





FIT FOR A QUEEN

*A botanic breakthrough
for WA's most iconic orchid*

The Queen of Sheba orchid has been successfully grown in cultivation thanks to a partnership between researchers in Western Australia and Victoria.

by Karla Forrest

Beloved by orchid enthusiasts, the Queen of Sheba (*Theylymitra variegata*) is one of Australia's most beautiful and threatened native orchids. It is endemic to Western Australia and exists in just two locations in the State's south-west. In 2019, interstate interest in the species prompted a fruitful pairing between scientists from WA's own Kings Park and the Royal Botanic Gardens Victoria. By early 2020, the teams had each managed to grow hundreds of Queen of Sheba seedlings in purpose-built propagation facilities, sparking renewed hopes for conservation of the species in the wild.

ANSWERING THE CALL

For DBCA research scientist Dr Belinda Davis, the story began 11 years ago, when the City of Bunbury approached the Botanic Gardens and Parks Authority with concerns for the local Queen of Sheba population near Bunbury. Belinda set about gathering seeds and fungi from the area in order to safeguard the species.

The Priority 2-listed Queen of Sheba grows in banksia woodland habitat near Bunbury and Albany. Known for its

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Main The Queen of Sheba orchid is known for its distinctive pinky-purple blotched flowers, spiral leaf and ornate column.

Photo – Ann Storr

Above Dr Belinda Davis is dedicated to growing the orchid in cultivation.

Photo – Peter Nicholas/DBCA

Inset top Magnified image of the early stages of germination (called a protocorm). The protocorm will go on to develop a leaf and tuber.

Inset above A scanning electron magnification image of orchid root tissue showing fungal coils. These fungal coils will be cut off from contact with the soil by the orchid and digested and the nutrients will be absorbed across the orchid cell walls. Once digested the cell will be reinfected by the fungi and the process begins again. This is the way the orchid obtains nutrients from the soil.
Photos – Belinda Davis/DBCA



eye-catching flowers featuring blotchy pink, purple and orange colourations, the Queen of Sheba is one of nine species in the spiral-leaved sun orchid complex. The aptly named group all feature a narrow, spirally-twisted leaf and only open their flowers on warm, sunny days. They grow between 100 to 350 millimetres tall.

Like all orchids, the Queen of Sheba requires a soil fungal partner, or mycorrhizal fungi, to grow. The fungi provide essential nutrients to the orchid, and the orchid provides photosynthetically derived carbohydrates. As such, orchids are a particularly challenging species to grow outside their usual habitat in the wild, due to these complex and highly specialised symbiotic relationships. Scientists must look beyond the plant and into the rest of the ecosystem to see if all the pieces are there.

The material Belinda had collected from Bunbury was kept at the WA Seed Centre for long-term seed storage, with some kept aside for cultivation. She and her team tried various methods to replicate these relationships in order to grow the orchid in the Kings Park laboratory, but finding the right combination of nutrients and conditions



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proved difficult, and it was seven long years until they saw even a flower.

PRECISION PROPAGATION

In 2019, a chance meeting with fellow researcher Dr Noushka Reiter at an orchid workshop prompted Belinda to revisit the Queen of Sheba propagation program. As the research scientist leading the Orchid Conservation Program for the Royal Botanic Gardens Victoria, Noushka works on threatened flora ecology, mycorrhizal associations and reintroductions into the wild. She had been studying two other nationally endangered orchids in the Queen of Sheba complex; the spiral sun orchid (*T. mathewsii*) and the brilliant sun orchid



● Known distribution of Queen of Sheba orchid



(*T. mackibbinii*); and had successfully grown both species.

While the Queen of Sheba is endemic to WA, some of its relatives in the spiral-leaved sun orchid complex occur in Victoria, so collaboration on the project seemed mutually beneficial.

Using seed and fungi samples collected near Albany this time, Belinda, Noushka and their teams began new attempts, working from their own laboratories in WA and Victoria, but sharing methods and findings. They knew success was all about getting the right mix of nutrients on the petri plate, where the collected seed and the fungi would be introduced to each other. When this mix is wrong, the fungi consumes the seed.

Work continued for 18 months, before eventually – a breakthrough. The latest nutrient mix allowed a multitude of protocorms to develop, the very beginnings of a new plant. Over time, the teams carried out several careful transfers to ensure continued growth of the winning ‘batch’. The developing orchids were moved from sterile petri dishes into ‘humidicribs’ in a laboratory – small closed containers to ensure a humid environment – before being moved into fogging units.

Once strong enough, the seedlings were taken from the laboratory and planted into soil-filled pots in Kings Park’s glasshouse, where hundreds are now cared for and thriving.

Top left Potted seedlings in the early stages of flowering already showing a unique spotted pattern and the beginnings of its eye-catching pink, purple and orange flowers.

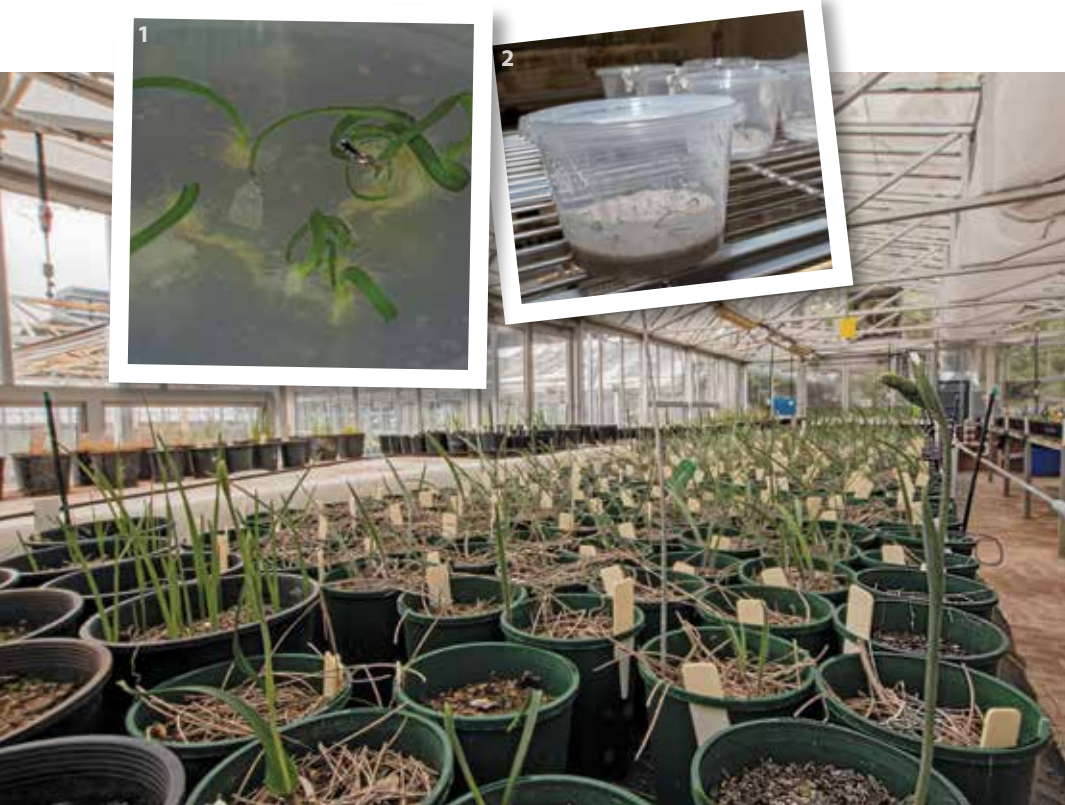
Photo – Peter Nicholas/DBCA

Top There are several variations of the Queen of Sheba orchid. The focus of this research is on arguably the most iconic, the Queen of Sheba (*T. variegata*), as opposed to its relatives the northern Queen of Sheba (*T. pulcherrima*) and the eastern Queen of Sheba (*T. speciosa*).

Photo – Mark Brundrett

Above The Queen of Sheba orchid is almost impossible to see when not in flower, blending into its banksia woodland habitat, making it easy to accidentally step on the rare plant when bushwalking.

Photo – Sarah Barrett/DBCA



Left Following several acclimatisation steps to adapt to a lower humidity environment, the plants move to the glasshouse, joining *ex situ* orchid living collection. Here they will form a conservation seed orchard for future propagation and translocations.

Insets left 1) The petri plate on which the seed and fungi are introduced to each other. Getting the nutrient mix right on the petri plate is key to success. If wrong, the fungi will parasitise the seed and consume it. **2)** Orchid 'humidicrib' in which seedlings are moved to once they outgrow the petri dish. The sand and agar medium encourages early tuberisation which is key to surviving their first summer dormancy.

Above Seedlings are kept and grown in a sterile, temperature, humidity and light-controlled room until large enough to make the transition to glasshouse and soil.
Photos – Peter Nicholas/DBCA

Below The Queen of Sheba orchid in full bloom.
Photo – Keith Smith



Karla Forrest is a DBCA communications officer. She can be contacted on (08) 9219 9818 or by email karla.forrest@dbca.wa.gov.au

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Belinda is hopeful that in time, the plants will be robust and plentiful enough to begin reintroductions into the wild, as well as being placed on display in the public spaces of Kings Park for more people to enjoy.

The plants at the Royal Botanic Gardens Victoria will be used for seed orcharding, with staff there sending genetically diverse seed material back to Kings Park for propagation into the future.

BRIGHT FUTURE FOR SUN GODDESS

The establishment of insurance populations at both botanic gardens is an exciting achievement for a species that came close to being ‘loved to death’. With its striking appearance and intriguing name, the Queen of Sheba has been impacted by picking, trampling and habitat decline since European settlement in WA. The orchid once grew naturally in the

heart of what is now metropolitan Perth – making Kings Park a fitting location for its ‘rebirth’.

Native orchids hold a special place in the hearts of plant enthusiasts. For members of the WA Native Orchid Study and Conservation Group, the chance to survey and record wild occurrences of the Queen of Sheba is a privilege, not a chore. Indeed, the orchid is so loved that its image graces the covers of many reference books.

In the far south of WA, local tour operators offer like-minded individuals guided walks to see the Queen of Sheba during its flowering months from June to September. Over the years, the Queen has even attracted international visitors eager to make a rare sighting, many of whom go home with no such luck. But this latest breakthrough, coupled with broader land conservation works, could mean their chances will be better next time they return.