

Global management of Titan Arum (*Amorphophallus titanum*): Using a “studbook” to document pedigree, demography, and genetics of a high value species

Jordan Wood^{1,2}, Andrew Bunting¹, Jeremie Fant¹, & Marcia Glenn¹
1. Chicago Botanic Garden, Glencoe, IL. 2. Correspondence; jwood@chicagobotanic.org

Introduction

What is a studbook and how can botanic gardens use them?

The zoo community compiles, shares, and analyzes information about every animal in a captive population by using a studbook to track pedigree. A pedigree is used to make management and conservation decisions that minimize the risk of genetic and demographic decline.

Recently, the studbook approach was successfully adapted for living collections of plants through work on a critically endangered Hawaiian species, *Brighamia insignis*. The potential benefit of using a studbook to cooperatively manage living collections can be extended to other plant species, such as Titan Arum.

Why Titan Arum?

Titan Arums in botanic gardens would benefit from studbook management because they:

1. Originated from relatively few founders.
2. Have been held for multiple generations.
3. Are dependent on humans to reproduce.
4. Have an exceptionally well-documented history.
5. Are grown and exchanged by gardens worldwide.

What are the Benefits of studbook management?

1. Maximize retention of genetic diversity.
2. Support long-term stability of plants in collections.
3. Inform future breeding.
4. Inform plant distribution decisions.

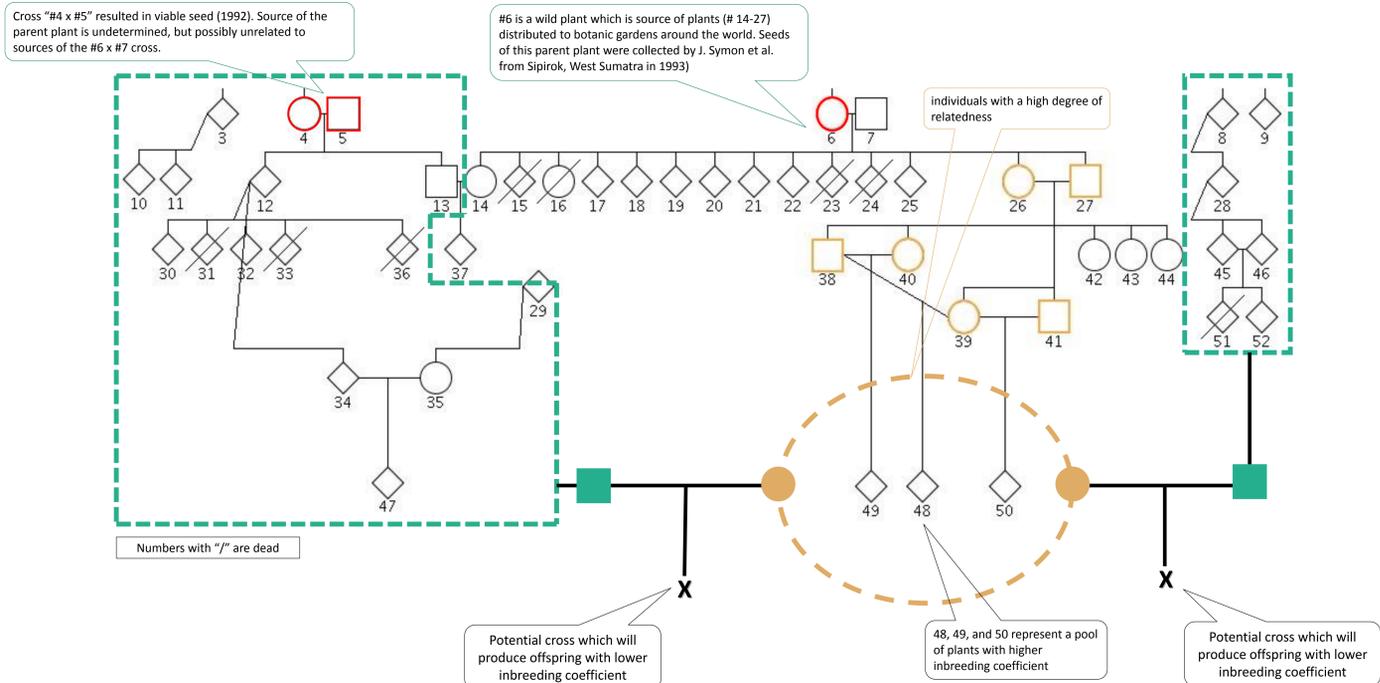


Fruit (left) and viable seeds (right) from “Alice”, a Titan Arum from Chicago Botanic Garden. As more Titan Arums successful produce seed it will become important to track pollen and ovule donors to ensure breeding pairs are the best match to help meet conservation goals.

Objectives

- Understand the history of Titan Arum in cultivation.
- Determine the wild origin of cultivated plants.
- Preserve the widest possible genetic diversity of Titan Arum in cultivation.
- Create a continuously updated studbook that can provide management and breeding recommendations.
- Complete a genetic study to support pedigree analysis.

Methods & Anticipated Results



A segment of the *A. titanum* pedigree shows past and potential breeding pairs. This portion of the pedigree consists of approximately 50 plants from 10 botanic gardens in the Canada, United States, and Germany.

Steps to create and manage a studbook

Step 1: Create a “studbook”. In August 2018 we contacted all Botanic Garden Conservation International (BGCI) members holding *A. titanum*. We identified 140 botanic gardens and private collections.

Step 2: Add genetic data. Botanic gardens were also asked to submit DNA samples of *A. titanum*. Genetic data is useful to determine relatedness when parentage is unknown.

Step 3: Perform pedigree analysis. Population Management software (PMx) uses pedigree and genetic data to provides recommendations for management of ex situ populations. Pedigree analysis helps to minimize relatedness (kinship) which prevents inbreeding and reduces the loss of genetic diversity.

Step 4: Publish recommendations. The analysis will determine ideal breeding pairs and identify plants that harbor unique or under represented genetic diversity worthy of pollen banking or transfer.

Step 5: Continue to update “Studbook”. When gardens propagate or receive new plants they will need to share updated records with a centralized studbook database. If records are kept up to date no new genetic data is needed as it can be inferred from past generations.



Titan Arum (*A. titanum*) - fruit, leaf, and bloom. Chicago Botanic Garden (2016).

Challenges

- Studbooks can be resource intensive, especially if every individual is documented. It may not be practical to include every seedling in the pedigree. Instead, a combination of tracking accessions and individuals could be used.
- An institution or organization needs to be responsible for maintaining and updating the studbook.

Works Cited

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