

## What is micropropagation?

Micropropagation can be defined as: growing plants from seed or small pieces of tissue under sterile conditions in a laboratory on specially selected media. This is performed in a carefully controlled environment. The media that the plants are grown on contain a carbohydrate source, a range of mineral salts and agar. Sometimes vitamins, amino acids, growth regulators or plant extracts may be added to encourage growth. Different media are used for different plants.

## How is it useful?

Plant tissue culture and micropropagation techniques play an important role in conservation programmes and management of botanical collections. The Micropropagation Unit was set up at Kew in 1974 to propagate plants that are endangered or difficult to grow conventionally. The techniques used include *in vitro* (literally 'in glass') laboratory propagation from vegetative material and germination of seeds and spores.

Expertise has been developed in growing over 3000 species from around the world. These include many that have never been studied before. Our knowledge can be put to good use in helping with conservation of threatened species from unique habitats and remote locations.

**Laboratory grown seedlings of *Anacamptis laxiflora* planted at Wakehurst Place**



## Kew information sheet KI

### Conservation programmes

#### Bryophytes

Also known as mosses and liverworts, these are plant pioneers and fill a vital niche in the ecology of many habitats.

The UK has an exceptional diversity of bryophytes with approximately 600 moss and 300 liverwort species. Of these, 50 are listed for attention under the UK Biodiversity Action Plan (UKBAP). In collaboration with the UK statutory conservation agencies, Kew is developing ways of propagating and storing these species using *in vitro* and cryogenic techniques. In this unique project, novel methods of culture have been developed using the endangered endemic UK moss, *Ditricum cornubicum*. Several priority species are now in culture and cryo-storage. Samples of the critically endangered *Orthodonticum gracile* have been collected from 16 sites and are being multiplied in tissue culture. This will provide a source of uncontaminated DNA for genetic fingerprinting as well as material for possible re-establishment.

#### Ferns

Fern that are rare or difficult to propagate from spores may be propagated *in vitro*. The techniques used reduce the risk of spores of different species becoming mixed. Successes with plants of conservation concern include the Tunbridge filmy fern, *Hymenophyllum tunbrigense*. This species produces green spores that can only be stored for a

Above: Thousands of plants can be propagated within a small space in the lab using a controlled environment

few days; micropropagation allows rapid germination and growth. These techniques are assisting the regional recovery programme for this species in the Sussex Weald.

#### Orchids

In nature most orchids form a *symbiotic* (mutually beneficial) association with fungi in order to help the plant obtain nutrients. This association is essential for the germination of orchid seeds that lack their own internal food supplies (endosperm). The Sainsbury Orchid Conservation Project (information sheet KI5) was established to investigate techniques for germination of temperate terrestrial orchids in the laboratory using fungi.

Many tropical epiphytic and terrestrial orchids are grown from seed *in vitro* at Kew (see information sheet KI4). The media on which the seeds grow contains nutrients to sustain the seedling and so a mycorrhizal fungus is not needed, it is therefore called *asymbiotic*. With good quality fresh seed, very high levels of germination can be achieved *in vitro*, this allows thousands of seedlings to be produced from a single capsule.

Working in collaboration with the Tsimbazaz Botanical and Zoological Park, seed was collected from endangered species such as *Bulbophyllum elliotii* and plants returned to Madagascar to help support dwindling populations. The laboratory continues this support through the Threatened Plants of Madagascar Appeal.

Kew is a lead partner in several of the UK Species Action Plans for endangered orchids such as that for the Fen orchid (*Liparis loeselii*) and the Lady's slipper orchid (*Cypripedium calceolus*) which is one of the UK's rarest orchids. In collaboration with English Nature, seedlings of the Lady's slipper orchid have now been reintroduced and the first flowering was reported in 2000. Laboratory grown seedlings of the Fen orchid have also been planted in the wild.

## Support for living collections

Over 2000 species within Kew's collections are classed with an IUCN Category of Threat. The laboratory supports the care of these valuable specimens by propagating and maintaining collections and rescuing plants that succumb to infection or damage. Through this, we are developing techniques for recalcitrant (difficult to grow) species.

### Bottle Palm (*Hyophorbe lagenicaulis*) on Round Island, Mauritius



## Carnivorous plants

Over 80 carnivorous plant species, 40 % of which have a conservation rating, have been grown from seed using *in vitro* techniques at Kew. Habitat destruction and over collection constitutes a serious threat to many species. The use of these techniques has overcome problems caused by low seed viability and their susceptibility to fungal disease, and has proved effective for increasing stocks of some species in cultivation.

Genera that can be grown *in vitro* include *Sarracenia*, *Nepenthes*, *Drosera*, *Pinguicula*, *Heliamphora*, *Dionaea* and *Cephalotus*.

## Woody Plants and Palms

Initiation of woody plant species into tissue culture can be difficult as many are slow growing and require very specific conditions to allow development. Specialised techniques with the potential to produce large numbers of plants from very limited amounts of starting material are being developed for the critically endangered Café Maron, (*Ramosmania rodriguesii*).

The successful transfer of micropropagated plants to glasshouse conditions is difficult for many tree species. Critically endangered endemics such as *Sophora toromiro* from Easter Island have required the development of novel methods to achieve success.

The Bottle Palm (*Hyophorbe lagenicaulis*) from Round Island, Mauritius is critically endangered and is included in the Threatened Plant Appeal. Propagation through *in vitro* methods will assist in the long-term conservation of this palm and its close relative *H. amaricaulis*, of which only one plant remains.

## Cryopreservation

This is the storage of living material at or near the temperature of liquid nitrogen (-196 °C). At this temperature cellular processes are effectively stopped and the cells or organs are stored in a state of suspended growth, free from pathogens or the risk of genetic drift. It is therefore a valuable tool for plant genetic conservation and allows a tissue bank of vegetative material to be stored over long periods of time. Techniques have proved successful for a variety of species including: *Wahlenbergia insulae* - *howei*, *Hymenophyllum tunbrigense*, *Ditrichum cornubicum* and *Cypripedium*



*Nepenthes in vitro* (inset) and as a mature plant

*calceolus*. Other species are being evaluated and techniques developed to extend the range of species that may be stored in this secure and cost effective way.

## Education and Sharing of Information

Published information, in the form of scientific papers or popular press articles, are released at every opportunity to help pass on knowledge acquired at Kew. The Micropropagation Unit also edits and produces the Botanic Gardens Micropropagation News (BGMN), a newsletter that brings together scientific research papers from around the world. This is received by institutes and individuals in more than 70 countries.

For further information on the work of the Unit, specific enquiries about particular plants or techniques, or submission instructions for BGMN, please contact:

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