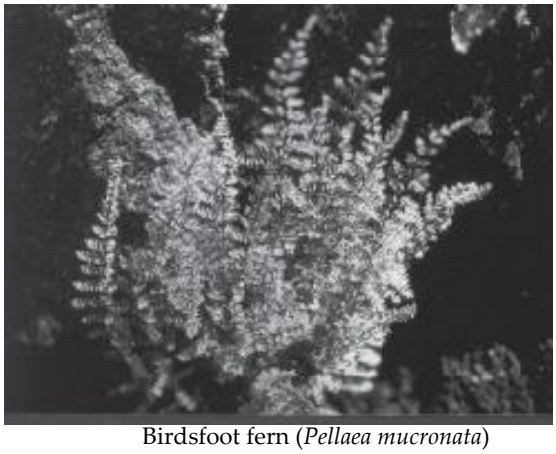
California Native Ferns from Spore to Sporophyte

MARGERY EDGREN



Birdsfoot fern (*Pellaea mucronata*)
Photograph courtesy of Glenn Keator

Did you ever go hiking in the mountains and see some charming little fern filling the crevices of a rocky cliff face? On returning home you may have thought how nice it would be to have some of those ferns fill the crevices in your rock garden or alpine trough. But just try to find them at the local nursery or in specialty catalogs. Even on lists from first-rate fern nurseries like Fancy Fronds, names like *Cheilanthes gracillima*, *C. clevelandii*, *Athyrium alpestre*, and the small *Pellaea* species—*P. breweri*, *P. brachyptera*, *P. bridgesii*—are missing. One solution for this problem is to grow ferns from spores yourself. Anyone who can grow plants from seeds can grow ferns from spores.

Obtaining the Spores

Spores are available from various sources such as the Los Angeles Fern Society, occasionally from plant society seed exchanges, and sometimes from specialty seed catalogs. Seed collectors who specialize in montane species may offer ferns from mountain trails like *Cheilanthes gracillima* and *Athyrium alpestre*, giving collection data on location and altitude. Northwest Native Seeds and Alplains are two examples. If you collect your own spores, here are a couple of tips. Use lightweight paper envelopes, legal size or somewhat larger, with pieces of clean newspaper about the same size laid flat inside. When collecting fronds, lay them flat between layers of newsprint. Do not hesitate to cut the fronds to fit the envelope. In some cases a few pieces of frond are adequate. Cutting is much better than folding or curling the pinnae. The newspaper absorbs moisture, encouraging the spore cases to open and release the spores in a few days or less. Giving the lower edge of the envelope a smart rap on a table top will cause the spores to fall down and collect at the bottom. Spores may be stored in the envelope with the dry frond until you are ready to sow them. Some spores stored this way have remained viable for several years, but longevity varies, and it is best to sow them without too much delay. Letting the fronds dry in a curled position makes it difficult to collect clean spores, as the fronds tend to shatter when handled, leaving much debris mixed with the spores.

Giant chain fern frond (*Woodwardia fimbriata*), underside of leaf showing sori
Photograph courtesy of Glenn Keator

Sowing

The gametophyte generation (the stage that alternates with the sporophyte phase we plant in the garden) gives propagators the most trouble. The small gametophytes that grow from spores and look like little liverworts can be overwhelmed by growth of contaminants such as fungi, algae, bacteria, and mosses. Traditionally this problem has been addressed by sterilization of the spores and the medium, a tedious process that discourages many propagators. The following simple method seeks to avoid this problem by favoring development of the fern gametophyte over the contaminants instead of eliminating them.

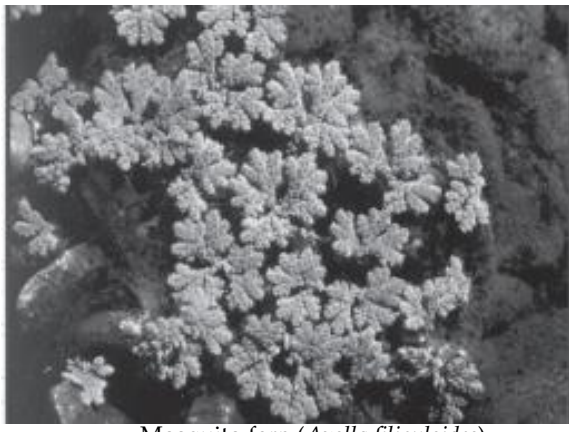
The familiar plastic saucers sold to place under flower pots make excellent containers for growing spores. The four-inch size fits well into a reclosable plastic sandwich bag used for a cover. It is also rigid enough to protect the medium from becoming dislodged. The five-inch size is also satisfactory, but harder to find and slightly large for the average sandwich bag. The saucer should be new and the plastic bag should be a good fit or moisture control will be compromised and the pan more likely to spill.

Masking tape placed around the outside edge of the pan is convenient for recording identification and data. The saucer may be filled to approximately
2/3 of its depth with a medium made of five parts perlite to one part milled sphagnum and moistened with one part of hydroponic fertilizer. (Chem Gro is a commercial fertilizer that works well.) It is important to get the mixture moist, but not wet. This medium must be pressed firmly into the bottom of the saucer with a clean spoon so that the perlite and sphagnum lock together and form a stable surface for sowing the spores. To check stability, hold the saucer on its edge at right angles to the table surface. If the medium shifts at all in this tip test, try again and press harder. Use a new small plastic cup to moisten two rounded teaspoonfuls of fine vermiculite with the same hydroponic fertilizer. Add a light sprinkling of spores over the surface of the vermiculite. Mix thoroughly to distribute the spores over the particles. Scatter the vermiculite over the surface of the medium in the saucer. When it is evenly spread, press it firmly into the medium below, making a good contact between the two layers. Slip the finished pan into a new plastic sandwich bag with a zipper closure.

Now place the finished pan under continuous fluorescent light for growth. Cool white tubes used everywhere for room lighting are excellent for most ferns. (A different quality of light may be required in rare instances.) Low intensity light is best. Keep pans about two feet below the tubes or place a white paper towel over them to reduce and diffuse the light. Pans can also be placed around the edges of a lighted area for other plants where the light is less intense. A stable environment with an ambient temperature of 70 degrees is best, but reasonable approximations give good results. Occasional brief extremes of temperature are of little significance, but wide daily swings from warm to cold make moisture control difficult and give poor results.

The bag should be opened every few days, especially at first, to check moisture content. Remove the pan, place it on a clean surface and wipe condensation from the inside of the bag. Keep the same side of the bag on top to avoid having contamination from the bottom of the pan drip into the medium with condensed moisture. Eventually the medium may dry enough to need more moisture, but this is not likely to occur for several weeks. Water can be added sparingly with a fine mist from a sprayer, especially around the edges, where the medium dries out first. When misting the whole surface of the pan, hold the sprayer about two feet from the pan to avoid overwatering.

Spores usually start germinating within a few days, but this will not be apparent without a microscope. Gametophytes should be growing well, making a green mat across the pan in several weeks, and little sporophytes will develop in several months. These can be pricked out to a soil mix for small ferns as they develop, or chunks of gametophytes and sporophytes can be lifted out together for later separation when they are more mature. The following mixture for tiny sporophytes has a good track record with moisture-loving ferns as well as with xeric varieties. Add three parts coarse vermiculite to two parts sphagnum peat and one part sand and moisten with the same hydroponic fertilizer used for the spore pan. By the time the individual sporophyte has filled a two-inch pot it can be planted in a soil mix suitable for mature ferns.



Mosquito fern (*Azolla filiculoides*)
Photograph courtesy of Glenn Keator

A broad spectrum of ferns—from mountain species to those from wet woodland settings—has been grown using these methods. Important factors are the continuous diffuse light from the fluorescent tubes, the low concentration fertilizer with micronutrients, and the steady warm temperatures. These all favor fast development of the fern gametophytes over their competition. Moisture control may be the most important of all. Moist, but not wet, is the key. The spore pan is designed to make this easier to achieve, as the bottom layer of perlite and milled sphagnum can stabilize the vermiculite layer by drawing off excess moisture and, alternatively, acting as a reservoir. The tiny rhizoids of the gametophytes do not reach beyond the vermiculite layer of the pan. Too much water, cool temperatures, and short days favor the development of fungi, algae, and moss. Perhaps you can adapt principles suggested here to work in your own propagation facilities.
It would be good to have additional California native fern species in general cultivation.