis hawaiensis (Hawaii Widelip Orchid, awapuhiakanaloa) and Peristylus (Platanthera) holochila (Hawaiian Bog Orchid, puahala a kane). Of these three, by far the rarest is P. holochila (Fig. 1) consisting of 33 known plants scattered amongst three islands as of 2011 (Kauai, Maui, Molokai).

On Kauai, only one individual plant remains, found in an open bog (Alakai Swamp) vulnerable to feral pigs, and deer that were deliberately released for hunting purposes. The species once occurred on Oahu, but has not been seen on that island since 1938 and is considered extinct there. Formal recognition of this orchid’s rarity was achieved in 1996, when the US ESA listed the species as ‘endangered’ (Zettler and Oppenheimer, 2012).
Dating back to at least 1977, many attempts were made to propagate *P. holochila* artificially in the lab from seed, but all of these attempts subsequently failed, raising the distinct possibility that this orchid would eventually succumb to extinction.

In 2002, a collaborative venture was established between our lab at Illinois College, and Steve Perlman at the National Tropical Botanical Garden on Kauai, to grow this terrestrial orchid from seed with mycorrhizal fungi (*in vitro* symbiotic seed germination). During the next decade, several attempts were made to isolate and use mycorrhizal fungi for this purpose, with special emphasis on securing peloton-forming fungi from protocorms acquired *in situ* through the seed baiting technique of Rasmussen and Whigham (1993). Although we eventually isolated several mycorrhizal candidates, none of the fungal strains facilitated seed germination *in vitro* to our dismay (Zettler et al., 2011). Our focus then shifted to applying standard asymbiotic germination techniques to *P. holochila* knowing full well that seedlings of terrestrial orchids reared in this manner generally have poor survival rates upon deflasking, compared to seedlings grown with fungi. Given *P. holochila*’s problematic track record and uncertain future, we were left with little choice.

Three years after sowing seeds on asymbiotic media (P723, PhytoTechnology Labs), 85 leaf-bearing seedlings of *P. holochila* were deflasked and reintroduced into Hawaii by three Illinois College undergraduate students (Zettler and Perlman, 2012). Prior to the trip, the seedlings all received phytosanitary inspection and were then carefully packaged as carry-on baggage for air transport. Most of the seedlings were taken to Maui and placed into the care of Anna Palomino at Olinda Rare Plant Facility. This site was chosen given its higher (cooler) elevation matching the extant orchid sites, coupled with the facility’s outstanding reputation for cultivating other Hawaiian endemics in peril. In February the next year (2012), another subset of seedlings were taken from Illinois to Olinda by an Illinois College alumnus, Doug Sutton, who offered his orchid transportation services en route to a vacation (Fig. 2).

**Fig. 1.** *Peristylus (Platanthera) holochila* in flower on Molokai, photographed in August 2003 by L. Zettler.

**Fig. 2.** Pot-bound seedlings of *P. holochila* in front of Anna Palomino (l) and Doug Sutton (r) at Olinda Rare Plant Facility on Maui, photographed in early 2012 by Hank Oppenheimer.
A third trip to the archipelago was made by Hank Oppenheimer from Maui PEPP who visited the Illinois College facility in December of 2012, and returned to Maui with 33 additional seedlings. Taken together, a total of 141 *P. holochila* seedlings grown from seed in Illinois were returned to the islands.

What prompted us to write this note concerns what ensued after the initial reintroduction trip in 2011. On 16 July 2012, we were notified by Mr. Oppenheimer that one of the seedlings taken to Olinda in February by Mr. Sutton appeared to be initiating anthesis (Fig. 3).

![Fig. 3. A *P. holochila* seedling at Olinda on Maui initiating anthesis in July 2012. Photo courtesy of Hank Oppenheimer.](image)

Four months later (December 2012), one of the 33 seedlings at Illinois College and destined for Maui initiated anthesis *in vitro*, almost 5 years (59 months) after sowing (Fig. 4). This seedling originated from seed acquired from the lone Kauai plant which was sown on acidified P723 and initially incubated darkness for 32 months. Although it is rare - though not unusual - for orchids to initiate anthesis *in vitro* (e.g., Kerbauy 1984, Hee et al. 2007), rearing seedlings of this U.S. Federally endangered species to the flowering stage is significant especially given the troubled past associated with orchid’s cultivation dating back to 1977.

![Fig. 4. Illinois College undergraduate student and co-author, Shanna David, shown with a *P. holochila* seedling in the act of anthesis shortly after it was deflasked and packaged for its return to Hawaii in December 2012. Photo courtesy of Hank Oppenheimer.](image)

This past June (2013), two of the pot-bound seedlings at Olinda were observed in full bloom, and several others had sizable leaves (Fig. 5). We anticipate that these seedlings will eventually be released into natural habitats to augment existing populations. Hopefully these plants will then increase the seed output in these fragile populations resulting in a new generation of spontaneous seedlings. Although asymbiotic germination of terrestrial orchids may be a more cumbersome and time-consuming technique compared symbiotic germination, it remains the only viable option for cultivating this Hawaiian endemic orchid. For now, we are encouraged by these results, but we remain convinced that more effective protocols have yet to be developed aimed at *P. holochila* cultivation, particularly involving seed germination with mycorrhizal fungi.
Fig. 5. Two artificially propagated P. holochila individuals that were taken to Olinda on Maui are shown in full bloom on the right. Strap leaves of healthy seedlings are also visible poking up through mats of moss.

Acknowledgments

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Literature


The Native Orchid Conservation Center (NAOCC)

http://northamericanorchidcenter.org/

Dennis Whigham

On March 24-25, 2014, a key players meeting was held at the Smithsonian Environmental Research Center (SERC) to discuss accomplishments in the first phase of development of NAOCC and plans for moving forward with development of seed and fungal banks in Phase II as well as efforts to begin to develop techniques to propagate native orchids. The Go Orchids web site was launched in December, 2013 and included orchids of New England and the mid-Atlantic states. Alaska orchids will be launched on the site in May. Significant progress is being made on the orchids of the southeast. The goal is to include all native orchids in the US and Canada on the site by the end of 2014. http://goorchids.northamericanorchidcenter.org/
Over the next 1-2 years, NAOCC will focus on the development of a regional network to collect materials that will be needed for the seed and fungal banks as well as collecting leaf tissue for molecular analysis. A committee led by Larry Zettler is also developing a list of the Top-25 native orchid species that will be the focal species for the NAOCC.

Two populations of *Isotria medeoloides* (small whorled pogonia) have been discovered in West Virginia. These will be the topic of a six-year project that will be based at SERC.

Hal Horowitz has offered to lead an effort to produce a field guide to native orchids that will be a companion to the Go Orchids website.

The NAOCC web site continues to highlight news related to native orchid events and the gallery section has been a popular site based on the number of hits that it has received. Jay O’Neill has actively been developing material for the gallery. If anyone has ideas for topics to be addressed, they should contact Jay at oneillj@si.edu

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**IUCN RED LIST ASSESSMENT OF SLIPPER ORCHIDS: *Cypripedium***

There are approximately 160 species of slipper orchids worldwide, and they are instantly recognisable because of their slipper-like flowers. They receive much interest due to their fascinating flowers and the environments in which they grow, and hybrids derived from the wild species are becoming increasingly affordable and intriguing gifts.

Most slipper orchids require particular environments and are sensitive to environmental change and they are severely threatened by habitat destruction, logging, deforestation, ruthless collection for regional and international trade, exploitation for horticultural purposes, trampling, recreation, ecological disturbance, mining, leisure activities, urbanisation, infrastructure development and management activities. In addition, climate change and intrinsic characteristics of the species could lead to near extinction in the wild.

Despite the threats to these species and their high profile for conservation, only a few global assessments have been published to date in the IUCN Red List of Threatened Species database. Therefore, this project aims to create and complete the Red Listing of Slipper Orchids and publish the conservation assessments in the Global Red List.

We have completed the Red listing of the genus *Cypripedium* and have submitted the conservation assessment to the Red List Unit to be published online by June 2014. The red list assessments for *Cypripedium* showed that 78% of species are threatened and only 13% are of least concern (LC). The threatened categories for *Cypripedium* are: 8% Critically Endangered (CR), 46% Endangered (EN), 25% Vulnerable (VU) and 8% Near Threatened (NT).

Having completed *Cypripedium*, we intend to finish the red listing of the remaining slipper orchids (a complete subfamily) and to publish the results on the IUCN Red List of Threatened Species by the end of 2015. 

*Mike Fay & Hassan Rankou 2014.*

Red listing of *Cypripedium* (52 species)
On The Bookshelf


Food for Thought

Knapp, W.M., and Weigand, R., 2014. Orchid (Orchidaceae) decline in the Catoctin Mountains, Frederick County, Maryland, as documented by a long term dataset. Biodiversity and Conservation, May 2014. DOI 10.1007/s10531-014-0698-2


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Please submit material in Microsoft Word, and illustrations, if any, as separate jpeg files (not embedded), including photographic credit.

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To maintain effective communication, we need to know of any changes in contact information. Please inform the OSG Chair, Dr. Mike Fay (M.Fay@kew.org)

Cypripedium parviflorum var. pubescens tracked from 1985-2014 in Gatineau Park, Québec, Canada, has oscillated from 1 to 8 stems over 30 years with two consecutive years of absence above ground. Photo: M.H.S. Light