

Growing from spores, Success and Failure



Pterrarium of sporlings

How it all started

Jo my wife at college did, a project on ferns and soon joined the BPS. The British Fern Society. Soon she was trying to sterilise bricks with boiling water then keep them damp with no success. She then tried clay pots covered with pieces of glass that I had cut for her, messing up the kitchen and sterilising with Potassium permanganate. But yet again they would dry out or grow moss. But with advent of the microwave oven and disposable food containers, she had her first success.

Growing from spores fuelled my growing interest in Ferns.

Contamination

Contamination can lead to a failure of the wanted ferns, that were sown. This can, from, biological sources, it can be spores of other ferns, mosses, algae, and fungi. Contamination by chemicals such as plasticisers in plastics (in one case a new Tomato glass house had to re glassed as the rubber seals effected the crop), or herbicide residue, (a Common problem with peat free compost, containing straw treated with herbicide) taint by cleaning products, also chemicals from cooking, volatile organic compounds, and tars.

Collection of spores



Dicksonia antarctica spores and trash

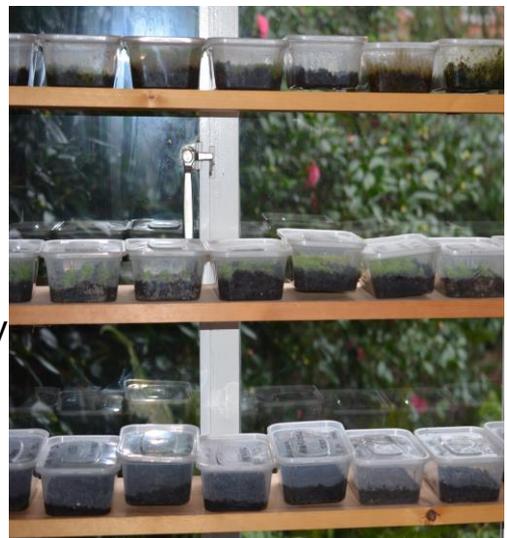
Contamination is a major problem and starts with the collection of fertile fronds. Collecting should be well away from other fertile ferns, as far as practical. Lay the fronds between sheets of clean paper, in a draft free room. As soon as they shed clean the trash by light tapping on the paper held at angle, most spores are left on the paper and the trash will slide off. With Gummy spores such as *Culcita macrocarpa* more care is needed. Clean up after and let the room settle any airborne spores, and clean again before starting on the next one.

Then pack in to paper packets. It is possible to sterilise spores. Not something that I have tried yet. Ref1

Selection of growing containers

Window with containers.

I use disposable food containers (Polypropylene) because they are cheap, thin, have no silicone rubber seal. They can be microwaved and seal well. This means that they will contain less plasticisers, Silicone rubber may also contain plasticisers that can effect plant growth. The porosity to air of the Polypropylene is such that it will not suffocate the plants. They are a little porous to water but takes a long time to dry out.



My method

Food containers

Prepare takeaway food containers
Clean, add ½ cup soil less potting compost, (they are not too fussy to start with) Wetting this will depend on how dry it is, but it needs to be very wet.



Sterilising. microwave for 1.5- 2 minutes with lid on but not fully sealed, If it smells burnt you have over done it, if not steaming hot you have not got it hot enough. NB soil in a microwave may damage it. Organic compost seems OK. At your risk!
Allow to cool.

Sowing



Prothalli well developed, over sown and damping off.

DO NOT SOW TOO THICKLY

One fertile frond of *Osmunda* can have more than 25 million spores.

We only need a few 1000 at most.

A density of prothalli of about 20-30/cmsq would seem desirable but is subject to the viability of the spores.

The containers I use are about 10cm x15cm = 150cmsq so that would be 4500 spores. Ref2 Ref3

In a draught free room, open the container. Using a sharp knife get a very small pile of spore on the tip and tap over compost, seal and label.

If you want to do another tub with a different fern, clean all surfaces, leave room to allow air borne spores to settle, and clean again.

Keep them where there is full light but not direct sunlight. It is distressing when your rare tree fern turns out to be a common *Dryopteris*!

Growing



Well developed sporophytes in weaner case.

They should germinate in a few days to a few months.

Avoid opening the containers as this will allow in contamination.

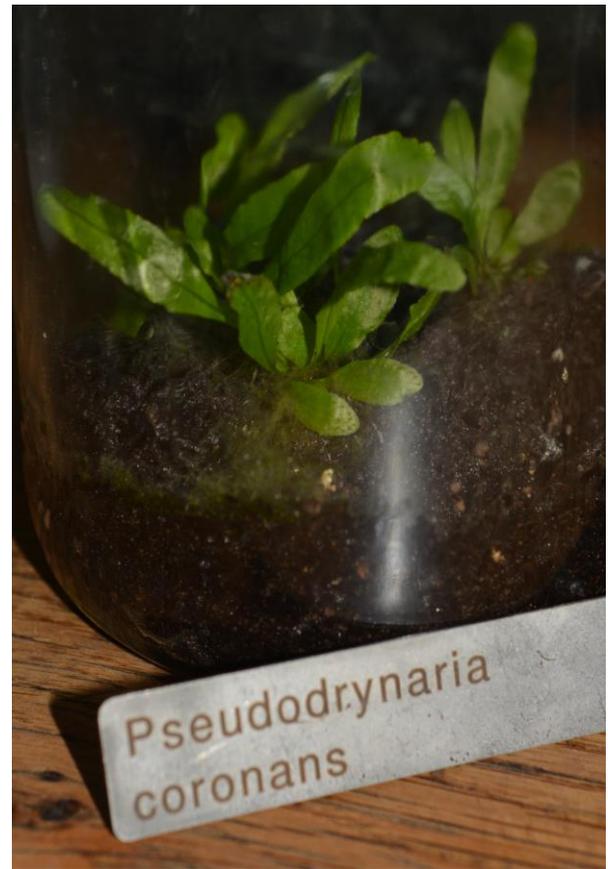
Look though the sides, If you get some prothalli forming, tap lid to get the condensation to drop and aide fertilisation.

Successes



Dicksonia berteriana on Robinson Crusoe Island, one of the Juan Fernandez Islands. A few spores from Amazon.co.uk produced a few plants, although I had expected a failure. One of a few tree ferns that branches, only found on Robinson Crusoe Island.

Pseudodrynaria coronans very slow to develop prothalli looked very poor then produced dozens of sporlings, I pricked out into jam jars, keeping the lid loose. And are now growing very fast.



Sporeling Culcita macrocarpa

Culcita macrocarpa after many attempts a few miserable sporlings. Prick out in to Plug trays. some are making good growth.





Dryopteris sinofibrillosa

Dryopteris sinofibrillosa found at Cally Gardens

<http://www.callygardens.co.uk/>

Identified by Roger Golding

<http://rogergolding.co.uk/>

Thousands of prothalli that had to be patched off, producing 100s of sporelings.

Polypodium guttatum from sowing to sporelings in 3 months.

Actiniopteris australis has grown quickly from spores and are grown on in a large jar, with some moss.



Actinopteri australis

A few *Sadleria cyatheoides*

Failures

Dryopteris sinofibrillosa Thousands of prothalli that had to be patched off repeatedly! Sown too thickly.

Dryopteris when you expected a rare tree fern, all too often.

Calocitica macrocarpa that would not fertilise, many times.
NB. a diploid that is outcrossing.

All that moss I have grown!

Tubs of prothalli wiped out in a few days with a damping off fungi.

Asplenium obovatum that developed just the right number of prothalli fertilised, a great crop of sporlings that went a sickly yellow, alkali compost!

Pseudodrynaria coronans very slow to develop, temperature too low.

Yeast like white patches slowly growing across the Prothalli.

Problems

The pH of the compost needs to be appropriate for the species you are sowing, this can sometimes be very difficult to find out, if not sure use an acid compost, as it is easy to add lime but difficult to remove it.

Getting the temperature right is very important. For temperate species 15-25°C tropical 20-30°C, too high a temperature can damage the spores.

Temperature effects can regulate gender proportions as well, so being in the right range will aid fertilisation. Also the density of prothalli can effect gender proportions. Ref 4 Ref 5

Psilotum and *Tmesipteris* are particular difficult as grow with a mycorrhizal fungal association and in the dark.

Light levels, spectrum and day length need to be considered. I have found that daylight has been adequate up to now. But I am now experimenting with LED panels and long day length. Ref 6

Fertilization

This can be a major problem with Ferns that are outcrossing, you will have to have spores from 2 genotypes. Ref 7 Ref 8

Conclusions

Growing from spores can be a cheap way of building your collection.

The understanding of the Biology that one come across seems never ending and fascinating.

References

Ref1. The Experimental Biology of Ferns Dyer 1979 Academic press p.264
Not something that I have tried Yet. Out of print and difficult to find a copy.

Ref2. The Experimental Biology of Ferns Dyer 1979 Academic press p.266.
Out of print and difficult to find a copy.

Ref3. Density affects gametophyte growth and sexual expression of
Osmunda cinnamomea (Osmundaceae: Pteridophyta)

Ref4. Unravelling the secrets of fern spore germination: what are their
thermal thresholds and how will they cope with climate change.

Ref5. Effect of Temperature on Germination in Northernmost Populations of
Culcita macrocarpa and *Woodwardia radicans*

Ref6. The experimental biology of ferns A F Dyer Academic Press page 280
This is a very useful book to have if you can find a copy.

Ref7. On the widespread capacity for, and functional significance of, extreme
inbreeding in ferns Sessa Testo Watkins
(The Supporting Information has a list of mating systems in ferns, Not
comprehensive but a good indication of where problems may be found.)

Ref8. Sex and the Single Gametophyte: Revising the Homosporous Vascular
Plant Life Cycle in Light of Contemporary Research Haugler Et Al

About

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All pictures by Ashley Basil.