

The reintroduction of *Primulina tabacum* Hance, a critically endangered endemic plant, in southern China

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Introduction

Primulina tabacum Hance is a calciphilous perennial herb belonging to the family Gesneriaceae. Its distribution is restricted to the entrances of karst cave drainages along the border between northern Guangdong and southern Hunan, China. *P. tabacum* is on the list of the 'First Class Protected Key Wild Plants of China', a legally binding national plant protection list issued in 1999. It is also on the funding priority list of 'Wild plants with extremely small populations in China' developed in 2012. *P. tabacum* relies on alkaline calciferous groundwater and grows in poor soils. Because of climate change and increasing anthropogenic disturbances, the population size of *P. tabacum* has drastically decreased during the past century. It is estimated that there are less than 10,000 individuals at the entrances to only eight karst caves in South China.

Goals

- Goal 1: Restore the populations of *P. tabacum* to a healthy state.
- Goal 2: Secure habitat protection.
- Goal 3: Facilitate propagation for commercial use.

Success Indicators

- Indicator 1: Establishment of reintroduced *P. tabacum* individuals to the cave entrances where the species were historically present.
- Indicator 2: The reintroduced plants can produce offspring.



Primulina tabacum Hance

Plants



Surveying the reintroduced plants

- **Indicator 3:** Establishment of *in vitro* propagation and plant regeneration system using biotechnology.

Project Summary

Feasibility: Successful reintroduction requires knowledge about the distribution, taxonomy, reproductive biology, demography, horticulture, and ecology of the reintroduced species. We have studied the distribution, conservation status, ecological and biological characteristics,

genetic diversity, and pollination biology including pollen morphology of *P. tabacum* since 2002. We established our intent to reintroduce *P. tabacum* to appropriate sites in 2002. We began by performing seed germination tests at the South China Botanical Garden during 2003 - 2006 to determine whether seeds could be used effectively for reintroduction, but no seeds germinated. However, we were successful in tissue culture and obtaining plantlets in 2007, which led to the reintroduction of *in vitro* propagated *P. tabacum* plantlets to the plant's historical and extant habitats.

Implementation: We used leaf explants from the *P. tabacum* population for tissue culture in January 2007 and obtained about 4,000 plantlets *in vitro* in July. We acclimatized these plantlets at the South China Botanical Garden on 25th September 2007. During the acclimation period, 7.2% of the plantlets died from desiccation. One thousand of the remaining plantlets were then transplanted into the caves at Dixiahe (25°1' N, 112°21'E), Lianzhou City, Guangdong, southern China, on 26th October 2007. At the time of transplanting, the plantlets were 1.5 ±0.1 cm in height and 3.0 ±1.0 cm × 3.5 ±1.0 cm in crown size. The transplants were watered on day one and day three. The planting quadrats were not fenced, fertilized, or mulched. In addition, we proposed successfully to the local government to establish a small natural reserve to conserve the remaining wild individuals in 2007. We also successfully established an *ex situ* collection in the experimental area of the nature reserve in 2010. We recommend continuing promotion of these propagation techniques in commercial horticultural use to alleviate wild collecting pressure.

Post-planting monitoring: After transplantation, we monitored the survival, height, and crown of all transplants, and examined the causes of death (i.e., insect defoliation, fungal decay, nutrient deficiency, lack of water, or strong radiation) from 2007 to 2012. The monitoring was carried out once per month during the first year and once per year thereafter. Micro-habitats and soils were also monitored every year. About 10% of the transplanted seedlings survived by 2012. Our field observations indicate that transplanted *P. tabacum* grew slower

than wild *P. tabacum*. The transplanted *P. tabacum* performed especially well under the cover of the nursing moss, *Gymnostomiella longinervis* Broth. Positive interactions between species, i.e., nurse plant effects, are important for the reintroduction success.



Next generation of individuals

Major difficulties faced

- The local farmers and domestic animals unintentionally disturbed or sometimes destroyed the reintroduction sites.
- It will take a long time and large effort to survey the entire potential distribution range to locate any remaining populations in remote mountain areas

Major lessons learned

- Success depends on the close cooperation among all stake holders including farmers, scientists and the local government.
- It is essential to have an integrated species-recovery plan that includes patrolling to prevent plant removal, establishing an *ex situ* living collection that contains the entire wild genetic diversity, facilitating propagation for commercial use, and implementing reintroduction and augmentation to increase population number and size.
- The best way for the conservation of rare and endangered plant is *in situ* preservation, and reintroduction can be used to achieve this goal and function as a helpful tool to conserve biodiversity.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reason(s) for success/failure:

- Moss is a key nurse plant for the reintroduction of *P. tabacum*.
- The use of innovative propagation methods and nurse plants can facilitate the reintroduction of rare and endangered herbs.

References

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