Propagation of *Dicksonia antarctica*

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Dicksonia is a commonly cultivated but relatively small genus of about 25 species distributed widely throughout the world (Jones, 1987). They are strange plants, considered rather primitive, and can be traced back to the prehistoric flora of the great super continent Gondwanaland. The most graceful and hardy of the plants that are rather loosely called "tree ferns", are not trees in any sense of the word. Other tree ferns at least have trunks; these ferns are really epiphytes sitting on the top of a "trunk" composed of an entwined, elongated mass of their own dead matter. The young roots must make their way down through this dead matter to find nourishment. In the wild the trunk is usually covered with epiphytic plants which trap humus and moisture, from which the fern roots travelling down the trunk benefit. The plants struggle to survive unless the so-called trunk or root system is protected and kept moist, this is often an unsuspected cause of failure in cultivation.

Dicksonia antarctica (soft tree fern) is a hardy native of the eastern states of Australia, including Tasmania. It is widespread and abundant in Tasmania, from dry sclerophyll forest to rainforest, and ranging from sea level to subalpine forest. It is mostly absent from extremes of altitude (above 900m) as on the Central Plateau, and from low rainfall areas such as the Midlands. It may grow to 15 m tall with a frond span of 9 m, with up to 40 fronds unfurling at a time. It is an ideal potted plant, requiring little space for its roots, and thrives on regular feedings with leaf mould and bone meal. It thrives in cool, moist conditions and, if given plenty of water, will tolerate a fair degree of exposure to sun.

Dicksonia antarctica is such a hardy species and produces spores in such copious amounts (over 800 million spores per plant annually) that scattered but dwarfed individuals are commonly encountered in micro-environments of otherwise unsuitably harsh alpine, coastal, or arid regions. This is one of a few fern species that is the first to recolonise from spore in soils disturbed by activities such as logging or road construction.

HISTORY

The trade in *D. antarctica* trunks dates back well into the last century when bush harvesting of the fern was a major business. There is evidence of several businesses in the port of Hobart relying totally on the export of tree ferns back to England. This practice has now all but ceased due to increasing concern over conservation.

SPORE

Spore is collected on a dry day by taking a fertile frond with mature sori and placing it in an appropriately labelled paper bag. The bag is stored in a warm, dry place for at least 3 days to enable the spore to drop. Ripe spore will drop almost immediately, others will take longer. When all spore has dropped it is separated from debris (the indusium, sporangia, hairs, and scales) by sieving with a fine mesh sieve. It is then placed for long-term storage (up to 6 months) in a paper envelope, which is sealed in a plastic container and kept at approximately 4 to 5°C. *Dicksonia antarctica* spore has been found to retain viability for 10 to 15 years. However, fresh spore gives superior results.

SOWING

At this stage hygiene is extremely important. All trays, glass, and labels used are soaked in a bleach solution (sodium hypochlorite) for at least 30 min, and are subsequently washed down with hot water (60°C) to remove any bleach residue. Benches and any other work surfaces are also washed down with a bleach solution. The spore is sown into trays containing a potting mix which is topped with a layer of sterile peat (we use crushed jiffy pots). The mix is wet through with water at 60°C to kill any pathogens, and tamped down twice. Once the mix is just warm, the paper envelope is torn at the corner, and the spore is sown by gently tapping the edge of the envelope. *Dicksonia antarctica* is easier to sow than some others fern spores because of its bright yellow colour. Once a tray has been sown it is protected from the entry of pathogens by covering with a glass sheet.

Once all trays are sown, individual trays are placed immediately in a plastic bag, labelled, both inside the tray and on the plastic bag, and sealed. The trays are then placed on shelves under fluorescent lights in a room where the maximum temperature is controlled to under 27°C. The lights are on for 15 h per day, and this is the only source of light for the spore until the trays are removed to the growing house.

PROTHALLI

Prothalli become visible between 2 and 4 weeks after sowing. After about 10 to 12 weeks the prothalli will cover the tray, and if left, will start to bubble and grow over each other. The tray is then removed from the growing room. The prothalli are separated onto trays of moist sphagnum (which has been hot watered through to kill pathogens) in round pieces approximately 30 mm in diameter. These trays are then placed on hot-water heated bed which is covered with a plastic tent. The bed temperature is maintained at 18 to 20°C, giving an effective air temperature of around 16 to 18°C overnight.

The trays are watered two to three times a week, and the plastic tent is lifted for approximately 3 h a day. The prothalli will grow together, and after about 4 weeks the young ferns become visible. The ferns should cover the tray and be well rooted into the sphagnum in 10 to 12 weeks. At this stage the trays are removed from the plastic covered bed and place on a heated low bed in the same house in order to harden off.

PRICKING OUT

After 1 week of hardening off the young ferns are ready to be transplanted into small pots or trays filled with a potting mix. After removing as much of the sphagnum mix as possible, a small clump of ferns is placed into each tube. The trays are then labelled and placed back onto the heated beds. After 4 to 6 weeks the roots should be half way down each tube. The trays are then raised to a higher bed where they will receive more light, and after 4 to 6 weeks the roots should reach the bottom of each tube

POTENTIAL PROBLEMS

- Infertile spore is a major cause of failure. This may occur because the spore was either immature or over mature, or because of incorrect storage.

- Attacks by pathogenic fungi or bacteria. These attacks may occur in spite of all precautions taken, and the infection site should be removed and the tray drenched with a fungicide.
- Attacks by fungus gnats (to the prothalli roots). Once the maggots of these gnats are in a tray of prothalli they are very difficult to control. It is best to ensure prevention by effective sterilisation and sealing.
- Algae and mosses may smother the newly grown ferns. This may be an indication of incomplete sterilisation of the media before sowing or later contamination.
- If spores are sown too thickly the prothalli will become crowded, misshapen, and weakened. They are therefore more susceptible to damage and the entry of disease.

LITERATURE CITED

Jones, D.L. 1987. Encyclopaedia of ferns. Lothian Publishing, Melbourne.

Propagation of Apple Rootstocks by Tissue Culture

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Tasmania has historically been recognised as a prime apple growing region of the world. Traditionally, commercial apple orchards have grown fruit on large seedling trees. In recent years, the trends have been for trees grown on dwarfing rootstocks to cater for new planting techniques and return higher yields per hectare. There is considerable demand in the marketplace for the supply of elite dwarfing rootstocks which are difficult to conventionally propagate quickly in large numbers.

INTRODUCTION

Forest Home Nursery's business operations began in 1985. Since its inception the nursery has delivered quality apple and stonefruit trees annually, primarily to Tasmania and several mainland states.

The nursery has conventional field stoolbeds of several *Malus* cultivar rootstocks. The quantity and quality of these stocks over recent years has varied. A decision was made in 1991 to establish a tissue culture facility. The purpose of Forest Home Laboratory is to meet the first class rootstock requirements of cultivars to meet market needs, i.e., disease free, robust, and high production levels. A fully qualified biotechnologist was employed to establish the laboratory and get production under way. Training of a second staff member commenced immediately and in 1992 two more staff were employed. The laboratory now has three skilled staff trained in basic micropropagation techniques and an additional two people managing the hardening-off stage. The operation is housed in a basic structure modified to a clean laboratory environment.