

PROPAGATION OF SPORE BEARING PLANTS - FERNS

In this lab, you will be introduced to the basic life cycle of ferns. The reproductive cycle of ferns will be presented so you will be familiar with the terminology necessary to communicate with professionals regarding fern spore propagation. You will also be given links to additional resources describing how you may initiate fern spore propagation at home or in a commercial setting. You are encouraged to view the additional videos and answer the questions provided.

PROPAGATION OF SPORE BEARING PLANTS - FERNS

Plant Propagation Lab Exercise Module 2

Propagation of spore bearing plants requires a knowledge of spore bearing plant life cycles. Ferns are a popular horticultural plants which will be used as a model for describing the various stages of development of a spore bearing plant. The activities in this lab can be accomplished on a commercial scale or at home and provide an opportunity to directly observe the progression of the fern life cycle from spore to sporophyte.

LAB OBJECTIVES • Introduce students to the life cycle of ferns.

The objectives of this lab are to: Introduce students to the life cycle of ferns. Demonstrate the appropriate use of terms to describe the morphological characteristics for describing the stages of fern development. Demonstrate techniques for collection, cleaning, and sowing of fern spores. Provide alternative systems for fern spore germination in home or commercial settings.

Fern spore germination

For most plant enthusiast, the mature or sporophyte generation of ferns are most familiar. Ferns are an economically important aspect of the horticulture industry but also represent a significant threat to natural areas where some fern species have become invasive and are causing considerable ecological changes threatening plant communities, wildlife, and contribute to agronomic/forestry losses. Understanding the life cycle and reproductive patterns of these species is critical to all these industries.

Shown here are the Cinnamon Fern (left) and old world Climbing fern (right). Cinnamon fern is a Florida native and popular landscape plants. Old world Climbing Fern is not a native of Florida and is classed as an Invasive species in Florida and several other states in the US. For both species you can see both vegetative fronds and reproductive fronds which are distinguishable by changes in overall frond morphology.

Fern relationship to other vascular plants

As a group, ferns are thought to be 380-430 Million years old and contain approximately 10,500 species.

Ferns •Many are rhizomatous and have circinate vernation •Reproduce sexually by spores •Eusporangiate ferns •~250 species of horsetails, whisk ferns moonworts •Leptosporangiate •~10,250 species

The sporophyte generation of many ferns is rhizomatous, although the form of the rhizome can vary considerably among species. The foliage is often described as having Circinate vernation. This describes the way a fern frond emerges. Fern fronds are often tightly curled with the tender expanding tip of the frond along with the various subdivisions protected within a coil. These young expanding frond are also referred to as a fiddlehead.

Ferns do not produce seed but reproduce sexually by production of spores. The spores are produced in small structures called a sporangium. Sporangia can arise from a group of epidermal cells or the sporangia can arise from a single epidermal cells. Ferns with sporangia arising from a group of cells are eusporangiate and those with sporangia arising from a single epidermal cell are leptosporangiate. A larger proportion of the ferns are leptosprangiate.

Fern Life Cycle diagram

This graphic (Figure 4-1 from your propagation text) demonstrates the life cycle of the fern.

The portion of the graphic with the white background represents the sporophyte generations while the portion of the graphic with the light orange background represents the gametophyte generation. You should revisit this portion of Chapter 4 to make sure you can recognize the various parts of the fern and that you understand the terms used to describe each item in the cycle.

Sporophyte Generation Spores are produced on the mature leaves (fronds) of the sporophyte generation of ferns. The spores are arranged in sporangia which are often inside a structure called a sorus. The sori often have a protective covering of living leaf tissue over them that is called an indusium. As the spores begin to mature the indusium may also go through physical changes such as a change in color or desiccating and becoming smaller as it dries to allow an opening for dispersal. The spores ($1n$) may be wind dispersed or they may require rain (water) to aid in dispersal.

Gametophyte Generation The gametophyte generation is initiated with the germination of the spore ($1n$). The gametophyte generation is initiated with the germination of the spore ($1n$). The germinated spore begins to grow and form a heart-shaped structure called a prothallus. The prothallus contains root-like structures called Rhizoids. As the Prothallus matures the Antheridia (male) and Archegonia (female) develop. Antheridia contain male sperm ($1n$) which are mobile in water. Under wet conditions the sperm fertilize the female eggs ($1n$) when they enter the Archegonium thereby resulting in the formation of the zygote ($2n$).

Japanese climbing fern spore germination (40X) Cinnamon fern spore germination (40X) Japanese Climbing Fern -prothallus

Japanese Climbing Fern –Prothallus with initial growth of sporophyte

Japanese Climbing Fern with established sporophyte and necrotic prothallus

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Demonstrate the appropriate use of terms to describe the morphological characteristics for describing the stages of fern development.

Demonstrate techniques for collection, cleaning, and sowing of fern spores. • •Provide alternative systems for fern spore germination in home or commercial settings.

Lab Exercise

Materials

- Mature fern fronds with sporangia containing ripe spores
- Clear plastic container with a tight sealing lid
- Small pot of sterilized potting mix (peat, coir, or very fine bark) and clean water
- Clean piece of paper and/or envelope

Procedure

- Place the mature fern frond on the clean sheet of paper with the sporangia facing down –allow to dry for a few days –tap the frond a few times until you observe spores (looks like dust) on the white paper.
- Place moistened potting mix in your container and distribute spores over the surface of the potting mix.
- Place the cover on the container and place in a bright but not hot window and observe the soil surface weekly for growth of gametophytes and keep observing until you see the sporophytes develop.

Lab Exercise

View the following videos

•The dark art of propagating ferns from spores | Wow to | Gardening Australia
https://youtu.be/Okvz09DpL_w

•Growing Ferns from Spore •<https://youtu.be/IX3HA9QQZ2s>

growing ferns from spore •<https://youtu.be/4tYTz7ONMXU>

1.Prepare a short report that will compare/contrast the differences between the approaches to fern production. Are there any incorrect uses of the fern reproductive terms?

2.Provide a conclusion that summarizes the steps you determine to be the most critical for developing and implementing your own fern spore germination experience.