Smallest waterlily in the world brought back from the brink of extinction at Kew Gardens

May 19 2010

Nymphaea thermarum - smallest waterlily in the world. Image: Royal Botanic Gardens Kew

The Royal Botanic Gardens, Kew's top propagation 'code-breaker', horticulturist Carlos Magdalena, has cracked the enigma of growing a rare species of African waterlily - believed to be the smallest waterlily in the world with pads than can be as little as 1cm in diameter - bringing it back from the brink of extinction; a fitting success story to celebrate International Day for Biological Diversity on 22 May 2010.

This 'thermal' waterlily (*Nymphaea thermarum*), so named because it grows in freshwater hot springs, was discovered in 1985 by German botanist Professor Eberhard Fischer of Koblenz-Landau University. It was endemic to just one known location in Mashyuza, Rwanda, in the south west of the country. However, it disappeared from this location

about two years ago due to over-exploitation of the hot spring that fed its fragile habitat. Water was prevented from reaching the earth's surface resulting in the desiccation of the few square metres where this species grew and no plant is known to have survived in the wild.

Luckily, Professor Eberhard Fischer realised that the species was in jeopardy and he transported a few specimens to Bonn Botanic Gardens soon after its discovery. At Bonn, horticulturists were successful at preserving these valuable specimens and indeed they lasted for more than a decade. However, the species proved extremely difficult to propagate.

As a result of a conservation plant exchange between Bonn and Kew, a handful of seeds and pre-germinated seedlings reached Kew in July 2009. All other known waterlily species start life as submerged plants until large enough to send pads to the surface. Therefore *Nymphaea thermarum* seedlings were initially grown submerged like any other waterlily. But, at both botanic gardens, this method was unsatisfactory: seedlings were barely clinging on to life and did not develop to adult stages.

Carlos, who has a track record of bringing the rarest and most difficult plants back from the brink, took on the challenge of learning the secrets of successfully propagating *Nymphaea thermarum* over many months.

He ran a series of trials involving a range of temperatures, water hardness, pH and depth. Plants grown in harder water at shallower depths seemed to develop further. However, no plant reached maturity, which was disappointing; as it seemed that every possible permutation known to have an influence on aquatic plant growth had been tested. Everything except the concentration of CO2 and other gases, such as O2, which are found in much smaller concentrations in water than in the air. Or, perhaps there was something crucial in the natural habitat of which

he was not aware?

So the next step was clear: Carlos needed to start investigating ways to increase the carbon dioxide concentration in the water available to the plants whilst gathering information on the natural habitat.

Returning to the original German description of the species and its natural habitat supplied the final clue: "it grows in damp mud caused by the overflow of a hot spring. Water reaches the surface at 50C but the plant colonizes an area where the water has cooled to a temperature of 25C". This meant that, unlike all other known waterlily species, *Nymphaea thermarum* did not grow submerged in the deep waters of lakes, rivers or marshes. The revelation was that this small, extremely rare and unusual species, with a spread of only 5 to 20cm, grows in the damp conditions at the edge of a thermal hot spring - and this was the vital clue needed to crack the code.

With this knowledge Carlos did one final trial. He placed seeds and seedlings into pots of loam within small containers filled with water, thus keeping the water at the same level as the surface of the compost, at a temperature of 25°C. In this way, the last remaining individuals of the species could be exposed to the higher concentrations of carbon dioxide and oxygen in the air. And to his surprise and joy, soon the plants started to improve and after a few weeks, eight plants began to flourish, growing to maturity with thicker, greener and wider leaves. In November 2009, Kew's collection of Nymphea thermarum flowered for the first time.

Carlos Magdalena says,"When I received this donation from Bonn, I realised how important it was for the survival of the species to find a way of growing them successfully. At first they didn't seem to respond to any of the traditional ways of treating these plants and they remained weak and failed to develop and eventually died. It was only when I searched a little deeper that the key I needed came to the surface. Now

we have over 30 healthy baby plants growing here at Kew and some are producing seeds so soon we may have an army of these tiny waterlilies here at Kew. Its future in botanical collections seems secured for the long term."

He adds, "Waterlilies are among the most ancient of flowering plants. This species could provide information about the evolution of flowering plants as it is truly unique. Our immediate priority is the ex situ conservation of the species and thereafter, if the natural flow of water in its historic location can be restored, plants grown at Kew can then be reintroduced into the wild. Also, this species may provide an opportunity to breed beautiful small and compact waterlily hybrids that don't need a pond. Gardeners would love something like this, the advent of the 'no-waterlily'."

Professor Stephen Hopper, Director of the Royal Botanic Gardens, Kew says, "Kew is one of those places that offers a sense of hope in a time of relative doom and gloom about the state of the natural world, where individuals, by doing practical things with plants, can make a real difference to biodiversity conservation. Kew's Breathing Planet Programme is about harnessing Kew's horticultural and plant science expertise to support conservation around the world."

He adds, "Waterlilies have long been associated with Kew - we have an entire glasshouse dedicated to them that is very popular with our visitors in the summer - and Kew was the first botanic garden to grow the giant waterlily, Victoria amazonica. Therefore, for Kew to pay a vital role in saving this tiny species of waterlily is truly thrilling. We hope in the near future it will be restored to its natural habitat and we will try to collect seeds for safekeeping in Kew's Millennium Seed Bank and repatriation to Rwanda.

"The *Nymphaea* story also illustrates a broader biodiversity issue - the

plight of ephemeral wetlands or temporary pools, on soil or rock, worldwide. Typically, these places are small in areal extent and often targeted for uses that threaten biodiversity. Yet seasonal wetlands often are richer in endemic species of plants and animals than 'traditional' wetlands of permanent water. Particularly in the face of global warming, it is vital for biodiversity conservation, and for human well-being in many places, that such seasonally wet havens are afforded every protection, and their biodiversity is nurtured back from the brink of extinction."

Professor Eberhard Fischer, who discovered *Nymphaea thermarum*, says, "When I visited Kew earlier this year I couldn't believe that *Nymphaea thermarum*, which we thought had gone extinct about two years ago, was thriving. These 30 plants were the last viable population of this species on the planet and thanks to the work done at Kew we have an opportunity to secure the future of this fascinating, little waterlily."

On Saturday 22 May 2010 visitors to Kew Gardens will be able to see *Nymphaea thermarum* on display in the Secluded Glasshouse, along with other rare and endangered plants from Kew's conservation nursery. Free guided tours - Biodiversity - what's it all about? - will take place from 10am. Tours start at the Guides' Desk, Victoria Plaza. See www.kew.org/events for tour times.

Provided by Royal Botanic Gardens Kew