

Envirotalk



GOVERNMENT OF BERMUDA
Ministry of Environment and Planning

WINTER 2012
VOLUME 80 No. 4

PROMOTING APPRECIATION, ENHANCEMENT AND CONSERVATION OF BERMUDA'S ENVIRONMENT

WELCOME

to our winter edition of Envirotalk.

In this issue –

- **Kimberly Burch**, Laboratory Technician, discusses the species re-establishment of the Governor Laffan's fern.
- Love Envirotalk? Help us make it better by filling out the attached survey.
- Salty Oat Chocolate Cookies – a recipe the whole family will love.
- See the planting calendar to get a head start on what to plant this winter.

Please contact:

Aaron Lutkin (Tel: 239-2312 or e-mail: ajlutkin@gov.bm) with ideas for future articles.

Kimberly Burch – *Editor* (Tel: 239-2322 or e-mail: kmburch@gov.bm) to be added to the subscriber list.

SPECIES RE-ESTABLISHMENT – GOVERNOR LAFFAN’S FERN (*Diaplazium laffanianum*)

Extinct in the wild since 1905, the Governor Laffan’s Fern (*Diaplazium laffanianum*) is one of Bermuda’s most rare plant species. Due to its rarity, the fern has been listed as a Level 1 Protected Species (along with 5 other fern species) and ownership of the fern is highly regulated. There are approximately five mature specimens in captivity but none unfortunately in Bermuda due to environmental conditions, loss of habitat and possible natural harvesting. Fortunately the fern is currently undergoing species recovery by employees of the Department of Conservation Services and Environmental Protection along with scientists at the Henry Doory Zoo in Omaha, Nebraska.

Description and Habitat

Endemic to Bermuda, the Laffan fern is named after Governor Sir Robert Laffan and is described as a relatively large species, reaching up to 30 cm (12 inches) in height and 13 cm (5 inches) wide, with bright green fronds which are triangular in shape. Some of the more distinct characteristics of the fern are the long petioles (stems) with black fibrous hairs and a linear arrangement of the sori (clusters of spore containing sacs) on the undersides of the fertile fronds.

As there is currently no evidence of the Laffan’s fern in the wild, conservationist must look to historic documentation in an effort to note the best locations to re-establish the fern species. According to the book *Flora of Bermuda* [Britton, 1918], the fern was located in caves and crevices between Harrington Sound and Paynters’ Vale. As there is no written indication of where the fern grew, out of the rock, out of the soil on the ground or both, tests are currently being conducted to see what conditions best support this fern’s growth.

Interesting Fact: *As with other fern species, the Laffan’s, when mature, produces spores which fall to the ground and germinate producing a carpet of heart-shaped flat plants called prothalli, which are gametophytes (producing gametes). The gametophytes produce motile sperm and an ovum containing an egg on the same prothalli which when fertilized, produces a sporophyte. The sporophyte, when grown, is the typical fern that we are familiar with.*

History of recovery

In the 1990s Mr. Don Lubin, a fern enthusiast visiting Bermuda, observed

the seven remaining Laffan's ferns at the Bermuda Botanical Gardens and started a recovery effort which continues on today. Due to Mr. Lubin's continued insistence on the protection and recovery of the species, recovery efforts started in 2001 when the remaining five plants were moved to the Department of Parks, Tulo Valley Nursery, after the remodelling of the Botanical Gardens, Arrowroot Factory. Unfortunately in 2003, Hurricane Fabian, destroyed the greenhouse housing the remaining mature specimens and only one mature plant survived. Luckily in 2002 and 2003, Sarah Northcott, Tulo Valleys Superintendent, sent spores from one of the ferns to Marge From, at the Rare Plant Research department of the Henry Doorly Zoo in Omaha, Nebraska. Ms. From and Ms. Melanie Landry worked relentlessly with the small samples provided and produced many sporophytes and some gametophytes for transportation to Bermuda in 2004 and 2006. Additionally, spores were also sent to Ms. Leslie Duthie at the Northcross Wildlife Sanctuary where Mr. Lubin observed over 40 sporophytes in apparent good health in 2003.

As keeping the sporophytes alive after transport to Bermuda proved difficult there have been subsequent imports of in-vitro (artificial propagation of plant material in a sterile environment containing sterile media, usually agar gel) gametophytes in an attempt to rear them to maturity, however most attempts failed after a few years of successful growth. Due to the difficulty in rearing this fern as its habitat and environmental considerations are relatively unknown, there has been little success in its conservation here in Bermuda. Nevertheless in 2009 two shipments of gametophytes were again imported and have been successfully grown with the assistance of Ms. Kimberly Burch (Laboratory Technician, Department of Environmental Protection) with approximately 13 ferns ranging from 1 to 4 inches in height. In 2012 an additional shipment of 20 flasked gametophytes were again imported and due to successful growing methods of the previous shipments there is a very good chance of survival for any future shipments imported into Bermuda.

Interesting Fact: *In the mid-1820s Dr. Nathaniel Bagshaw Ward, an amateur botanist, invented the Wardian case (glass cases which to display plants, mainly ferns) launching a Victorian craze called Pteridomania (fern-fever) which lasted from 1830 to 1860. Although this craze did cause mass losses of mature fern species, this interest in ferns benefited the Governer Laffan's fern enabling it to survive total extinction by being present in pot culture between 1905 and 2003.*

Difficulties presented

As a rare and endemic plant there has not been many studies done on the actual fern itself as there have not been many available, therefore conservationist must rely mainly on botanical observations prior to their wild extinction in 1905. Habitat consideration is a very large factor in dictating if a species, be it plant or animal, survives re-introduction into a wild, non-managed habitat. Regarding the Laffan's fern there may be difficulty finding suitable locations at this present time as environmental conditions have changed and more importantly habitat has been lost due to development and over growth with more competitive (invasive) plants. This being said, growth from gametophyte to sporophyte presented a keen challenge as all growth efforts were previously un-documented and any notes regarding growth were completed by work done by Ms. From and Ms. Landry.

The 2009 shipments of gametophytes lead to the first Bermuda documented study (lead by Ms. Burch) of growth for the Laffan's fern. Though trial and error it was observed that the ferns had moderate to high success rates being grown in groups inside humid and low light terrariums.

Study – Growing Method

To begin, the gametophytes were de-flasked (removing plants from sterile flasks containing gel and plant cells for propagation) and gently emptied out into water and the gel removed from around the callus (gametophytes clumped together to form a ball of cells). The callus was then broken into 1 inch pieces and placed into one of three growing conditions involving a mixture of potting mix and sphagnum moss to promote growth. The first growing method was primarily unsuccessful as the calluses often required more water and were infested with fungus gnat larva which ate the roots and green leaves of the plant. The second growing method was moderately to highly successful as water was recycled so it required less attention and fungus gnat infestation was easier to control. Finally the third growing method was highly successful and is most recommended for the growing of Laffan's ferns.

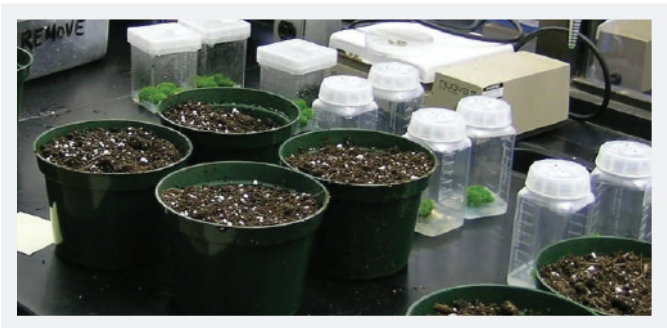


Laffan's fern calluses in in-vitro

In growing method three, the fern calluses were placed in large terrariums containing a mixture of potting mix and sphagnum moss (2:1 ratio) and misted every two weeks. The terrariums were placed in a southern facing room with indirect natural light and florescent office lighting (working time 7 hours). Plastic opaque tops were placed on the terrariums to seal them allowing the moisture to stay within the terrarium. Table 1 details each growing method and observations noted.

Table 1

Growing Method and Details	Observations
<p>Growing method 1 – low to moderate success</p> <p>The gametophytes were placed into 5" pots contain ¾ moist potting mix under a thin layer of moist sphagnum moss. Moss was tucked around the ferns and the plants were misted. The ferns were covered with a plastic 4" inverted container and misted occasionally.</p>	<ul style="list-style-type: none"> • Did not work unless plants were in the process of producing a sporophyte • Hard to do as plants had the tendency to dry out (Air conditioner in the office the ferns were in was not working so was rather warm in the summer months) • Ferns were on the east side of the office • Had problems with fungus gnats and fungal infections. Fungal infections were removed with application of powdered copper fungicide. Fungus gnats were more problematic (they consumed the delicate roots) and were harder to control. • Moved small ferns into trays (about ten ferns). Due to the major fluctuations in humidity ferns died off. • Fungus gnats. Origin unknown. Controlled by removing surviving ferns and soaking them for a period of 30 minutes in water to remove all larvae. They were then transplanted on methods described in Growing method 2 and 3.

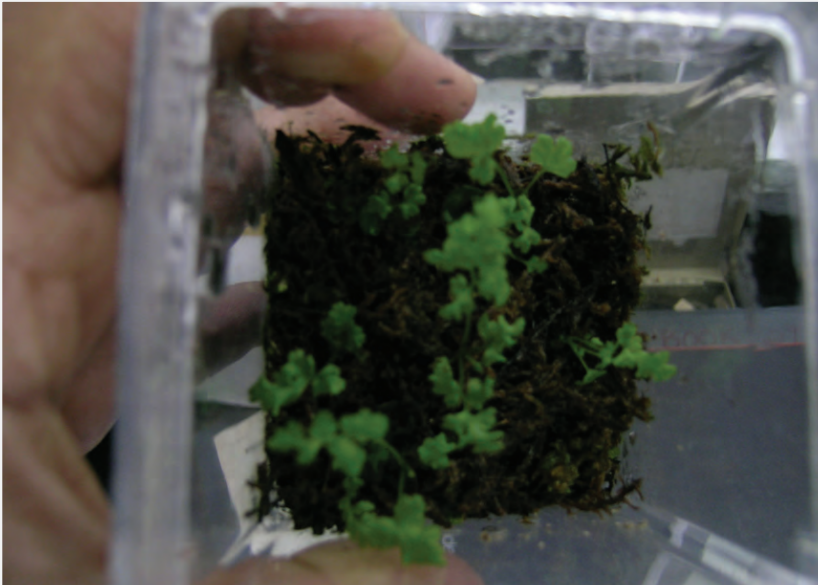


Growing Method 1

Growing method 2 – moderate to high success

The gametophytes were placed back into their sterile containers containing a layer of potting soil (~ 1") and a layer of sphagnum (~ 1"). Gametophytes and sporophytes (without roots) were placed in these containers. Water was added and the top to the containers was placed securely on them. No misting was required as frequently as Process 1 as moisture was recycled.

- There were instances of fungus gnats but they were not as severe and easy to remove by soaking the gametophytes in water and replacing them in sterile containers.
- Plants seem to be doing fairly well under these conditions. There has been multiple frond growth and possible root formation.
- Experienced some gametophyte growth to replace lost fern cultures. Even when cultures looked dead (brown) continued to mist. Gametophytes grew approximately 40% of the time.
- Continued to mist at untimed intervals (about every two weeks) as conditions were static and only changed due to water intake by fern cultures.
- It was noted that when tops of the containers were cracked there was a higher incidence of dieback due to humidity changes.
- Continued to have fungal infections, however, not as prevalent.

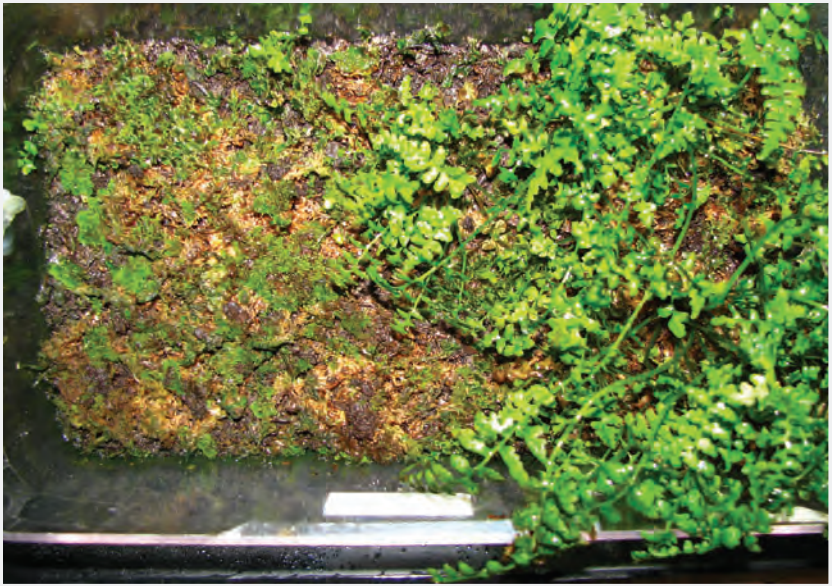


Growing Method 2 – Sporophytes

Growing method 3 – high success

The gametophyte calluses were placed into long low plastic terrariums containing a mixture of potting soil and sphagnum moss (2:1). Gametophytes and sporophytes (without roots) were placed in these containers. Water was misted on the plants and the top to the containers was placed securely on them. Containers were stackable. No misting was required as frequently as Process 1 as moisture was recycled.

- No incidents of fungus gnats.
- As gametophytes were very close together there was a higher incidence of sporophyte production.
- Continued to mist at untimed intervals (about every two weeks) as conditions were static and only changed due to water intake by fern cultures.
- Gametophyte production from calluses were more stable.
- Sporophyte production was higher and healthier than Method 2.



Growing Method 3 – Gametophytes and Sporophytes

Future recovery plan

Currently conservationists working on the recovery of the Bermuda fern species are still working on techniques to produce as many plants as possible for reintroduction into protected natural locations. There has been significant effort from conservation personnel like David Wingate (well known Bermudian ornathologist, naturalist and conservationist) and Alison Copeland (Biodiversity Officer, Department of Conservation Services) in monitoring protected sites from invasive plant species, evaluating native and endemic species in protected areas and focusing efforts to involve the public in the conservation of Bermuda's botanical environment. The future of the Laffan's fern is currently looking very promising due to the efforts of all the people involved in the project and even though reintroduction into the wild may not be possible, conservationist are not giving up hope to one day see this plant in its natural habitat.

If you are interested in seeing the recovery plan for all six protected fern species please go to: http://www.conservation.bm/publications/species-recovery-plans/Fern%20Recovery%20Plan_s.pdf.

Kimberly Burch
Laboratory Technician
Department of Environmental Protection

IN THE KITCHEN

Salty Oat Chocolate Cookies

Ingredients:

- ¾ cup unsalted butter
- 1 cup brown sugar
- ½ cup sugar
- 1 tsp vanilla
- 2 eggs
- 1 cup flour
- 1 tsp baking powder
- ¼ tsp baking soda



½ tsp salt

2 cups oats

¾ cup chocolate (chunks or chips)

Method:

Beat butter, sugar and vanilla until smooth (2–3 minutes). Add eggs one at a time and beat with each addition. On lowest setting, stir in flour, baking powder, baking soda and salt until well blended. Stir in oats and chocolate. Cover and chill for 1 hr.

Pre-heat oven to 375 degrees.

Place 1¼ inch balls of dough on a cookie sheet and bake for 12–15 minutes. Cool cookies for 5 minutes on rack.

Recipe supplied by Kimberly Burch

PLANTING CALENDAR – WHAT TO PLANT IN THE WINTER...

Vegetables

December

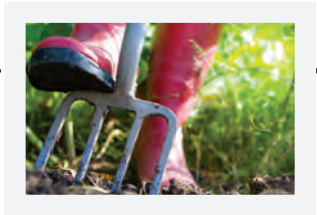
Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chard, Chives, Kale, Leeks, Lettuce, Mustard Greens, Onions, Potatoes, Radish, Rutabaga, Spinach, Squash, Strawberry, Tomato, Turnip.

January

Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cassava, Cauliflower, Celery, Chard, Christophine, Kale, Leeks, Lettuce, Mustard Greens, Potatoes, Radish, Rutabaga, Spinach, Squash, Tomato, Turnip.

February

Beans, Beets, Broccoli, Cabbage, Carrots, Cassava, Cauliflower, Celery, Chard, Christophine, Corn, Cucumber, Kale, Leeks, Lettuce, Mustard Greens, Potatoes, Pumpkin, Radish, Rutabaga, Spinach, Squash, Sweet Potato, Tomato, Turnip.



Flowers

December

Ageratum, antirrhinum (snapdragon), aster, aubrieta, begonia, bells of Ireland, candytuft, carnation, centaurea, chrysanthemum, cineraria, dahlia, dianthus, geranium, gerbera, gypsophila, impatiens, larkspur, lathyrus, nasturtium, nicotiana, pansy, petunia, phlox, rudbeckia, salpiglossis, salvia, statice, snow-on-the-mountain, spider flower/cleome, star-of-the-veldt, stock, sweet William, verbena and viola.

January

Agratum, antirrhinum, aster, aubrieta, begonia, bells of Ireland, candytuft, carnation, centaurea, chrysanthemum, cineraria, dahlia, dianthus, geranium, gerbera, gypsophila, impatiens, larkspur, lathyrus, nasturtium, nicotiana, pansy, petunia, phlox, rudbeckia, salpiglossis, salvia, statice, snow-on-the-mountain, spider flower/cleome, star-of-the-veldt, stock, sweet William, verbena and viola.

February

Acrolinium, ageratum, alyssum, antirrhinum, aster, aubrieta, baby blue eyes, bachelor's buttons, bird's eyes, blanket flower, begonia, bells of Ireland, calendula, candytuft, carnation, centaurea, chrysanthemum, cineraria, coreopsis, dahlia, Africa daisy, dianthus, forget-me-not, geranium, gerbera, globe amaranth, globe gilia, godetia, gypsophila, hollyhock, impatiens, larkspur, lathyrus, marigold (African), marigold (French), nasturtium, nicotiana, pansy, petunia, phlox, phlox (annual), red tassel flower, rose everlasting, rudbeckia, salpiglossis, salvia, scabiosa, statice, snow-on-the-mountain, spider flower (cleome), star-of-the-veldt, stock, sweet pea, sweet William, verbena and viola.

ENVIROTALK – SURVEY

The Envriotalk Committee are committed to bringing you the best and most interesting articles on the environment. Therefore, we wish to know what you, as the readers, wish to see in future editions of Envirotalk and in general how you wish to see the issues move forward. The survey can be copied from the issue and sent to: Envirotalk, The Department of Environmental Protection, 169 South Road, Paget DV 04 or e-mailed to kmburch@gov.bm.

What topics would you like to see more of?

1. How to/Do It Yourself
2. Gardening/Farming
3. Conservation
4. Fisheries
5. Animal Husbandry
6. Scientific Studies
7. Holiday themed

What topics would you prefer to see less of?

1. How to/Do It Yourself
2. Gardening/Farming
3. Conservation
4. Fisheries
5. Animal Husbandry
6. Scientific Studies
7. Holiday themed

Overall how satisfied are you with the publication?

1. Very dissatisfied
 2. Dissatisfied
 3. Neutral
 4. Satisfied
 5. Very satisfied
 6. What ideas do you have for future articles?
-
-
-
-

ON HER MAJESTY'S SERVICE



GOVERNMENT OF BERMUDA
Ministry of Environment and Planning