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NEWSLETTER

Fern Society of Victoria Inc.

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MAY/JUNE
2007

FERN SOCIETY OF VICTORIA Inc.

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Our Society's Objectives.

The objectives of the Society are:

- *to bring together persons interested in ferns and allied plants*
- *to promote the gathering and dissemination of information about ferns*
- *to stimulate public interest in ferns and*
- *to promote the conservation of ferns and their habitats.*

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SUBSCRIPTIONS:

*Single	$15.00	*Pensioner/student	$12.00	*Family	$17.00
*Pensioner Family	$14.00	*Organisation	$17.00		
*Overseas	$22.00 (Payment by international bank cheque in $A please. Sent by Airmail.)				

***Subscriptions fall due on 1st July each year.**

MEETING VENUES: The Kevin Heinze Garden Centre at 39 Wetherby Road, Doncaster (Melway 47; H1). Other meetings at members' gardens or as advertised on the following page.

Timetable for evening general meetings:

7.30	Pre-meeting activities - sale of ferns. Spore, books, merchandise and special effort tickets. Also library loans and lots of conversation.
8.00	General meeting
8.15	Workshops and demonstrations.
9.15	Fern identification and pathology, special effort draw.
9.45	Supper and another good yarn.
10.00	Close.

CALENDAR OF EVENTS 2007

MAY MEETING

Thursday the 17th, at 8.00pm at the Kevin Heinze Centre Wetherby Road, Doncaster.

Will be a Group discussion (headed by the three wise men), Keith Hutchison, Don Fuller and Barry White on:

Favourite Ferns, & fern growing problems - What went wrong?

This is a good opportunity to bring along those ferns that are causing some concerns and have the panel and members try to resolve the causes. These nights are put together for members to learn what to do and not to do, but they do require your attendance and input. So come along and bring a couple of ferns to discuss and enjoy the evening.

Competition category: **Favourite or Problem Fern.**

JUNE MEETINGS

Thursday the 21st, at 8.00pm at the Kevin Heinze Centre Wetherby Rd, Doncaster.

We again have secured a date with Dr. Terry Turney, a long time member of our society. Terry will be talking on Asian Ferns. For those new members who have not had the pleasure of listening and learning from Terry, just let me say, this is not a night you would want to miss.

Competition category: **Asian Ferns.**

PRESIDENTIAL PERORATION

Only a small group of us went along on the visit to Pirianda Garden on April 1, but on a clear, fine day (the rain disappeared again as the month ticked over, didn't it) it was most enjoyable. The garden looked well in its early autumn colours, and the ferns in the gully were also looking good. Reinforcing the great advantage of the Mt. Dandenong climate (aided by the fact that the garden slopes in a mostly southerly direction), Pirianda's manager John Curtis was able to tell us that almost no watering had been used in the garden - only a very few newly-planted beds containing hydrangeas, etc. had been watered (occasionally) even during the height of summer. After a relaxing picnic in the comfortable rotunda, most of us went on to visit Rickett's Sanctuary, where the abundant ferns also looked very happy. For those who couldn't make it on April 1, a private visit to these easily accessed gardens before autumn is over should be rewarding.

On behalf of the Fern Society, we donated a nice *Todea barbara* plant to be positioned in Pirianda's fern gully, as this species was not represented (it used to be fairly easily found in the general vicinity, but it's harder to find these days). John was very grateful for the donation.

I think it's appropriate to note that a friend of the Society, who generously gave his time to provide interesting insights into his work on plant fossils in talks to groups such as ours, passed away in February. Perhaps other members noticed that Dr. Jack Douglas - formerly of the Geological Survey of Victoria and co-author of *Geology of Victoria* published in 1976 - was remembered in an obituary published in The Age on March 1. As noted there, Jack earned an international reputation as a geologist specialising in plant fossils, researching palaebotany (the study of prehistoric plants) and palynology (the study of fossil spores and pollen). One of his long-term involvements outside professional life was as a member, and president, of the Field Naturalist Club of Victoria, so he shared a strong interest in the sorts of things about the natural world that matter to people such as us.

Back on the subject of the weather, no doubt we've all been disappointed that the long "dry" has resumed during April. But at least with temperatures lower, the plants that have made it with us thus far should be a little more able to cope, even with fewer watering periods permitted. Perhaps members are busily installing more tanks ready for the rain we all hope for before the warmer weather comes along again (they seem to be "walking" out of the sellers' premises by themselves - we'll try to get an extra one in at home by mid-year).

On the "better news" front, Eddy and Robyn Sabljak at Fern Acres have managed to keep their stock together pretty well, with the aid of their bore water, and sales turnover has been reasonable (and Robyn's health is also much improved). The *Todea* mentioned in the second paragraph was sourced from Fern Acres.

Also it's nice to be able to report that - although the retail nursery demand has reduced - Chris and Lorraine Goudey have been able to keep their Austral Ferns business ticking over by retaining access to mains water for limited watering in accordance with an approved plan for usage (whilst emptying some of their tunnel houses of ferns).

Gay & I have decided that we need to see some wetter places for a short while, so we're soon going to travel to do some visiting of gardens in the UK and Ireland. We'll hope to find everyone well and happily tending reviving fern collections when we return.

Barry Stagoll

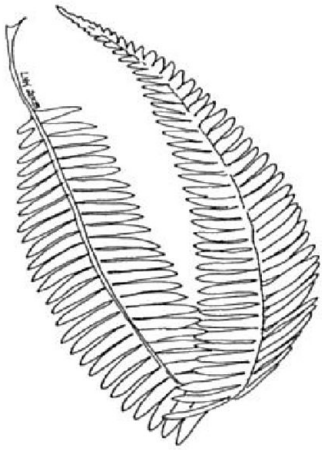
GROWING FERNS IN THE GARDEN

A short sequel to last month's article

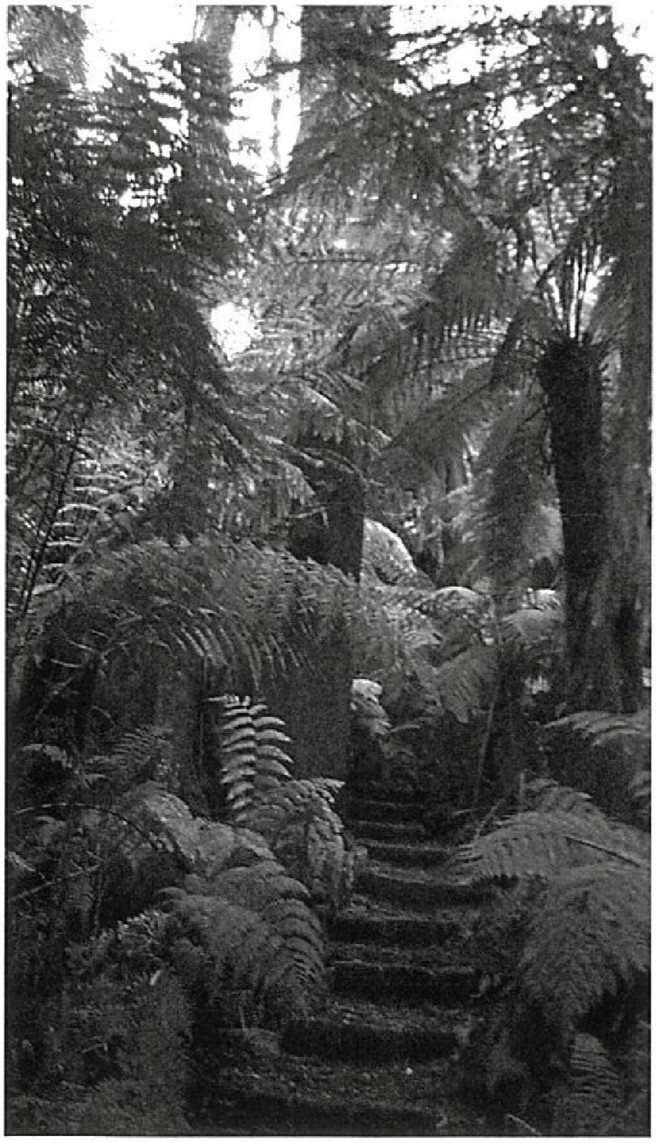
GAY & BARRY STAGOLL

We realised after publication that we'd erred in describing *Lastreopsis acuminata* as *L "marginans"* in the segment on *Choosing the Ferns*. Our only excuse is that we often transpose terms for plants these days - we're in overload from trying to follow too many different plant families simultaneously.

We should also have taken some more care in suggesting *Brachychitons* as shading trees, to acknowledge that *B. acerifolium* (the "Illawarra Flame Tree") is not really suitable for this role, as in years when it breaks into bloom (in the summer) it drops its foliage. But it is a most decorative addition to a garden, and with the warmer climate we have now in Victoria it will flower pretty reliably once it's well established.



Below:
Visit to Pirianda Garden & Rickett's Sanctuary, Mount Dandenong



Fern Survival Strategies
TERRY TURNEY

(Terry is a long-standing member. He gave a presentation on this subject at the FSV Members' Meeting in June 2005 – this is sourced from a transcript).

A fern has a structure which differs obviously from other groups of plants, and it reproduces differently to seed-bearing plants. But its system operates in a basically similar way. A fern is not like a mushroom or other organisms which have no chlorophyll. It's got a vascular system, so it can get water and nutrients to flow from its roots up to wherever it needs it. There are a lot of lower plants that don't have any way of getting the water there; they basically just soak it up - algae for example. It reproduces in a particular way, and it's got two living stages, the gametophyte and the sporophyte, so it reproduces from spores and it's found nearly everywhere from very dry conditions, through to the tropical areas, and also almost to sub-Arctic, sub-Antarctic conditions (for instance, the *Cyathea smithii* found on Campbell Island south of New Zealand). And they're very tasty as well, if you're a bug, so they've got to have found ways to limit predation. So I'd like to look at each of these areas and discuss what ferns are doing to give them some competitive strategies to survive.

Getting Energy

Photosynthesis: Green plants use chlorophyll for photosynthesis. They take water, and carbon dioxide out of the air, and convert it into starch for food. They use the sunlight to do it, this being their energy source. This is basically what is driving everything today - for instance, most of our oil and natural gas has been produced from the sunlight by this process back in the Carboniferous era, about 68 million years ago. So this probably the most singularly important process that has ever occurred on earth - at least for us it is. Of course, nearly all of our food comes from this as well. We eat plants, or we eat the things that eat them - we're either vegetarians, or vegetarians once removed.

Now there's a big issue for plants - how do they get the right amount of light and water? They have strategies for this, and they've developed structures for it. The basic structures that all plants use - including ferns - are these little chloroplasts, which consist of discrete lumps, which are probably captured bacteria. They were captured into the cells of plants maybe about a billion years ago. They were originally free-living bacteria - the same as mitochondria, or free-living bacteria which came into our cells maybe about 2 billion years ago. They form little layers, which are the things which capture the light, and use it in a complex chemical process to turn it into starch - which the plants live on.

Colours of Plants: Out of all the types of visible light plants mainly use the blue light and the red light, and not the green light. And that's why they appear green, because they've absorbed all the blue and red light and reflect the green light. So it's the bit of the light they don't use that you see.

Most plants get all their energy from light. But they can also get "sunburn". Just as we can put on sunscreen to prevent getting sunburn, young ferns can prevent it by putting red pigment in their fronds. The red pigment absorbs light in the ultra-violet part of the spectrum, which is the same part which gives us sunburn. We can't see this light - but some animals can, including bees and some birds. So the red frond is actually a very unusual use for pigment. Even though the fronds appear red, they're actually still absorbing reasonably strongly in the red area of the light, and also in the blue and beyond in the ultraviolet - and getting their energy needs from the absorption. As the fronds mature and harden out, they don't need to have

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Opposite:

Pirianda manager John Curtis accepts our gift of a plant of *Todea barbara*

Reprinted with thanks to Western Australia Fern Society 1994.

ATHYRIUMS Helen Moorehead

An attractive group of ferns which contain some very decorative species of delicate appearance. The Lady Fem (Athyrium felix□femmina) has been responsible for hundreds of cultivars. The genus consists of about 600 species, widely distributed around the world with about seven species extending to Australia.

Habitat:

Ferns of **this group** are invariably ground growers and mostly shade lovers. A few hardy types grow in sunny positions, but usually where there is an abundance of soil moisture or at high altitudes. Some species have very brittle fronds which are easily damaged by wind or rough handling.

Soil types:

Most Athyriums prefer a well drained, organically rich loam containing plenty of humus. They also appreciate regular applications of organic mulch to the soil surface. A few athyriums such as Lunathyrium Japonicum appreciate the addition of lime. Potted athyriums prefer an open mix based on well structured loam which has been fortified with peat moss or milled pine bark. Many ferns in the group have a very strong root system and quickly outgrow their container. Such species are best planted in the ground, otherwise their appearance suffers because of the confined root system.

Watering:

Athyriums generally like moist conditions and appreciate plenty of water, especially during periods of hot dry weather. They also respond to water sprayed onto their foliage during such weather. Their fronds quickly become tattered if the plants dry out at the roots or'are exposed to dry, buffeting winds.

Fertilising:

As a group, these ferns are strong growers and respond to the use of fertilisers and manures. Blood and bone, well rotted animal manures and compost are particularly beneficial and should be applied during the spring and summer. Slow release fertilisers can be added to the potting mix or plants can be supplemented with applications of liquid fertiliser.

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FERN SURVIVAL STATAGIES

sun protection any longer, so they lose the red pigment. Other plants adopt the same strategy as well. Examples can be found in *Aloe spp* with a bright pinkish red colour and some *Hosta* and *Coleus spp* can be bright red.

Red colours in plants which live in low-light conditions can serve another function. Many *Plecanthus* species can be red underneath - and that's another light harvesting strategy. An important thing for plants that live in low light is to use the available light as efficiently possible. Light can actually go right through a leaf. A plant which lives in a very dark place can have a red layer on the underside which reflects the red light back, so it gets another chance at using low light levels for photosynthesis. So there can be two different reasons why plants may have red colouration in their leaves - the first to protect new growth from the sun, and the second to succeed in very low light conditions. Leaves are also phototrophic - they'll actually move, very slowly, to capture the most amount of light.

Now you'll also find that some plants which are adapted to grow in rather low light will just produce a higher concentration of pigment in their leaves or fronds. So you'll find that ferns which grow under dark conditions usually have darker fronds, because they're packed with pigment - with chlorophyll. Ones out in the sun will often bleach because they're getting too much sun.

There's a couple of ferns which have just been reported over the past few years which appear blue, and they've actually got "diffraction gratings" within the frond, and they appear blue because the light bounces off these. These structures consist of layers, one after another, similar to which you can see sometimes in fine curtain, where the light comes back off the "gratings" and shows the colours of the rainbow. Insects use the same phenomenon to show colours - for instance this produces the bright colours of the Christmas Beetle - it's not due to pigmentation but reflected light.

Getting Nutrients

Ferns have a system of veins which is equivalent to the system in animals which carries blood. In their case they move water and nutrients, generally obtained through their roots.. The fern has vascular tissue through which it can suck up the water and nutrients, funneling it out into the stipe or the fronds. It needs to control this movement so that there's not too much our too little. Essentially most of the water in most ferns comes in through the roots - the rhizoids. It can leave the system through evaporation - but it can evaporate though a whole range of different places; for instance the stomata and through special structures, called hydathodes or aerophores. The typical frond also consists of a waxy cuticle on its upper surface, which is actually there to stop evaporation and protect the cells underneath.

Stomata are found on nearly every fern frond. The stomata are places the fern "breathes" - it takes in the carbon dioxide so it can photosynthesize, and the by-product of this photosynthesis is oxygen. Essentially all of the free oxygen in the world's atmosphere has actually come from plants. There was no free oxygen until plants started photosynthesizing. So we rely on plants as we wouldn't have anything to breathe if it weren't for them.

The stomata or breathing pores are interesting, as they are basically "bags" full of water. There are two cells on each side of the hole which is the stomata, where the carbon dioxide can go in and the oxygen go out. These are so-called "guard cells". If the plant starts losing water too rapidly and needs to cease evaporation, the water leaves these cells - which may be likened to elastic bands. When the water leaves them, the cells collapse, and the pore closes. When the plant hasn't got enough water and it starts wilting, these guard cells protect it from losing more water by closing the pores. The consequence of this is it can no longer photosynthesize, because it can't get any carbon dioxide. So it stops producing food for itself. Nearly all green plants have stomata, and function in this way. They are ancient structures which can still be observed in fossilized specimens of ferns living tens of millions of years ago.

One type of fern doesn't have stomata - the filmy ferns. Because they're only one cell thick, they don't have anything to protect. They don't have any mechanism by which they can control their water. That's which they will only live where there's virtually 100% humidity, essentially all the time. So they can only live in very wet rainforest environments. Temperate rainforest plants like *Leptopteris* - which are similar to a filmy fern in structure, but quite large - are also extremely sensitive to drying out if the relative humidity in the air is far below 100%.

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FERN SOCIETY OF VICTORIA SPORE LIST

ORDERING Fern spore is free to members of the Fern Society of Victoria who donate spore. Otherwise the cost to members is 20 cents per sample, non-members 50 cents, plus $1.00 to cover postage and handling. Available at meetings or by mail from Barry White, 34 Noble Way, Sunbury, Vic. 3429, Australia , phone (03) 9740 2724.
There is no charge for spore for overseas members, however to cover postage two International Reply coupons would be appreciated. Coupons can be purchased at the Post Office. Overseas non-members may purchase spore at three packets for each International Reply Coupon, plus two coupons per order to cover postage and handling. There is a limit of 20 packets per order. As some spores are in short supply please include alternatives.

Please find complete list on page 47

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ATHYRIUMS

Pests:

Slugs and snails eagerly attack. the young fronds. Grubs may be a problem on those with finely divided fronds and aphids may congregate on crosiers and uncurling fronds.

Athyrium Felix□Femmina (Lady Fern)

One of the commonest fems widely distributed throughout the British Isles, India, China, Japan, North Africa, Canada, North America, Mexico and Peru. Plants are dormant in winter and in cold regions they may be completely deciduous. A vigorous flush of new growth in spring is very decorative. In all, over 300 cultivars of this fern, have been named. As a plant of this species gets older, the crown tends to grow out of the ground on a short trunk so that the young roots have further to grow to reach the soil. This can slow the whole plant down and make the growth a little sparse. Replanting (possibly at the same time as dividing the crowns if they are becoming too crowded) so that the crowns are just level with the soil, followed by regular mulches of leaf mould, will result in renewed vigour.

Cultivars : Athyrium f.f. congestum, f.f. cristatum, f.f. congestum cristatum, f.f. congestum grandiceps, f.f. victorae, f.f. frizelliae.

Athyrium Japonicum (Lunathruin Japonicum)

This Athyrium is native to Australia and is a weedy type that naturalises readily in any favourable situation. Plants are variable from one population to another, especially in the thickness and lobing of the leaves. It grows in colonies on damp rock faces, stream banks, etc, and sometimes in quite exposed situations.

Other Athyriums which are native to Australia are : A. accedens, A. assimile, A. austral and A. dilitaturn

Athyrium Niponicum var Pictum (Japanese Painted Fern)

This Athyrium is prised for its delicately coloured new fronds which are of a soft metallic grey colour, but frequently contain reddish of bluish tints. The colour is maintained in old fronds, however, the young fronds contrast pleasantly with the mature ones. Plants are cold□-hardy, withstanding quite heavey frosts. They can also be grown in subtropical regions. A shady location in humus□rich loam is suitable, although plants in good light develop the best colour. Deciduous in Australia.

Opposite:

One of our companions at the Pirianda picnic lunch

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Pneumatothodes: There are other ways for a plant to take in air. It's OK when you have an entire mature frond with fully-extended stipe and lamina - the stomata can take in the air. But what happens when the frond is just uncurling? It still needs to breathe. Air is used to respire, and it's also being used in the process of photosynthesis and oxygen is being expelled as a by-product. In some plants, little pores are found along the crozier, and in others there are holes within the stipe which allow the oxygen to migrate through. These linear pores are called aerophores, and they're often coated in glue-like "mucilage" which is used to promote the gas exchange when the crozier is tightly curled. This is found in quite a few different types of plants - for instance in *Cyatheas*. There are others like pneumataphodes which have these little raised tissues - for instance they can be found in *Angiopteris* and *Marattia*. In some plants they're visible to the naked eye. The mucilage not only assists in gas exchange, but it's also not very palatable, so it's also acts as an insect repellent.

Hydathodes: If you look at a fishbone fern (*Nephrolepis spp)*, often you can find little white dots around the perimeter of the pinnule. That's lime (mainly calcium carbonate) which has been forced out of the plant. What happens is that the plant is taking up water which has dissolved salts - calcium salts mainly - and the plant evaporates the water and the salts are left. It has to metabolize the salts (get rid of them) somehow. Many plants can do this by exuding them through little pores like those on the margin of the *Nephrolepis* frond. They will exude a very concentrated brine solution, which leaves the little white dots as it evaporates. Many other plants have them as well. So this is one of the means of controlling salt in the plant's system. Grasses use this mechanism quite a lot. If you overfeed a plant with fertilizer, this is what the plant will do with the excess.

Associations with other plants and animals: Many plants have various ways of getting nutrients which ferns don't. For instance, some plants such as pitcher plants, sundews and bladderworts, are carnivorous - trapping insects for nutrients. Many ferns are epiphytes - growing on other plants - but to my knowledge none are parasites. They don't get any nutrients directly from the host plants. The only nutrient they get is either through association with a fungus, or from dissolved materials via their roots.

Fungal association is found among the fern allies -*Botrychium* ("moonworts") really require specific fungus - one of the reasons why these have proven impossible to cultivate from spore. In this regard, it is similar to many orchids - but of course (unlike in the case of the moonwort) a lot of work has been done by many people on getting the growing conditions right for orchids including where necessary inoculating potting mixes with fungus, so a considerable number of different orchids are cultivated successfully.

Insect Associations: Some ferns do use an association with insects, in particular with ants.
These "ant ferns" provide a home for the insects, typically by a bulbous rhizome with hollow chambers which the ants inhabit. There are about 18 to 20 different species of *Lecanopteris* which have this character, some found in Malaysia, Indonesia, PNG and North Queensland. The plants get two advantages - being fertilised by nitrogen-rich excrement from the ants, and the ants protect them from invasion and attack by other insects. The Potato Fern - *Solanopteris brownii*, lives in South America *and* it produces these potato-like tubers, which ants will live in. Both *Lecanopteris* and Solanopteris are desirable ferns to collect, are quite easy to grow from spore, if this can be obtained – that unfortunately is the difficult part.

Reproduction

Ferns reproduce from spores, as we know. Their life cycle is unique, making water a really important factor in the fertilization stage. Just to review this briefly; there are two distinct alternations of generations - the gametophyte and the sporophyte. With most ferns we normally grow the sporophyte, and that's the plant we like to display. But the gametophyte is very interesting as well. And each of the generations develops from just a single cell. The gametophyte develops from a single spore - it's only got half the number of chromosomes - the sporophyte is from the fertilized egg - the zygote - which has the complete complement of chromosomes.

The sori produce the spore - an almost unique fern characteristic, there being very few other plants which have sori with a fern-type structure. The annulus - a membrane within the sori - when it dries out will contract, and then operates like a catapult to project the spore away from the plant.

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APRIL RAFFLE WINNERS:

Don Fuller
Greg Boulton (visitor)
Brenda Girdlestone
Barry White
Jack Barrett

COMPETITION WINNERS:

1. Blechnum cartilagineum
   John Hodges
2. Blechnum moorei
   Mirini Lang

2. Blechnum gibbum
   Barry White
3. Blechnum filiforme
   John Hodges
3. Blechnum penna-marina
   Barry White

Above:
Blechnum cartilagineum

Below:
Blechnum moorei

Opposite:
William Rickett's sculptures integrate with the natural features of the Sanctuary landscape

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FERN SURVIVAL STATAGIES

But it only happens in dry conditions. In drying out a fertile frond to collect spore, what we're doing is emulating this - to promote the rupturing of the annulus to release the spore. Spores have a range of different shapes. Experts can discover which fern particular spore is from by examining the shape and surface characteristics of individual spores. This can extend to determining from fossil spore how prevalent ferns were in prehistoric periods and which types of ferns and climatic conditions were present.

So with plenty of water and light germination of fern spore produces a prothallus. Some of the primitive ferns also require specific fungus to be present to obtain nutrient, just like the moonwort mentioned previously. The gametophyte gets to a certain stage, and then develops two structures - the antheridium and the archegonium - the latter is where the egg is, and the former is where there is sperm with their tails (flagellae), just like mammalian sperm. And eventually from fertilisation the sporophyte emerges.

There's a big difference between ferns and mosses. They have a similar life cycle. But the moss that we see is the gametophyte, the stage that only has half the full number of chromosomes and the sporophyte is the little tiny capsule on the top of the gametophyte. So the sporophyte is totally dependant on the gametophyte for its nutrients.

It's not clear why, but when it comes to reproductive strategies the Nardoo (*Marsilea spp*) and other types of aquatic ferns have two different types of spores - big spores and smaller spores. It's a complicated life cycle. some of the fern allies are similar - *Selaginella spp* also have mega-spores and micro-spores with quite enormous differences in size.

Some ferns and their allies (eg Horsetails)also have green spores. This is a problem if you're trying to reproduce them. They are green because they have chlorophyll, and they're actually photosynthesising. They're really quite difficult to grow from spore. Plants like *Todea barbara*, and Finger Ferns (*Grammitis spp*) have chlorophyllus spore. Horsetails (*Equisetum spp*)are very interesting. Not onlyare their spore green, but they also have a structure called an elata, which is like a piece of ribbon curled up around them. This unfolds when its dry, and that enables the spore to be carried further by the wind. And when it arrives in a moist place the ribbon contracts and the spore will then lodge there.

Non-sexual Reproduction: Many ferns have ways of growing other than sexually, for instance, via apogamy, where a small sporophyte grows directly out of the prothallus. That plant will have only half the number of chromosomes that a normal sporophyte would have. Apogamus plants are quite common. It's useful when the plant grows in a dry climate, because to reproduce in this way the plant doesn't actually require any water. However, this doesn't give you any variety in the offspring - in effect it's similar to vegetative reproduction. The ones that do this, such as *Cheilanthes* generally live in arid zones. Then there are ferns which do the opposite. They will actually take a gametophyte and produce it directly from the sporophyte (apospory). In this case the gametophyte has the same number of chromosomes. Examples are ferns such as *Lunitherium japonicum* and the Japanese Painted Fern (*Athyrium Goeringianum*). It's not clear what the competitive advantage of this is. It doesn't seem to be typical of ferns which grow in dry places, for instance. But it happens with quite a lot of ferns. By these types of mechanisms lots of ferns can change the number of chromosomes they have - polyploidy is very common in ferns and sometimes whole populations of a particular species can have twice the number of chromosomes than other populations.

Simple vegetative reproduction is also common in various species of fern. It's common with *Aspleniums* and *Polystichums*, for instance. But reproduction by this means has the disadvantage that there is no genetic variation, and the offspring can never be any more robust than the parents.

Fern Habitats

There are about 12,000 known species of ferns. They're found over a large part of the earth in a wide variety of habitats. None are found in pure marine environments, unlike algae and certain other plants - the nearest is one which can tolerate high levels of salt - the Mangrove Fern (*Acrostichum speciosum)* which grows in mangrove swamps. However, there are ferns can grow close to the sea - mainly *Asplenium spp.*

Of the 12,000 species reported, it's difficult to know, but probably 3,000 to 4,000 are already extinct - mostly through logging and land clearing. The number could be more.

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And it seems possible that in about another 15 years there could be only 3,000 or 4,000 species left. So it's not generally realised what mass extinction is being caused by tropical timber extraction or clearing for pastures. By far the greatest diversity of species occurs in the tropics. The highest concentration of fern species was found in Java and Sumatra, around the so-called "Wallace Line", and there was also a very high concentration in parts of Brazil and Columbia. In Australia, there are more fern species in tropical Queensland than in the whole of the rest of the country. There are more fern species found in Victoria than in the whole of Europe (also more than in the whole of New Zealand).

So ferns growing in a wide range of different areas have come up with a whole range of different structures to survive in them. If they live in an arid zone they need to avoid losing water. To do this they have a protection of small "hairs". This forms a sort of "still air" zone, so the water doesn't evaporate as much. Some are so small the plant actually looks silver. It's a strategy that other plants use too - for instance *Stachys lanata* (Lamb's Ear).
Some ferns will actually completely dry up - ending up as a shrivelled lump, and then can rehydrate - like the so-called "resurrection ferns" found in Texas and similar environments. You get seasonally dry ferns like *Pityrogramma*; Cloak ferns with their little cloak of hairs like *Cheilanthes* - these are around Melbourne. *Polypodium* and certain *Selaginella* also are "resurrection ferns". The other thing ferns from these arid environments usually have in common is that they are small and have small lamina surfaces to minimise the area exposed to the air and therefore loss of moisture. They hug crevices in rocks and so forth also to avoid exposure. Ferns with a creeping rhizome such as *Pyrossia* (Rock Felt Ferns) have thick fronds which also have a fine covering of hairs to help avoid seasonal drying out.

Aquatic ferns by contrast are all over the place. *Salvinia* (Water Lettuce) is a major problem in waterways. *Azolla* is interesting -the surface of this plant has all these little hairs that prevent the surface from getting wet, so they float. *Nardoo* is a fern with highpolyploidy - some plants will have double or even quadruple the normal number of chromosomes. And they also survive well by producing great quantities of spore.

The Mangrove Fern (*Acrostichum*) mentioned earlier also produces huge amounts of spore. It is also interesting because the whole of the underside is covered in spore. That characteristic of some species is called acrostichoid - named after *Acrostichum*..
Ferns live in mountains and cold regions, and this is where the "sunscreen" comes in handy. The waxy cuticles on the surface of fronds give them some protection. Cold regions tend to be very dry, with low relative humidity for most of the time. Getting liquid water in cold regions can be very difficult, when much of the time water will freeze. Ferns tend to have stunted growth - there's no advantage is growing larger and then having pieces drop off when they get too cold. They tend to have underground stems, and propagate from them. Ferns like *Blechnum cycadifolium* - actually really little tree ferns - can be found on sub-antarctic islands, such as Heard Island (also on Juan Fernandez Islands off the Pacific coast of South America).

Heathland environments can also give ferns problems in obtaining enough water. So we find ferns of little, wiry habit in such places. If you think of heathlands around Melbourne, you'll know that they tend to be seasonally dry places, with sandy soils where the water goes right through.

Some ferns have problems managing with fire. However, ferns adapted to fire usually regenerate very well, and can come back very quickly, as long as the fire doesn't get too hot. In the case of tree ferns, the caudex around the trunk is quite a good insulation.

Don't get eaten!

There are also ferns that can live in quite contaminated soils. *Pteris vittata* will actually accumulate arsenic. So it can be used to decontaminate soils. *Azolla* can remove cadmium and other heavy metals from waterways. It's not clear why they do this, but maybe it gives them a competitive advantage in that it gives protection from predation or simply that they can live where other plants can't.

There are a couple of spectacular examples of this protection in other plants - one is Euphorbia which normally has a white latex-type sap. One species lives in New Caledonia on a lateritic nickel deposit, the latex is green - carrying something like 30% dry-weight nickel oxide.

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MARCH COMPITION WINNERS:

1. Gay Stagoll
   Pteris umbrosa

2. Don Fuller
   Hypolepis glandulifera

3. Keith Hutchison
   Todea barbara

Continued from page 45

FERN SURVIVAL STATAGIES

There is a tropical plant in the Daintree Forest in Queensland whose seeds have a high concentration of arsenic in them, which prevents the birds eating them. A lot of plants produce alkaloids and toxins to save being eaten - and animals need to spend a lot of time trying to remove the toxins from the plants, for instance by eating absorbent clays. Producing toxins takes up a lot of energy, so the plants can't go overboard on this.
Bracken (*Pteridium*) contains a potent thiaminase. *Nardoo* has this enzyme as well. This has the effect of making it impossible for animals to metabolise Vitamin B1 - thiamine, so leading to Vitamin B1 deficiency. It is not all clear whether the high levels of thiaminase are a a predation mechanism or just a part of their normal metaboloism. There are also carcinogens in Bracken. The Japanese eat Bracken croziers - they have the highest incidence of stomach cancer in the world, and there could be a connection.

So ferns are generally pretty successful, with a variety of survival strategies - this having allowed them to survive for around some 315 million years up to today.

Continued from page 41

SPORE LIST

Acrostichum sp. 6/04
Adiantum concinnum 1/05
Adiantum cunninghamii 1/05
Adiantum formosum 6/05
Adiantum pedatum 2/07
Adiantum radd. 'Fragrans' 3/05
Amphineuron opulentum 2/05
Anemia phyllitides 6/06
Anemia tomentosa 6/06
Angiopteris evecta 7/05
Anogramma leptophylla 12/06
Arachniodes aristata 11/06
Arachniodes webbianum /05
Asplenium aethiopicum 6/05
Asplenium breynii 10/06
Asplenium flabellifolium 11/06
Athyrium filix-femina 07/06
Athyrium filix-femina 'Victoriae' 1/07
Athyrium filix-femina (red stipe) 12/06
Athyrium niponnicum "Pictum,' 3/07
Athyrium otophorum 12/04
Belvisia mucronata 12/06
Blechnum cartilagineum 2/07
Blechnum chambersii 4/06
Blechnum discolor 08/06
Blechnum fluviatile 4/06
Blechnum minus 5/05
Blechnum moorei 10/06
Blechnum novae-zelandiae 1/05
Blechnum procerum 3/07
Blechnum spicant 12/06
Blechnum spicant 'lobatum' 12/04
Blechnum wattsii 4/06
Bolbitis quoyana 7/06
Cheilanthes alabamensis /06
Cheilanthes kuhnii 1/06
Cheilanthes tomentosa 1/05
Christella dentata 3/06
Cryptogramma crispa /05
Cyathea autralis 4/05
Cyathea baileyana 8/06
Cyathea brownii 2/04
Cyathea cooperi 05/06
Cyathea cooperi 'Cinnamon' 3/07
Cyathea cooperi (blue stipe) 1/07
Cyathea cunninghamii 1/07
Cyathea dealbata 1/05
Cyathea exilis 7/06
Cyathea medullaris 7/05
Cyathea rebeccae 8/06
Cyathea robertsiana 8/06
Cyathea robusta 3/06
Cyathea smithii 5/06
Cyrtomium caryotideum 5/06
Cyrtomium macrophyllum 5/05
Dennstaedtia davallioides 2/04
Dicksonia antarctica 2/07
Diplazium australe 2/07
Diplazium dilatatum 8/06
Diplazium queenslandicum 7/06
Doodia dives 3/07
Dryopteris affinis 'cristata' 4/07
Dryopteris athamantica 4/05
Dryopteris cycadina 12/05
Dryopteris dilatata 'crispa whiteside' 12/05
Dryopteris erythrosora 4/07
Dryopteris filix-mas 11/06
Dryopteris guanchica 12/05
Dryopteris sieboldii 12/06
Dryopteris tokyoensis 12/04
Histiopteris incisa 1/07
Hypolepis glandulifera 1/05
Hypolepis rugosula 2/07
Lastreopsis decomposita 12/06
Lastreopsis glabella 4/07
Lastreopsis hispida 11/06
Lastreopsis marginans 1/07
Lastreopsis windsorensis 8/06
Matteuccia orientalis /06
Oreopteris limbosperma 08/06
Pellaea sagittata 3/07
Pellaea viridis 2/05
Phlebodium aureum /06
Platycerium hillii 12/06
Platycerium superbum 8/04
Pneumatopteris pennigera NZ 12/05
Pneumatopteris sogerensis 7/06
Polystichum aculeatum 06/06
Polystichum australiense 12/06
Polystichum formosum 1/07
Polystichum onocolobatum 4/05
Polystichum polyblepharum 8/06
Polystichum proliferum 4/06
Polystichum retroso-paleacum 10/06
Polystichum setiferum 07/06
Polystichum setiferum 'Congested' 12/06
Polystichum tsus-simense 3/07
Polystichum vestitum 2/07
Polystichum xiphophyllum 12/05
Pronephrum asperum 2/07
Pteris biaurita 2/06
Pteris cretica 12/05
Pteris cretica 'albo-lineata' 1/05
Pteris cretica 'Wimsettii' 1/06
Pteris dentata 12/05
Pteris hendersonii /06
Pteris macilenta 12/05
Pteris quadriaurita 3/07
Pteris sp. (Nepal) 3/07
Pteris tremula 1/05
Pteris umbrosa 3/04
Pteris vittata 6/05
Pyrrosia lingua 'variegata' 5/06
Revwattsia fragile 2/06
Rumohra adiantiformis (native) 4/06
Rumohra adiantiformis (S.Africa) 12/06
Sadleria pallida 6/05
Stenochlaena palustris 2/07
Thelypteris navarrensis 1/07

Thanks for spore donations from Don Fuller, Wendy Johnston, Claire Shackel Crosby Chase, and Brenda Girdlestone

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