Threatened plant species: *Amorphophallus titanum* propagation©

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INTRODUCTION

One of the most exciting plant species is the titan arum, *Amorphophallus titanium*, which can truly be regarded as a flagship species for botanic gardens. Wild populations suffer from increasing pressure on their natural habitat and botanic gardens can play an important role in the ex-situ conservation of the species.

DISCUSSION

Amorphophallus titanum is one of the most prominent plants in the plant kingdom. It has the largest unbranched inflorescence known and what looks like a single flower is in fact a group of flowers making up the inflorescence. Like all arums, the inflorescence contains a spadix which extends in the middle and is usually a creamy yellow colour and a spathe which once unfurled is a dark maroon colour. The spadix can grow more than 3 m tall and the spathe can extend over a 1 m wide. The true flowers are extremely reduced with separate male and female flowers. There are approximately 400-500 of each located at the bottom of the spadix. Female flowers are active as the spathe starts to open (which happens in the afternoon of the day that it opens) and into the night. The next day the male flowers are active, however the female are no longer active so the flower can't self-pollinate so pollen from a different flower must be brought to it by a pollinator for successful pollination and fruit and seed set to occur. This is the reason that the flower mimics the smell of rotting flesh, to attract pollinators to the flower that are usually carrion beetles, blowflies, and sweat bees which bring the pollen with them.

It was discovered in Sumatra (where it is endemic), Indonesia in 1878 by the Italian Botanist Odoardo Beccari who sent seeds to the botanic gardens in Florence and Kew. It took 11 years before the first plant flowered in 1889 at the Royal Botanic Gardens Kew. For the next 100 years flowering events of titan arum in botanic gardens were extremely rare with only 21 flowerings recorded worldwide until 1989.

In 2006 the Botanic Gardens of South Australia received three seeds and all of these seeds were successfully germinated. Since 2006 these plants have been grown on in a glasshouse at the Botanic Gardens of South Australia Nursery located within the Mount Lofty Botanic Gardens (Figure 1). The likelihood of receiving subsequent wild collected material is remote as this species is listed as vulnerable in the wild on the Red List of Species and with CITES (Convention of International Trade in Endangered Species).

As an *Amorphophallus* plant grows the original corm grows and a side corm can form which when the plant is dormant and can be removed to make an extra plant. By this method we have made seven plants from the original three. Propagating plants from the original corm via division is a valid form of propagation but the number of plants that can be propagated is limited and this is a very slow form of propagation. Vegetative propagation of this species via leaf cuttings has been reported but very little information regarding the techniques and conditions used has been published. In early 2013 nursery staff at the Botanic Gardens of South Australia decided to undertake some trials to evaluate if this technique was achievable.

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Figure 1. *Amorphophallus titanum* pots growing at the Botanic Gardens of SA Nursery in its vegetative stages (image, Reg Baldock).

Figure 2. Cuttings prepared of *Amorphophallus titanum* before planting (image, Reg Baldock).

We successfully developed protocols to vegetatively propagate this species by two methods of leaf cuttings—horizontal and vertical. Leaves were harvested from motherstock pots held in the nursery and included material from each of the three original seeds. The cuttings were prepared by cutting leaves into 20-30-cm segments (Figure 2). The leaf material on the lower end of the cutting was removed and the leaf material on the top part

retained with the leaflets shortened to reduce water loss from the cutting by transpiration. The bottom part of the cutting was dipped into rooting hormone solution—indole butyric acid (IBA) 3,000 ppm. Each cutting was planted into propagation medium that consisted of 80% perlite and 20% coir peat. Once completed the cuttings were placed into fog chambers with 25°C bottom heat and a minimum of 70% humidity (Figure 3). Vertical cuttings were planted into a 150-mm pot. For horizontal cuttings the leaf was laid down horizontally in the propagation medium in a seedling tray.

Figure 3. A*morphophallus titanum* leaf cuttings placed in humidity fog chambers at The Botanic Gardens of SA Nursery (image, Matt Coulter).

After 8 weeks adventitious root formation started at the base where hormone application had occurred (Figure 4). The cuttings continued to grow and on the side of the stem where roots formed corms started to form with their own independent root system (Figure 5). Sometime later the original leaf died down and the corms went into dormancy. Following this new shoots formed and grew from these corms. The new plants went on to go through their normal cycle of growing, dying down then a period of dormancy (Figure 6). Each year the leaf and the corm continued to grow. The first plantlets we propagated by leaf cuttings are nearing 3 years old.

The interesting observation that we have found is you get quite different leaves/plants from vertical and horizontal leaf cuttings. Vertical leaf cuttings have the ability to make multiple corms and leaves from the one cutting and in many cases we achieved 6-7 leaves per leaf cutting which gave 6-7 individual plants. Horizontal leaf cuttings usually produced just the 1 leaf and corm per cutting however a much stronger vertical shoot was achieved as there is less competition, on the other hand if the maximum amount of cuttings was needed to be achieved then the vertical cutting is a useful technique.

Figure 4. Adventitious root formation of the *Amorphophallus titanum* leaf cutting (image, Matt Coulter).

Figure 5. The leaf of the *Amorphophallus titanum* cutting has died down and corms with independent root systems have developed on the cutting (image, Matt Coulter).

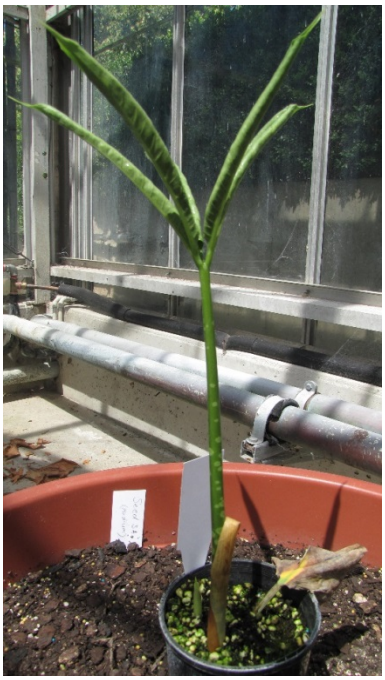

Figure 6. The corm has gone through its dormancy phase and the new leaf has emerged from the corm to start its growth (image, Matt Coulter).

CONCLUSION

In the coming years we hope to refine the technique for propagating and growing this unique species. Through this technique we have produced 100 new plants (Figure 7) from the 7-old specimens that we have. All this started with the three seeds that we had. This is an important process in ex situ conservation of the species and will give us a greater ability to display the characteristics of its exceptional growth habits and to display the flower to the public when we can flower the plants that we have.

Figure 7. The many new plants of *Amorphophallus titanum* growing in at The Botanic Gardens of SA Nursery 3 years after propagation trials, we have more than 100 new plants (image, Matt Coulter).