

GLOBAL RE-INTRODUCTION PERSPECTIVES

Re-introduction case-studies from around the globe



**Edited by
Pritpal S. Soorae**



The designation of geographical entities in this book, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of IUCN or any of the funding organizations concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The views expressed in this publication do not necessarily reflect those of IUCN, Environment Agency - Abu Dhabi or Denver Zoological Foundation.

Published by: IUCN/SSC Re-introduction Specialist Group

Copyright: © 2008 IUCN/SSC Re-introduction Specialist Group

Reproduction of this publication for educational or other non-commercial purposes is authorized without prior written permission from the copyright holder provided the source is fully acknowledged.

Reproduction of this publication for resale or other commercial purposes is prohibited without prior written permission of the copyright holder.

Citation: Soorae, P. S. (ed.) (2008) GLOBAL RE-INTRODUCTION PERSPECTIVES: re-introduction case-studies from around the globe. IUCN/SSC Re-introduction Specialist Group, Abu Dhabi, UAE. viii + 284 pp.

ISBN: 978-2-8317-1113-3

Cover photo: Clockwise starting from top-left:

- Formosan salmon stream, Taiwan
- Students in Madagascar with tree seedlings
- Virgin Islands boa

Produced by: IUCN/SSC Re-introduction Specialist Group

Printed by: Abu Dhabi Printing & Publishing Co., Abu Dhabi, UAE

Downloadable from: <http://www.iucnsscrg.org> (downloads section)

Contact

Details: Pritpal S. Soorae, Editor & RSG Program Officer
E-mail: psoorae@ead.ae

Conservation and re-introduction of the tiger orchid and other native orchids of Singapore

Tim Wing Yam

Senior Researcher, National Parks Board, Singapore Botanic Gardens, 1 Cluny Road, Singapore 259569 (yam_tim_wing@nparks.gov.sg)

Introduction

Singapore consists of a main island and many offshore islands making up a total land area of more than 680 km². Although Singapore is a modern city, there are many interesting types of natural habitats. In the heart of the main island is a primary rainforest and freshwater swamp forest. In addition, some mangrove also remain. The other habitats consist of secondary forests, shrub, grasslands and urban parks and fields. Some 221 species of native orchid have been recorded in Singapore. However, about 170 orchid species are already considered to be extinct and only four are viewed as common. Our orchid conservation program aims to monitor these species and to attempt to explore ways to conserve their germplasm and to increase their number for subsequent re-introduction into appropriate habitats, parks and roadside. So far, we have successfully re-introduced, *Grammatophyllum speciosum*, *Bulbophyllum vaginatum* and *Bulbophyllum membranaceum*.

Goals

- Goal 1: To explore ways to conserve their germplasm.
- Goal 2: To increase their number for subsequent re-introduction into appropriate habitats, parks and roadside.
- Goal 3 To share our experience with others.

Success Indicators

- Indicator 1: To carry out research to develop methods to propagate the species.
- Indicator 2: To re-introduce the species successfully.
- Indicator 3: To disseminate the know how through publications and presentation at international and conferences.

Project Summary

A comparison of habitats in the Island 150 years ago with



Close up of tiger orchid
(*Grammatophyllum speciosum*)



Arrow showing tiger orchid planted on a tree in Singapore

today, shows that most of the mangrove and marshy areas have been replaced by industrial estates or residential areas. Forest and mangrove areas such as those at Choa Chu Kang, Jurong, Ang Mo Kio and Serangoon, where native orchids used to thrive, no longer exist. Native orchids of Singapore are seriously endangered. In 1998, about 221 species of native orchid were recorded in Singapore (Keng *et al.*, 1998). However, based on lists in a preliminary report on the conservation status of plants native to Singapore (Ng and Wee, 1994 & Tan, 1995), about 170 orchid species are already considered to be extinct and only four are viewed as common. The remaining are placed within the “Endangered”, “Vulnerable” and “Rare” categories or have an indeterminate status. This means that more than 90% of the native orchids in Singapore are either endangered, vulnerable, rare or extinct.

Therefore an orchid conservation program was initiated to monitor these species and to attempt to find ways and means to conserve their germplasm and to increase their number for subsequent re-introduction into appropriate habitats in the nature reserves, parks and roadside trees. First, we want to propagate the species vegetatively and by *in vitro* culture. To increase the population of some of the rarer species, they will either be selfed or sibbed, seeds are germinated *in vitro* (Yam & Weatherhead, 1988) and seedlings are introduced back to nature. So far, we have managed to propagate several species and have introduced three species, *Grammatophyllum speciosum*, the tiger orchid, *Bulbophyllum vaginatum* and *Bulbophyllum membranaceum*, back to the nature areas in Singapore.

Mr H. N. Ridley, a Director of the Gardens recorded that the tiger orchid was found in the wild in Toas (Tuas) and Pulau Ubin in 1900 (Ridley, 1900). Unfortunately, naturally occurring plants are now extinct. A few years ago, a tiger orchid in the Gardens flowered and was self-pollinated. The huge seedpod was harvested seven months later. Seeds germinated one month after being sown on Knudson C (Knudson, 1946) medium. After 12 months in the laboratory, the seedlings were planted out in the nursery. Since the tiger orchid occurred naturally in Pulau Ubin, the first batch of seedlings was re-introduced there in July 1999 when they were 26 months old and about 15 - 20 cm tall with 5 - 6 leaves. They were affixed on durian, rambutan, mango, Angsana, Tembusu and rain trees. Seedlings were also planted on trees in the Gardens, around the Visitor Centre at the Bukit Timah Nature Reserve, and in the Orchard Boulevard area in the heart of the city. With experience from the initial trials, we decided to introduce seedlings to the Bukit Batok Nature Park in the beginning of 2001. This time, the

seedlings were more mature, about 30 - 40 cm tall with 16 - 20 leaves. They had at least three shoots, a well-established root system and fleshy pseudobulbs. In February 2001, these larger seedlings were planted on trees along Orchard Boulevard and on the yellow rain trees around the Bandstand in the Gardens. In April 2001, the same was introduced to a site adjacent to a mangrove area in Pulau Ubin, and in early May again to the Bukit Timah Nature Reserve. Lastly, 40 seedlings were planted on rain trees along Holland Road. In December 2002, some 40 seedlings were planted on trees at the Upper Pierce Reservoir.



Orchid - *Bulbophyllum vaginatum*

The seedlings we planted have been growing for six to seven years in their new homes. We observed that those in Pulau Ubin, Orchard Boulevard, Holland Road and Upper Pierce Reservoir are doing well. New shoots have developed and roots are firmly established on tree trunks. Unfortunately, most seedlings planted in the Gardens and the Bukit Timah Nature Reserve were damaged or removed by animals (probably by squirrels and monkeys respectively) (see table 1).

Table 1. Survival rate of re-introduced seedlings of *Grammatophyllum speciosum* to various parts of Singapore

Location	Seedling size (cm)	Survival rate (%)
Pulau Ubin	15 - 20	35
	30 - 40	90
Bukit Timah Nature Reserve	15 - 20	10
	30 - 40	75
Botanic Gardens	15 - 20	10
	30 - 40	70
Orchard Boulevard	15 - 20	45
	30 - 40	90
Bukit Batok Nature Park	30 - 40	90
Holland Road	30 - 40	95
Upper Pierce Reservoir	30 - 40	95

Furthermore, two other native orchids, *Bulbophyllum vaginatum* and *Bulbophyllum membranaceum* have been successfully propagated and re-introduced. Seeds of these species were collected from plants growing at their natural habitats. The seeds were sown on Knudson C medium. Seedlings were grown on the media to 2 - 3 cm tall before being transferred to the nursery. Some 10 seedlings were planted on each fern bark measuring 7 cm long by 5 cm wide.

There were grown at the nursery for six months until new shoots began to develop, they were then re-introduced. Trees were selected based on the same criteria used for re-introducing the tiger orchid. When a suitable tree is selected, fern barks with established seedlings were secured on the tree trunk by nails. So far, some 500 seedlings of *Bulb. vaginatum* and *Bulb. membranaceum* have been re-introduced. Over 90% have settled down and growing well in their new homes. We have learnt that these seedlings are best planted in slightly shady area, with at least 50% shade so that they will not get scorched. We are very pleased to report that most of these seedlings have produced new shoots and are growing onto the bark of the host tree.

Major difficulties faced

- Most seedlings planted in the Gardens and the Bukit Timah Nature Reserve were damaged or removed by animals (probably by squirrels and monkeys respectively).
- Some seedlings introduced did not survive due to change in microclimate such as removal of adjacent trees or major branches.
- Some tree where the species were planted were removed due to diseases and other developmental projects.

Major lessons learned

- Several factors appear to play important roles in the survival of introduced seedlings. These include the microclimate of the area (relative humidity, for example), texture of bark of the host, presence of other epiphytes and the size of seedlings.
- Seedlings of *G. speciosum* planted in areas with high relative humidity tend to survive better than those in dry areas. For example, in Pulau Ubin, seedlings established in a damp area inside a secondary forest are healthier and more vigorous than those growing near the sea where the breeze tends to dry the bark faster.
- Texture of the bark is important because certain barks tend to retain more moisture. For instance, Rain trees are generally better hosts than Tembusu. trees that support more epiphytes tend to be better hosts than those with fewer epiphytes. It seems that if the conditions are suitable for other epiphytes, they are also more appropriate for *G. speciosum*.
- The size of seedlings of *G. speciosum* is also an important factor in determining survival. Seedlings with 16 - 20 leaves (30 - 40 cm tall) tend to survive better than those with only five leaves (15 - 20 cm tall).
- For *Bulbophyllum vaginatum* and *Bulbophyllum membranaceum*, we have learnt that these seedlings are best planted in slightly shady area, with at least 50% shade so that they will not get scorched.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reasons for success/failure:

- The seedlings of *Grammatophyllum speciosum* planted have been growing for six to seven years in their new homes. More than 80% in Pulau Ubin, Orchard Boulevard, Holland Road and Upper Pierce Reservoir are doing well. Two of the re-introduced plants have flowered.
- Over 90% re-introduced seedlings of *Bulbophyllum vaginatum* and *Bulbophyllum membranaceum* are growing well in their new homes. Most of these seedlings have produced new shoots and are growing onto the bark of the host tree. Several seedlings of *B. vaginatum* planted have flowered.

References

- Keng, H., S.C. Chin & H.T.W. Tan (1998) The Concise Flora of Singapore - Vol. 2: Monocotyledons. Singapore University Press, National University of Singapore.
- Knudson, L. (1946) A new nutrient solution for orchid seed germination. American Orchid Society Bulletin, 15: 214 - 217.
- Ng, P.K.L. & Y.C. Wee (Eds.) 1994 The Singapore Red Data Book. Threatened Plants and Animals of Singapore. Nature Society (Singapore).
- Ridley, H.N. (1900) The flora of Singapore. Journal of Straits Branch of the Royal Asiatic Society 33: 27 - 196.
- Tan, H. (Ed.) (1995) A Guide to the Threatened Plants of Singapore. Singapore Science Centre.
- Yam T. W. & Weatherhead M. A. (1988) Germination and seedling development of some Hong Kong orchids. I. Lindleyana 3: 156 - 160.