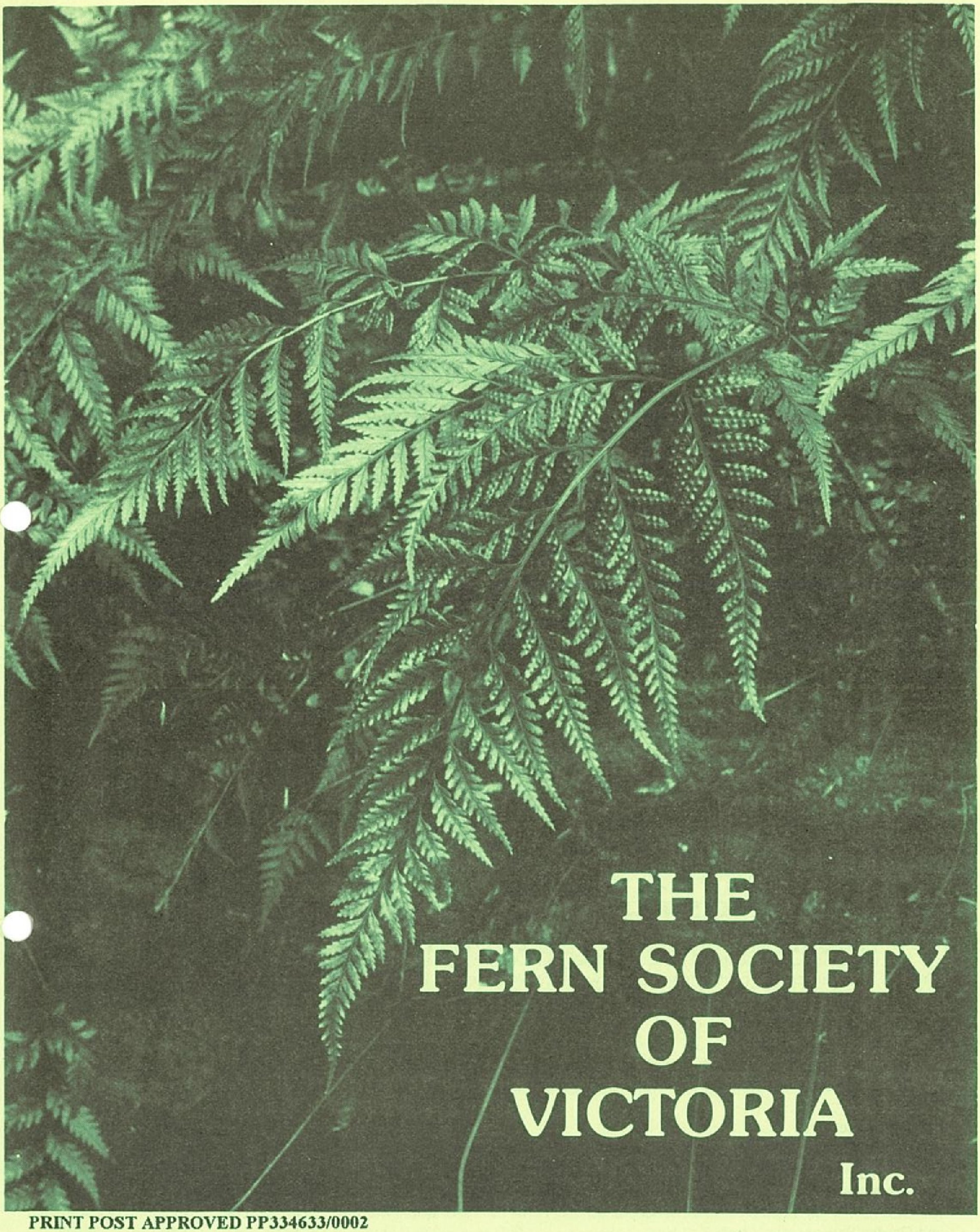

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NEWSLETTER

VOLUME 19, Number 6 - November / December, 1997

FERN SOCIETY OF VICTORIA Inc.

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SUBSCRIPTIONS:

Single -	$13.00	Pensioner/student	$10.00
Family -	$15.00	Pensioner Family	$12.00
Overseas -	A$20.00 (Magazine by airmail)		

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.

PRESIDENT'S REPORT

AS PRESENTED AT THE ANNUAL GENERAL MEETING

The new financial year has come and gone, and we move on into yet another new year - our eighteenth since the inauguration of our Society.

Finances

Our financial position is still satisfactory with a balanced budget, as we see in the September/October Newsletter. Again we are indebted to Don Fuller for his excellent work as Treasurer over the past year.

Monthly Meetings

The monthly meetings are reasonably well attended and again we have had some excellent speakers throughout the year. Our visiting guest, Robin Halley from the U.S.A., gave us an excellent presentation on 'The Ferns of San Diego County'. Barry White and Don Fuller gave us two very informative talks, the first with Norma Hodges on Carnarvon Gorge in Central Queensland last September and the second on the 'Ferns of Fraser Island' in May. Keith Hutchinson spoke on 'Fern and Garden Photography', Joan Rowland on their trip to Madagascar, Ian Broughton on 'Propagation of Ferns by Rhizome Cuttings' and Terry Turney on 'What's in a Name'. We also had two members' nights, an identification night in February and 'My Favourite Fern' in April.

The fern competitions at the meetings have all been well supported and I would like to thank Barry White for his very competent judging.

...continued on page 91

1997 FORTHCOMING MEETINGS & EVENTS

GENERAL MEETING - 20 NOVEMBER at 8 p.m.

THE FERNS OF LORD HOWE ISLAND

with Barry White

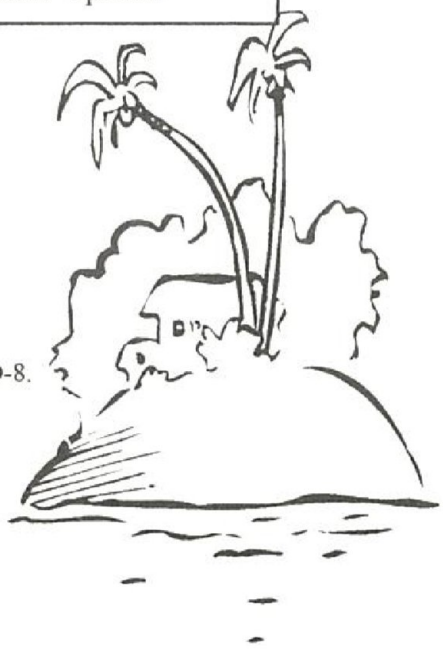
Barry talks about the unique ferns he has seen during his trip to Lord Howe Island, 750 km off the coast of N.S.W.

*Come and cast your vote on the Objectives and Rules' update.

GENERAL MEETING TIMETABLE:

7.30	Pre-meeting activities - Sale of ferns, spore, books, merchandise and Special Effort tickets. Also library loans.
8.00	General Meeting.
8.15	Workshops and demonstrations.
9.15	Fern identification and pathology, Special Effort draw.
9.45	Supper.
10.00	Close.

VENUE: Victoria Bowling Club, 217 Grattan Street, Carlton. Melways ref. 2B: D-8.



MONTHLY COMPETITIONS:

NOVEMBER **A Lord Howe Island Fern**

DECEMBER & JANUARY **No meetings.**

FEBRUARY **Fern(s) in a Hanging Basket or Container.**

1997 Christmas Function

Sunday 30th November.

The Committee invites you to the Society's end-of-year get-together which will be at the home of Lorraine and Chris Goudey at 25 Cozens Road, Lara on Sunday 30th November from 12 noon.
BYO lunch and drinks - tea and coffee will be provided.
Join us for an afternoon of fun, a good yarn, lots of great prizes for the special special effort and a look through Austral Fern's nursery. This is not a buying spree but Chris can usually be persuaded.....
Come when you can, leave when you must. Bring your partner, family, a friend and/or a potential member. See you on the 30th!

* Some ferns found on Lord Howe Island are; Skeleton Fork Fern (*Psilotum nudum*), Batswing Fern (*Histiopteris incisa*), *Adiantum aethiopicum, A. hispidulum, Cheilanthes distans, Asplenium polyodon, Blechnum attenuatum, Blechnum* sp. Lord Howe Island, *Polystichum mooreii, P. whitelegii.* There are many more.

AUGUST 1997 GENERAL MEETING - SPEAKER REPORT

WHAT'S IN A NAME?

Starring Blechnum nudum.

Terry Turney

LOBSTER LIPS.

Terry began by telling us about the recent discovery of *Symbion pandora*, a tiny parasitic animal that lives on lobsters' lips. It represents a completely new phylum (one of the major divisions of the animal or plant kingdoms, according to my dictionary). There is nothing that we know of which is related to this animal.
A discovery such as this is not a particularly unusual occurrence in the animal kingdom, which is changing all the time, but is extremely rare in the plant kingdom, which is pretty stable. Most of today's discoveries are at the genus or species level.

CLASSIFYING PLANTS

The **plant kingdom** is divided into two **Sub-kingdoms**;

Thallophytes (stemless, rootless or leafless plants such as algae, fungi, lichen, molds, bacteria) and
Embryophytes (the higher plants, including ferns).

These sub-kingdoms are then divided into **divisions**, which are divided into **classes**, which are further divided into **orders**, **families, genera** and **species**. In the case of ferns (Pteridophytes) most modern discoveries are made at genus or species level.

CLASSIFYING FERNS and ALLIED PLANTS

What is a Fern?

- Ferns are intermediate between seed-bearing plants and mosses.
  They are different from seed-bearing plants in that they do not have flowers
  And different from mosses - ferns have vascular tissue (a system of veins)
- They have independent alternating generations -
  Prothallus - contains reproductive organs and
  Sporophyte - the familiar fern plant
  Alternate generations are not independent in either mosses or higher plants.

The classification of ferns and fern allies is based on their structures, their morphology (how they vary from each other). **Psilopsida** contains the Fork ferns.

Sphenopsida includes the Equisetums or Horsetails.
Lycopsida contains the Lycopod (Clubmoss), Selaginella and Isoetes (Quillwort) families.
Pteridopsida. The vast majority of ferns belong here. Their features are listed in the table above. They (with the possible exception of the water ferns) look like ferns.

Class	Order	Family
Psilopsida – no true roots	Psilotales	Psilotaceae
Sphenopsida, - true roots, hollow stems	Equisetales	Equisetaceae
Lycopsida –	Lycopodiales	Lycopodiaceae
true roots, solid stems, small sessile		Selaginellaceae
leaves	Isoetales	Isoetaceae
Pteropsida –	Ophioglossales	Ophioglossiaceae
true roots, solid stems, fronds	Marattiales	Marattiaceae
	Osmundales	Osmundaceae
	Filicales	From 7 – 31 Families
	Marsileales	Marsileaceae
	Salviniales	Salviniaceae
		Azollaceae

All the 4 classes in this listing look quite distinct from each other so it is easy to tell them apart, which is the good news. The bad news is - this is only one of the models used to classify ferns. Though there is general agreement on the genera and species levels, Botanists cannot agree on the correct groupings above species level. In five books, Terry found five different classification systems. It depends on the criteria adopted; which features of a plant are considered most important. Some models rate the vein patterns highly, others the spore pattterns etc.

Unlike the methods used when classifying ferns, the rules governing the naming of them are rigid. Linnaeus' system of binomial nomenclature (naming with two names) for plants is used worldwide; the first name for the genus and the second for the species. Under this system, each two-part name should uniquely describe that plant.

WHAT IS A SPECIES?

A species is a group of (in this case) ferns which

- ◊ Have common distinguishing features
- ◊ Interbreed
- ◊ Are reproductively isolated from all other groups and
- ◊ Fill a distinct ecological niche.

SUB-SPECIES, VARIETY OR FORM

There is some conjecture about what the actual words mean and because of this, terms are often used inappropriately and so ferns are named incorrectly. Also, botanists use two codes of formal classification, one for classifying plants they find in the wild and another for plants in cultivation, so one plant can have two valid names, one in each code!! None of this helps the novice much.

Subspecies are;

***different in form**

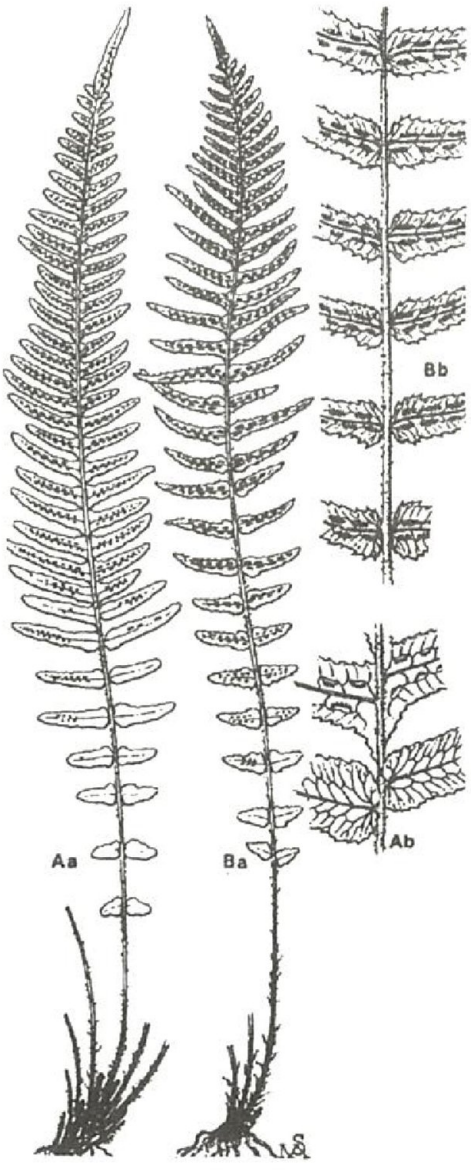
***AND geographically distinct.** You will never find two subspecies in the same geographical area.
eg., Doodia media subsp. media (Central and north-eastern Queensland and New Guinea) and subsp. australis (South-eastern Queensland, New South Wales, Victoria, Tasmania, Polynesia and New Zealand). The difference in this case is in the way the pinnules are attached to the midrib. Botanists didn't think that this difference was great enough to name them as separate species.
If two subspecies are bred separately in similar conditions they will always have that difference.

Varieties are below subspecies;

***a distinguishable group of ferns in a particular habitat.** One may live in bog while another lives in grassland. One may live up a tree while the other lives under the tree. They may have slightly different shapes because of their different environments. The difference is even less than in subspecies.

Forms are below varieties;

***different in a very minor character**. Examples are the crested form of a fern frond as in Blechnum cartilagineum cristata or the crested 'foot' form of the Green Grub Fern, Polypodium formosanum f. cristatum.



A. *Doodia media* subsp. *media*. **B.** *Doodia media* subsp. *australis*. Compare Ab. and Bb. noting the different degree of attachment in the most broadly attached pinna-base of each.

(Taken from "Ferns of Queensland", S.B.Andrews)

CULTIVAR AND HYBRID

Cultivars are cultivated plants with any difference which can breed true or can be propagated vegetatively

(eg., Adiantum raddianum cv. 'Bridal Veil' or Drynaria rigidula cv. 'Whitei').

Hybrids are offspring of different species or genera. These offspring must display characteristics which are intermediate between the two.

(eg., Cyathea cunninghamii X C. australis = C. x marcescens)

(eg., Aglaomorpha coronans X Drynaria rigidula = Aglaomorpha cv. 'Santa Rosa') It was probably named Aglaomorpha 'Santa Rosa' rather than Drynaria 'Santa Rosa' because it looked more like an Aglaomorpha. Two different species can produce a whole range of hybrids depending on the manner in which their genes are combined. Dryopteris spp, Nephrolepis spp and Asplenium spp form many hybrids.

The point was made that plants cannot breed across genera - so is 'Santa Rosa' (above) evidence that either Aglaomorpha coronans or Drynaria rigidula has actually been placed in the wrong genus? Some botanists are now combining these two genera, partly on the basis of this kind of evidence.

THE FAMILY BLECHNACEAE

There are eight (possibly nine) different genera in this family, being grouped together because they have a number of things in common. They are:

Stenochlaena (containing 6 species),
Woodwardia (13 species),
Blechnum (150 - 200 species),
Pteridoblechnum (2 species - Queensland) and
Doodia (~12 species),
Sadleria (~4 species, from Hawaii),
Brainea (*B. insignis* - Asia),
Salpichlaena (1 species - South America).

One feature that is almost universal in this family is the free veins - they don't cross over each other (are not netted or anastomosing). Another unique characteristic is that the sori, the sporangia, are running parallel with the midrib of each pinnule.

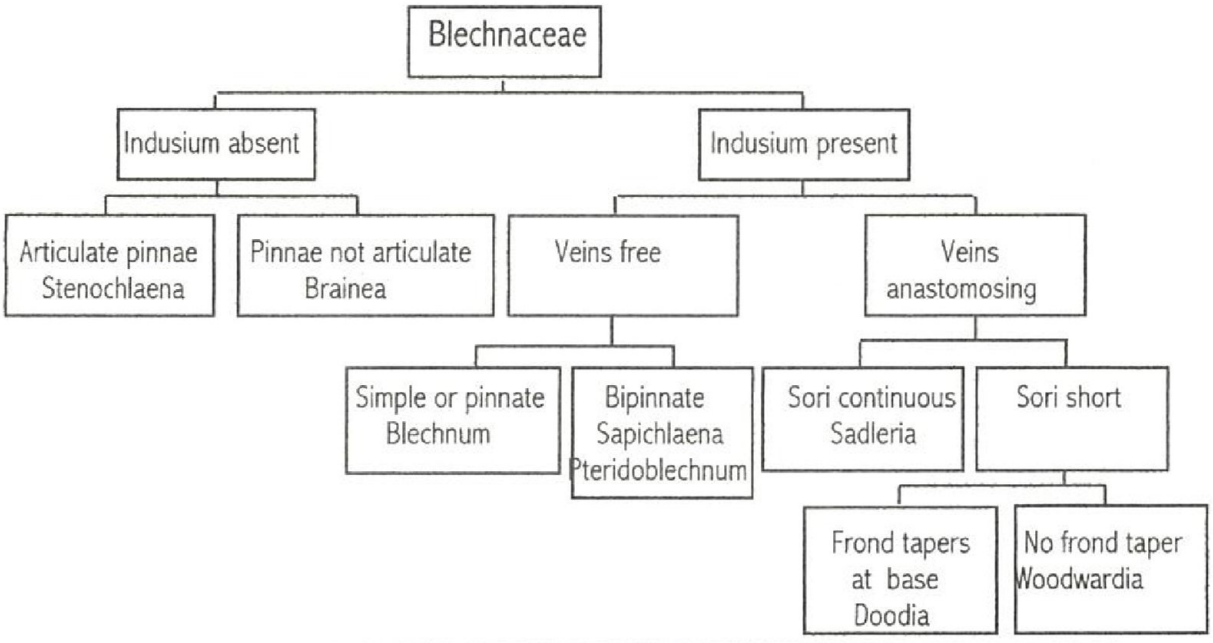
KEYING OUT BLECHNACEAE

This is one of the easier fern families to divide up into genera. Following the chart (below), the first thing to look for is an indusium. If it is absent it is either Stenochlaena or Brainea.

If the sori are covered by an indusium, check out the veins. Are they free or anastomosing?

If free, look at the frond shape. If it is simple or pinnate it is a Blechnum, if bipinnate it is Sapichlaena.

If the veins are anastomosing, look at the sori; are they in a continuous line (Sadleria or Pteridoblechnum) or are



they in short, discrete (separate) 'dashes' (Doodia or Woodwardia).
In the last case, look at the frond shape; if it tapers at the BASE you have a Doodia, if not it is a Woodwardia.

THE GENUS BLECHNUM.

- ◊ Blechnums are named from *blekhnon* (Greek) which is the name of a particular fern.
- ◊ Most, though not all, of the 150 - 200 Bechnum species are found in the southern temperate regions of the world; New Zealand, Australia and South America.
- ◊ They are usually terrestrial though they sometimes grow on rocks or up trees.
- ◊ Sometimes develop small trunks. *B. nudum, B. fraseri.* (So does *Brainea.*)
- ◊ Most, but again not all, are dimorphic.
- ◊ In all cases the veins are free, often forked, and sub-marginal.
- ◊ An indusium is always present.

CLASSIFYING *Blechnum nudum* - the Fishbone Water Fern.

Sub-kingdom - Embryobionta
Division - Pteridophyta
Class - Filicopsida
Order - Blechnales
Family - Blechnaceae
Genus - Blechnum
Species - nudum

Blechnum nudum is *Blechnum nudum* because it has the following set of properties. This particular combination of properties is unique to this one fern. It also fills the above criteria for a species. The following list compares it to some of the eight other Victorian Blechnums.

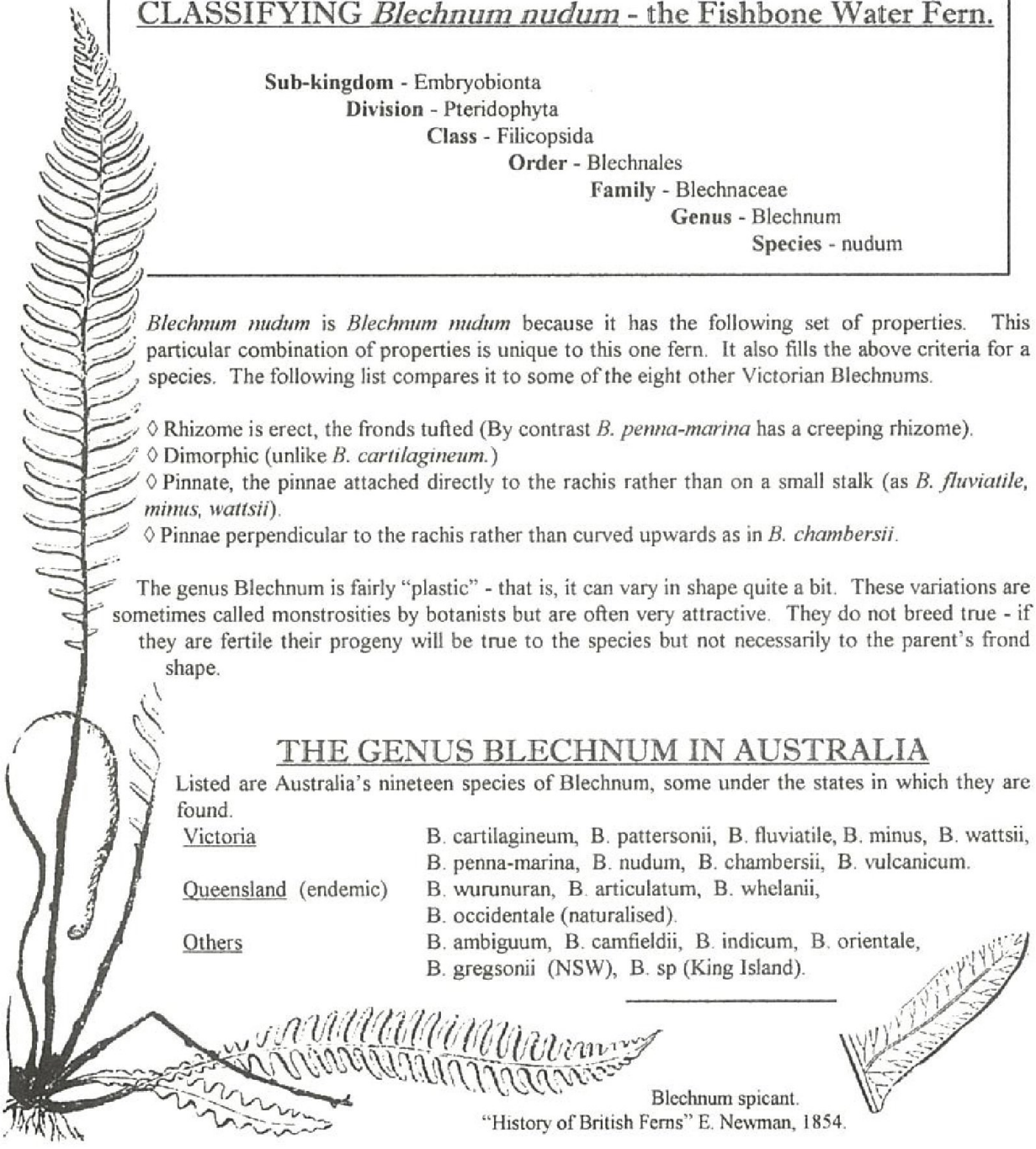
◊ Rhizome is erect, the fronds tufted (By contrast *B. penna-marina* has a creeping rhizome).
◊ Dimorphic (unlike *B. cartilagineum.*)
◊ Pinnate, the pinnae attached directly to the rachis rather than on a small stalk (as *B. fluviatile, minus, wattsii*).
◊ Pinnae perpendicular to the rachis rather than curved upwards as in *B. chambersii*.

The genus Blechnum is fairly "plastic" - that is, it can vary in shape quite a bit. These variations are sometimes called monstrosities by botanists but are often very attractive. They do not breed true - if they are fertile their progeny will be true to the species but not necessarily to the parent's frond shape.

THE GENUS BLECHNUM IN AUSTRALIA

Listed are Australia's nineteen species of Blechnum, some under the states in which they are found.

Victoria	B. cartilagineum, B. pattersonii, B. fluviatile, B. minus, B. wattsii, B. penna-marina, B. nudum, B. chambersii, B. vulcanicum.
Queensland (endemic)	B. wurunuran, B. articulatum, B. whelanii, B. occidentale (naturalised).
Others	B. ambiguum, B. camfieldii, B. indicum, B. orientale, B. gregsonii (NSW), B. sp (King Island).



Blechnum spicant.
"History of British Ferns" E. Newman, 1854.

SPEAKER REPORT #2 - JULY 1997 MEETING.

BORDER RANGES NATIONAL PARK

(or A Day in Fern Paradise.)

Ian Broughton.

The Border Ranges National Park is not as widely known as it deserves to be. It is an absolutely, breathtakingly spectacular area, not highly developed which is reflected in the relatively small number of visitors. There is not a lot of accommodation close by but it is well worth the effort to go there.

It is in the north-east corner of New South Wales. Mount Warning, near Murwillumbah, is an ancient volcano which is surrounded by a series of ranges in an arc. These ranges include Nightcap Range to the south, McPherson Range to the north and the Tweed Range. Lamington N. P. is on the Queensland side of the border in this same range.

Border Ranges N.P. is on the McPherson and Tweed Ranges. It abuts Lamington N.P., on the N.S.W. side.

Ian gives the Mount Warning area in general and the Border Ranges N.P. in particular a "must see" rating for both the fern species and for the sheer beauty to be seen there. He recommends that anyone who possibly can, should visit there. He and his family spent three days there recently.

HIGHLIGHTS

Dawsonia superba. Giant Moss is abundant in places, growing to 30cm tall. Remarkable!

Cyathea leichhardtiana - Prickly Tree Fern. For sheer numbers, our tree ferns in the Dandenongs jusy don't compare with the Border Ra. Prickly Tree Fern. Ian estimates they probably saw 10,000 individual tree ferns on a 10 km walk along a walking track. Every 100 metres at least 100 plants were visible.

There are spectacular stands of ***Adiantum formosum*** (Black-stem Maidenhair). Also of ***A. cunninghamii*** and ***A. silvaticum*** which are very similar except that *A. cunninghamii* has a blue-green frond whereas *A. silvaticum* is green.

Superb colonies of ***Pteris umbrosa*** (Jungle Brake), ***Diplazium assimile*** and ***D. dilatatum*** can be seen.

Linospadix monostachia - the Walking-stick Palm - is supposed to grow to 2 metres tall but in this superb area plants of 4 metres are found.

Ian closed his pre-talk talk with a few thoughts on our marvallous heritage of trees, inspired by a view over the forest in Barrington Tops National Park, north-west of Newcastle. The Broughton family called in there on the way home from Border Ranges.

To quote him, "There was one area that looked for about 90° over the National Park. As I looked at the view there (a real Sarah Lee Pastry type of view - layer upon layer upon layer of mountain ranges clothed in rainforest) I thought about the Greening Australia programme which aims to plant a billion trees by the year 2000. I guesstimated that we were looking at about one billion trees. A billion trees is not a scratch on the surface of what's been taken out of our forests. It's one thing to replant, but we've got to preserve what is still there. It's an asset that we can enjoy now and we need to keep for future generations.

The scene I looked out onto highlights the relative insignificance of the programme run by Greening Australia. I know it's necessary, and it is important, but it is nothing compared with what's out there already - which is nothing compared with what <u>was</u> there".

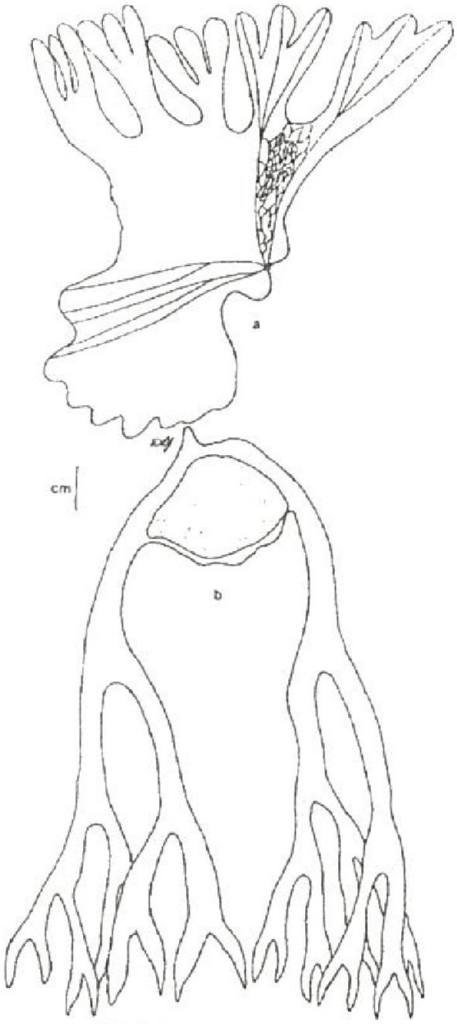


Fig 245 PLATYCERIUM SUPERBUM
a) Nest leaf x⅕
b) Fertile leaf (antler) x⅛

FERNS FOUND IN THE BORDER RANGES NATIONAL PARK AND SURROUNDING AREA

This is not a complete list, it is just what Ian saw without really trying. There are a few which he is not positive about - they are marked thus *

Adiantum	aethiopicum	Common Maidenhair
	cunninghamii	
	diaphanum	Filmy Maidenhair
	formosum	Blackstem Maidenhair
	hispidulum	Rough Maidenhair
	silvaticum	
Arachniodes	aristata	Prickly Shield Fern
Arthropteris	beckleri	
	tenella	
Asplenium	australasicum	Bird's Nest Fern
	flabellifolium	Necklace Fern
	polyodon	Mare's Tail Fern
Blechnum	cartilagineum	Gristle Fern
	minus	Soft Water Fern
	patersonii	Strap Water Fern
	wattsii	Hard Water Fern
Cheilanthes	distans	Bristly Cloak Fern
	sieberi	Mulga Fern
Christella	dentata	Binung
Culcita	dubia	Rainbow Fern
Cyathea	australis	Rough Tree Fern
	cooperi	NSW (Scaly) Tree Fern
	leichhardtiana	Prickly Tree Fern
Davallia	pyxidata	NSW Hare's Foot Fern
Dawsonia	superba	Giant Moss (not a fern, of course!)
Dennstaedtia	davallioides	Lacy Ground Fern
Dicksonia	antarctica	Soft Tree Fern
	youngiae	Bristly Tree Fern
Dictymia	brownii	
Diplazium	assimile	
	australe	Austral Lady Fern
	dilatatum	
Doodia	aspera	Prickly Rasp Fern
Doodia	caudata	Small Rasp Fern
	media	Common Rasp Fern
Gleichenia	dicarpa	Pouched Coral Fern
	microphylla	Scrambling Coral Fern
	rupestris	(Nightcap Ranges)
Histiopteris	incisa	Bat's Wing Fern
Hypolepis	muelleri	Harsh Ground Fern
	punctata	Downy Ground Fern
Lastreopsis	decomposita	Trim Shield Fern
	marginans	Glossy Shield Fern
	microsora	Creeping Shield Fern
	smithiana	
*	munita	
*Lindsaea	brachypoda	(Nightcap Ranges)
	microphylla	Lacy Wedge Fern
Lycopodium	fastigiatum	Mountain Clubmoss (N.R.)
*Microsorum	diversifolium	Kangaroo Fern
	scandens	Fragrant Fern
*Ophioglossum	pendulum	Ribbon Fern
Pellaea	falcata	Sickle Fern
	paradoxa	Cliff Brake
Platycerium	bifurcatum	Elkhorn
	superbum	Staghorn
*Polystichum	australiense	
Pteridium	esculentum	Bracken
Pteris	tremula	Tender Brake
	umbrosa	Jungle Brake
Pyrrosia	confluens	Robber Fern
	rupestris	Rock Felt Fern
Rumohra	adiantiformis	Leathery Shield Fern
Sticherus	flabellatus	Shiny Fan Fern
	lobatus	Spreading Fan Fern
Todea	barbara	King Fern

The following article is taken from an unidentified recent Tas. newspaper and was given to me by a Society member.

GRAND OLD FERN FINDS NEW HOME

A rare fern which was swept into a ditch has found a new home at the Botanical Gardens.

Todea barbara, or "Barbara" for short, has Forestry Tasmania to thank for its meteoric rise to fame.

The 600-year-old fern comes from near Beaconsfield, an area rich in minerals and plant species.

Last year the fern was washed from its home and dumped in a ditch.

Enter forestry practices officer Michael Boyden, who doscovered and identified Barbara.

He named her "Big Bottom Barbara" because she is 1m wide across the base, indicating her great age, and 1m high.

The plant was salvaged and donated to the Royal Tasmanian Botanical Gardens.

However, RTBG director David Bedford said the gardens rarely accepted donations because there was a risk live plants could introduce disease.

Barbara will spend three months in quarantine before she is found a permanent spot in the gardens.

'Housekeeping' Dept.

Would contributors please note that the deadline for sending January's newsletter material to me is 9th December because of the printer's holiday break.

Opinions expressed in articles in this newsletter are the personal views of the authors and are not necessarily endorsed by the Society, nor does mention of a product constitute its endorsement.

I apologise for having made empty promises in the last issue - the article on classification and genealogy of ferns has been included in this issue.

.....Lyn G.

1998 FERN SHOW

APRIL 18TH AND 19TH

MOUNT WAVERLEY COMMUNITY CENTRE
CNR. MILLER CRESCENT & STEPHENSONS ROAD
MOUNT WAVERLEY.

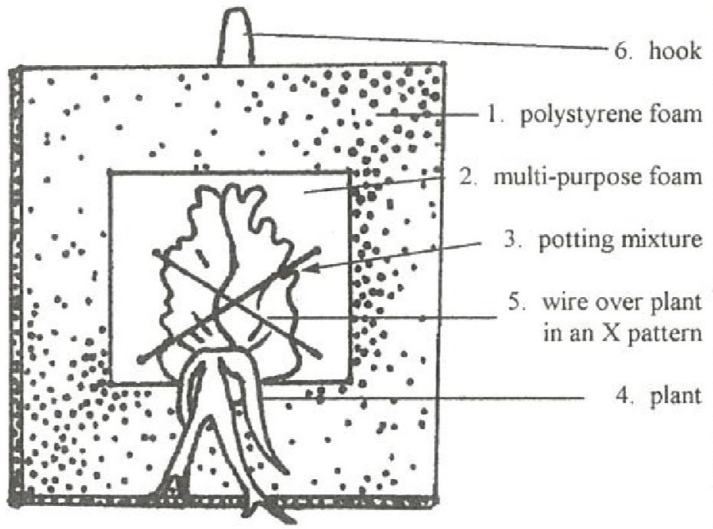
BE THERE!!

MOUNTING PLATYCERIUMS

Kathy Goodall

Things you will need;

Stag or Elk to be mounted
Sphagnum moss
Coprapeat or peatmoss
Mixed animal manure or cow manure (aged)
Used tea leaves
All purpose foam cut to size to cover back of plant or a little larger
Lid from a polystyrene foam box (local supermarkets usually throw these out)
Fine fencing wire or similar, cut to length.



Components of Kathy's system, numbered in order of steps.

Firstly take the polystyrene foam and lay it flat on a table, then place on it your cut-to-size all purpose foam and onto this lay all the sphagnum moss, copra peat or peatmoss, manure and tea leaves.

Then arrange your Platycerium on all the above. Take two pieces of wire and make a X over the Platycerium, being careful not to place the wire in the centre of the plant and damage it. Tie wire at the back of polystyrene foam, then make a hook and place in centre of foam at the top. It's now ready to hang. We use an old coat hanger for this.

Then give a good watering of liquid fertilizer. Place in a protected area, out of direct sun and keep moist but not wet until new growth begins to show. Fertilize every month in the growing season with Maxicrop or weak liquid animal manure.

You'll find the roots from the Platycerium will attach themselves to the multi-purpose foam quite readily - they just love it.
The polystyrene foam is only strong enough for small to medium Stags. When they have outgrown it because they have become too heavy, just transfer the whole mounting board with Platycerium still attached, onto a new, wooden board. We use the ends of an electrical cable reel. You may be lucky enough to find one when a shop is renovating.
It doesn't take long for the fronds to cover the old polystyrene foam.

To stop snails, slugs etc. damaging the Platycerium we put snail bait or dead line just on top behind the fronds but are careful around animals as this is very deadly to them.

When boarding your Platyceriums do be careful not to hold onto the face of the plant too tightly as they bruise very easily.

PRESIDENT'S REPORT...continued from page 82.

Excursions
There were three excursions last year but unfortunately none so far this year. The first was to our nursery in October, then Badger Creek in November and finally our Christmas Break-up at the Geelong Botanic Gardens in early December.

Fern Show
We returned to the Herbarium for our fern show which was held on the 22nd/23rd March this year. The show was a success although we did not break any records. The feature display was the ferns of New Zealand. The central pergola was used again to good effect and Ian Broughton had a large display as always. Reg and Mary Kenealy again provided an interesting display of memorabilia on ferns. Our thanks go to Mary Frost for her competent judging of the entries in the competition and to Don Fuller for the hard work he puts into organising and co-ordinating the fern show. Thanks also to the members of the Show Committee and to other members who participated in the show.

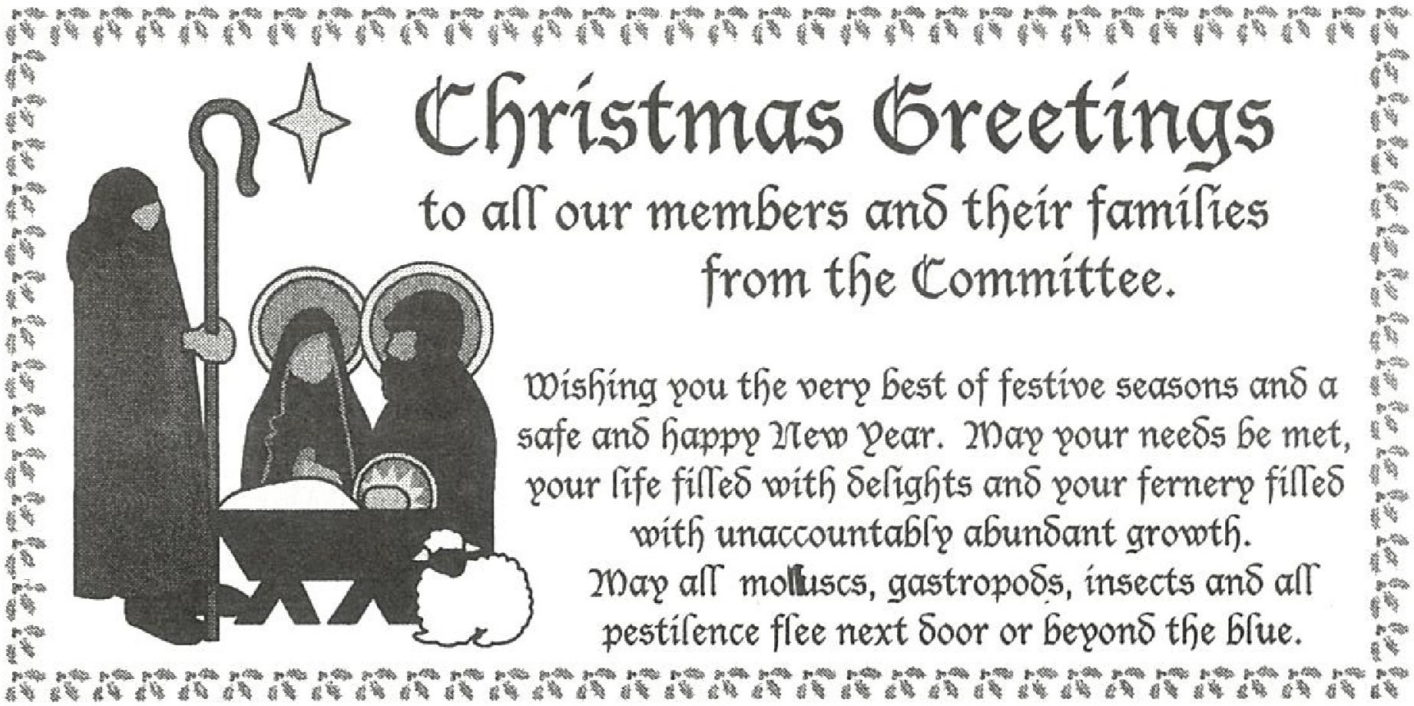
Newsletter
Lyn Gresham has excelled again as out Newsletter Editor. The newsletter just gets better and better. Lyn not only puts it all together but also contributes many of the articles contained within. Another regular contributor is Barry White. More contributions would be most welcomed by the editor. Thanks also to Margaret Radley and to Sharon, her daughter, for their part in folding and mailing the newsletter.

Committee of Management
The Committee of Management has functioned well over the past year, in spite of the fact that we did not have a secretary. Our thanks go to Lexie Hesketh who stepped in in a temporary capacity. My thanks go to all the committee members for their contributions over the past year; Barry White (Past President), George Start (Vice President), Don Fuller (Treasurer, Show Co-ordinator), and also John Oliver (Membership Secretary), Jean Boucher, Lyn Gresham, Simon Hardin, Ray Harrison, Lexie Hesketh and Cheryl Shelton.

Non-elected Positions
Many of our members have given their time and effort, not only over the past year but for many years and their contributions are acknowledged. Thanks to Margaret Radley and Joy Horman for selling raffle tickets at the door, Norma Hodges and Nancy Perry for their work in providing supper at the meetings, Don Fuller for organising the merchandise such as Maxicrop, baskets and liners etc., Lorraine Goudey for her work on the fern sales table, John Oliver as property manager, David Radford for looking after the library, Ivan Traverso for taking care of the book sales and also Barry White who manages the spore bank. Many thanks to Mavis Potter for the wonderful Christmas cakes she has baked for th Christmas Break-up raffles. I would like to thank George Start for the excursions he has organised and led over the year and also to Ray Harrison for the work involved in bringing the Constitution up to date.

In conclusion, I would like to thank all the members for their support over the past year and I look forward to the coming year, in the knowledge that our Society will continue to prosper.

Chris Goudey
18th September, 1997.



The following article is taken, with thanks, from "Fern World" XX, 6 (June 1996), the newsletter of the San Diego Fern Society

THE CLASSIFICATION AND GENEALOGY OF FERNS

Based on a presentation to the San Diego Fern Society on May 16, 1996 by
Dr. Alan R. Smith, University Herbarium, University of California, Berkeley.

I. Introduction

Most of us can relate to the study of genealogy as it applies to our own family lineage. We also follow with great interest discoveries of fossil man and his precursors in Africa. Further, in this era of dinomania, we have learned that birds are, in fact, the descendants of *Archaeopteryx* or similar organisms in the Jurassic.

If we believe in evolution, and nearly all biologists do, then the same fascination with genealogy and evolutionary history applies to plants. This discussion about the evolutionary history of the ferns attempts to demystify the subject by providing some historical perspective on the development of our understanding of the relationships. Before starting the genealogical journey, let us first digress for a moment and look at the general purposes of classification; what ends are we trying to serve by classifying organisms.

II. Classification

Classification is defined as the arrangement of objects (animate or inanimate) into groups or categories according to stated criteria. These criteria could be just about anything you like...color, shape, smell, use, or a combination of these.

Classification is a natural preoccupation of man. The human mind seems to enjoy this activity whether it is intellectual or just part of everyday life. Different classification of the same group may serve very different purposes. One of the chief purposes of classification is to order information so that it can be readily retrieved. A second purpose is to provide an "orderly" framework or hierarchy for remembering information. We could, after all, assign each species a "social security" number, but remembering a different number for each organism would not be as easy for most of us as remembering *Polypodium californicum*, that it belongs in the Polypodiaceae, that it is similar and closely related to *P. glycyrrhiza*, and that other genera like *Drynaria, Pyrrosia* and *Platycerium* are related and in the same family. A third purpose of classification is often said to be its "predictive value". Suppose, for example, one finds that *Blechnum spicant*, the Deer Fern, is found to contain a useful medicinal compound. This property of predictiveness of a good classification enables us to make an educated guess that the relatives of this species may also contain the same or similar compounds.

A useful classification is one that is practical. We could, for example, develop a classification based on chromosome number and karyotype. While this might be informative, it would not be very practical, and so would not be used. We could also develop a classification based solely on the number of changes in the DNA sequence in the genes of organisms, but that would not be very practical either. So, we would like a general purpose classification that serves a wide range of needs, from those of professional biologists to those of governmental agencies, hobbyists and growers, and also stimulate further research. But, general purposes can be most often served if the classification incorporates or reflects as much evolutionary history as possible.

III. Three Main Types of Classifications

Artificial Classifications: based on some arbitrary criterion or criteria of convenience. Chief aim is to be practical, that is, to provide a means of identifying objects or organisms.

The early Greeks (Theophrastus) based their classification of plants largely on habit. They classified plants as trees, shrubs, undershrubs and herbs, and then further divided these categories into cultivated and wild things. An artificial classification, but practical.

Others (notably the herbalists) based their classification on use. They classified into categories such as perfumes, oils, cereals, spices, condiments and medicinal. Some of you may have heard about the "Doctrine of Signatures", whereby each plant had some characteristic that was supposed to indicate its worth -- Moonworts, e.g., and particularly *Botrychium lunaria* (so named because of the crescent-shaped pinnae, which was taken as a sign that the plants would be useful in treating diseases of a periodic nature), which were thought to be under the influence of the moon .

The Sexual System of Linnaeus, published in *Sp. Plantarum* in 1753, was the starting point for our system of binomial nomenclature. Linnaeus counted the number and arrangement of stamens and, based on these numbers, categorized plants within 24 groups (Classes). Linnaeus further subdivided these classes based on number of pistils (female organ), e.g., *Pentandria Monogynia; Pentandria Digynia.* You can imagine that this was a very easy system to use, because all you bad to do was count. But it often did not group related organisms together. Linnaeus's 24th Class was "Cryptogamia" [hidden gametes]. At this time it was not really understood how ferns reproduced. This Cryptogamia class also included groups of mosses, fungi and algae.

Natural Classifications: based on overall resemblances, mostly gross morphology. Ideally, in a good natural classification, one would use as many characters as possible, and there could be correlation in the characters used. Another term sometimes applied to classifications based on overall resemblance is "Phenetic classification". Most classifications of the last 150 years or so have been natural, to a greater or lesser extent.

Phylogenetic or Evolutionary Classifications: based on genealogical relationships among species, genera and

families. These are usually inferred; only rarely are they known with certainty because we generally lack sufficient fossil evidence to reconstruct the history. There are methodologies now that allow us to infer better the history of organisms. One of the chief properties of a phlylogenetic classification is that it contains monophyletic groups, i.e., all of the elements of the clade (i.e. evolutionary branch) have originated from a common ancestor, and no element outside the clade has that same ancestor.

IV. Classification Systems (Pre-Linnaeus)

In Linnaeus' Sexual System (pre-Darwin, 1753), the following fern genera were recognized: *Equisetum; Onoclea; Ophioglossum; Osmunda; Acrostichum; Pteris; Blechnum; Hemionitis; Lonchitis; Asplenium; Polypodium; Adiantum; Trichomanes; Marsilea; Pilularia; Isoetes; Lycopodium* (incl. *Selaginella*) under MUSCI. That's 14 fern genera + 3 fern allies. Today, for example, we recognize approximately 350 genera.

Linnaeus based his genera on: (1) shape of sorus, (2) position of sorus and (3) dimorphism of fronds. Within each genus, subdivisions were based on the blade dissection. Later, in the 18th century, classification was refined based on indusium shape/placement. In the 19th century vegetative characters were emphasized, as well as those involving reproductive structures. This included (l) venation, (2) habit, (3) rhizome, (4) position of leaves, (5) blade dissection, (6) number of vascular strands in petioles, (7) indument (hairs, scales), (8) sporangium type/size, (9) annulus, (10) number of spores.

In the 20th century, with improved tools such as the scanning electron microscope, more minute characters have been used such as spores (e.g., trilete vs. monolete) and chromosome numbers (e.g., $\underline{n} = 22$ to $\underline{n} = 500+$). Ferns usually have many chromosomes in each of their nuclei, and these numbers tend to be relatively constant for a given species, genus, or even family. For example, *Osmunda* has one of the lowest chromosome numbers: $\underline{n} = 22$. Other examples are *Pentagramma* (30), *Asplenium* (36), *Dryopteris* (41) and *Cyathea* (69). The highest number is an *Ophioglossum* where $n = 550$.

Classification this century also focussed on (l) gametophyte characters such as shape (e.g., cordate/ filamentous/ ribbon-shaped), gemmae and sex organs (antheridia/archegonia); (2) phytochemistry, particularly micromolecules such as flavonoids and other secondary metabolites; and (3) macromolecular evidence such as proteins and DNA/RNA.

V. Recent Classifications of Ferns

There has been a spate of classification systems in the last 50 years or so, beginning with Ching (1940), Holttum (1947) and Copeland (1947). Resulting dendrograms (i.e. family trees), based on overall resemblances and differences, have produced without great rigor or explanation up to approximately 51 families. A consensus would be about 30 families with 10 in California.

Pryer et al. (1995) have produced cladograms, produced by methodology known as cladistics. This approach is based in the search for shared, derived characteristics, called synapomorphies (e.g., sori absent vs. present; annulus absent vs. present; homosporous vs. heterosporous). Recent classifications have used (1) morphology, (2) rbcL and (3) combined.

VI. Molecular Data

All plants (including ferns) contain genetic information -- DNA. DNA is a polymer containing a large number of sub-units.

Although it may be fairly obvious, it's important to review discussing the rationale for the use of molecular data in classification. The similarities and differences among plants in various characters (reproductive, vegetative, gametophytic, chemical) are believed in most cases to have a genetic basis and to reflect genetic similarities and differences. With morphological characters, it is often difficult to compare features across large taxonomic groups because of convergent evolution (the same or very similar structures arising as a result of the selective pressures of the environment). For example, aridity has been the selective force behind the similarities in stems of *Euphorbia* and cacti. With morphological characters we have the difficulty of comparison because of what can be called the "presence/absence" problem. That is, how can we compare absence of indusia in one fern vs. absence in another? And even if indusia are present, we are not always sure whether they are homologous, that is, is their similarity due to a common descent or of independent derivation. Molecular evidence does not suffer from these problems of trying to determine homology and presence/absence.

Most of the genetic information for plants is located on the chromosomes, in the nucleus, but some (both DNA and RNA) are also located in the chloroplasts (photosynthesis), mitochondria ("engines") and ribosomes (protein synthesis). There are, in fact, hundreds of thousands of different genes per cell, which encode information for the many chemical and developmental processes that go on within cells. One of the advantages of using molecular data is that there are, potentially, thousands of independent data sets that one can compare, to see if and how well they agree.

Each gene is in turn composed of hundreds or thousands of nucleotides, the coding units of the DNA. There are 4 nucleotides that make up the DNA; these nucleotides contain one of four nitrogenous bases: Adenine (A); Thymine (T); Guanine (G); Cytosine (C). Each nucleotide also contains a 5-carbon sugar (pentose) and a phosphate group.

A sequence of the nucleotides on a given gene can be determined and the sequence compared with the same gene in other species. The various substitutions (mutations) can be recorded. Using this information, one can use certain algorithms to generate trees, which are rooted through comparison with the sequence of bases in so-called "sister" taxa, the postulated most-closely related genera and species. One of the assumptions often used to generate these trees is that the observed character states are assumed to have evolved by a minimum number of changes, the principle of parsimony. Although this assumption may not always be

strictly true, it does seem to be operative in most biological systems.

Genes evolve at difference rates. Some genes are very conservative, e.g., chloroplast genes, like rbcL (ribulose 1, 5 bisphosphate carboxylase/oxygenase), which codes for an enzyme that catalyses an important reaction in the photosynthetic process of fixing $C0_2$ in the Calvin pathway. Other genes evolve at faster rates. So, the gene to be sequenced must reflect the problem one is trying to resolve. Therefore, if one wishes to resolve a higher level problem, such as relationships of families of ferns, then one would examine the genetic changes in a very conservative gene. If one wished to resolve relationships between species, a less conservative, more-rapidly evolving gene might be more appropriate. The gene that has most often been used for sequencing is called rbcL (a gene that codes for the large sub-unit of a protein called "rubisco").

The actual process of sequencing involves something called the "polymerase chain reaction" (PCR), which is a technique for producing millions of copies of a given genetic sequence. This technique became familiar to us during the O.J Simpson trial. This process amplifies a particular gene. Implications of this are that one needs only a very small bit of tissue for sequencing (Ranker in AFJ 85:).

VII. Using Molecular and Morphological Data Together

In general, taxonomists believe that the more data sets that can be brought to bear on a taxonomic problem, the better answers we can get. With this in mind, we have generated a tree combining morphological and molecular data [*more details on the resulting trees will be published in the July issue of Fern World*]. It does not differ significantly from the molecular tree alone, but there are subtle differences.

VIII. Next Project: Polypodiaceae/Grammitidaceae

Using the genus-level study results as a baseline, Dr. Smith and others involved in molecular/ morphological classification efforts will start studying the relationships in the Polypodiaceae and Grammitidaceae families.

Many thanks to ex-editor Bob Lee for yet another beautifully prepared rewrite.

FROST CLOTH

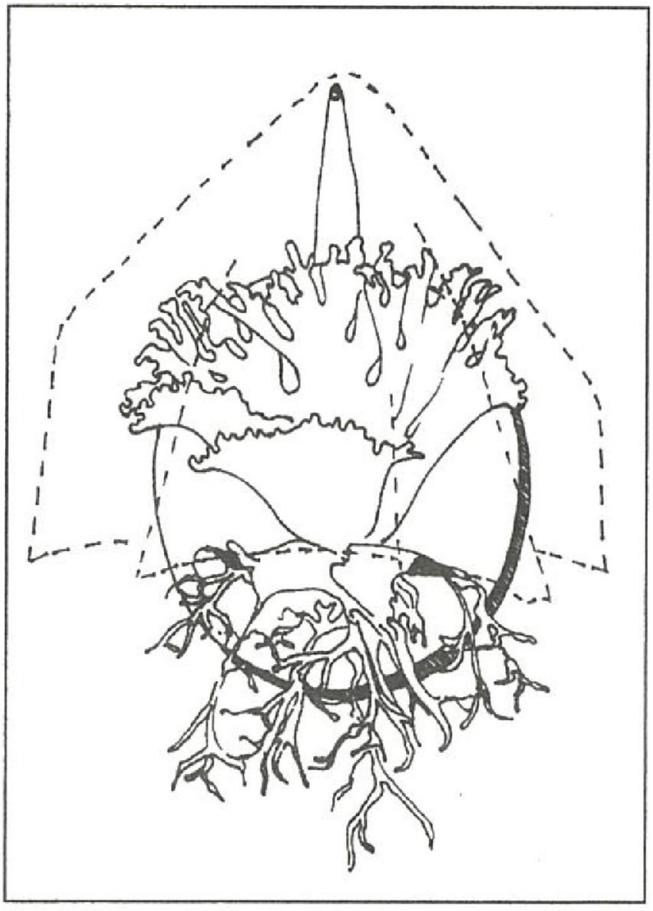
Kathy Goodall.

We live in Albury/Wodonga on the N.S.W. / Victorian border, ninety minutes from the snow-fields of Mt Buffalo and Falls Creek. Our winter temperature can get down to as low as -6°C. We have some HEAVY frosts here, with some black frosts occasionally.

Our large (185 sq. m.) fernery has 70% shade cloth overhead. In winter this lets the frosts in, which can do damage very quickly, so to avoid damage we place Marx Frost cloth over our large Platyceriums, on a slant so the rain will run off. We move our smaller Platyceriums under the cover of a shed.

We find the Marx Frost cloth tends to be water resistant, not waterproof, so we don't have to worry too much about the ferns underneath becoming too wet. If, however, you think you might have a really wet winter (we wish! -Ed) I'd advise you to move them.

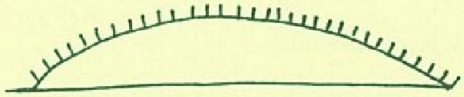
The Marx Frost cloth does a terrific job of keeping the frost off our ferns and it doesn't cost a great deal. There are two thicknesses, the cost varying between $2 and $2.50 per metre. It is handy to put over any frost tender fern you may have in your collection. The cloth does only last two or three winters.



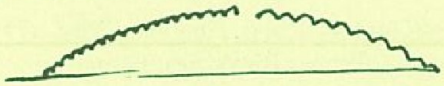
LEARNING YOUR WAY AROUND FERNS
5. PINNULE MARGINS.

Lyn Gresham

1. **Ciliate** - having marginal hairs, fringed.
eg., *Grammitis reinwardtii.*

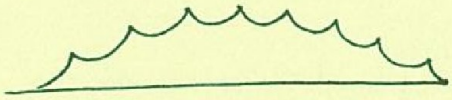


2. **Crenate** - with shallow, rounded teeth.
eg., *Arthropteris beckleri.*
3. **Crenulate** - finely crenate.

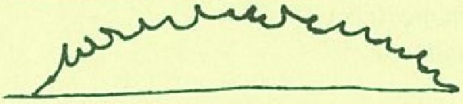


5 **Crispate** - irregularly curled or wrinkled.

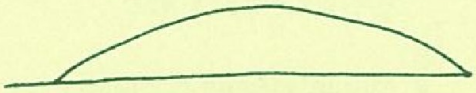
6. **Dentate** - with sharp teeth, more or less perpendicular to the margin.
eg., *Cyrtomium falcatum.*
7. **Denticulate** - finely dentate.



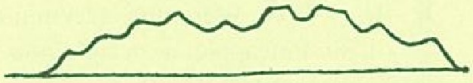
8. **Echinate** - prickly, spiny, bristly.
eg., *Doodia caudata.*
9. **Echinulate** - finely echinate.



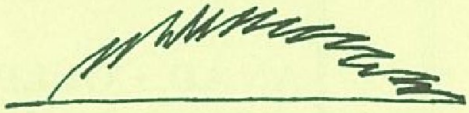
10. **Entire** - smooth, even, not divided, serrate or notched. eg., *Acrostichum aureum.*



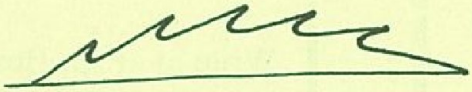
11. **Erose** - jagged and uneven as though gnawed.



12. **Fimbriate** - fringed, as cut in shreds.
13. **Fimbrillate** - finely fimbriate.

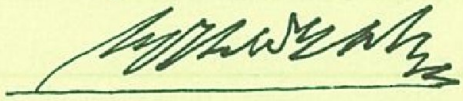


14. **Incised** - cut sharply, sometimes deeply.
eg., *Adiantum capillus-veneris* var. *incisum*

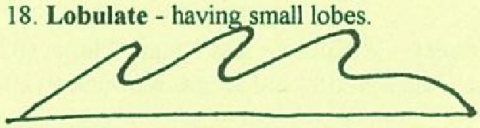


15. **Lacerate** - irregular, ragged as though torn.
eg., *Tectaria lacinata*

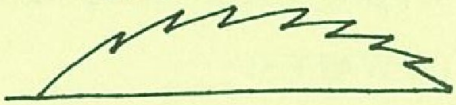
16. **Laciniate** - deeply slashed, cut into narrow, pointed, irregular segments. eg., *Adiantum capillus-veneris* cv. Imbricatum.



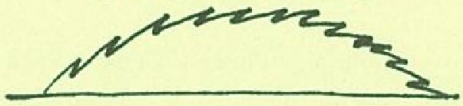
17. **Lobed** - with a recognizable but not separate division, often rounded.
eg., *Microsorum diversifolium.*
18. **Lobulate** - having small lobes.



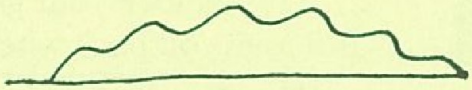
19. **Serrate** - toothed, notched like a saw.
eg., *Asplenium obtusatum.*



20. **Serrulate** - finely serrate.
eg., *Polypodium echinolepis.*



21. **Sinuate** - Strongly wavy, shallowly curved.
eg., *Myrmecopteris sinuosa*



22. **Spinulose** - having small spines.

23. **Undulate** - Wavy, corrugated with waves perpendicular to frond surface. (Also undose, undate)
eg., *Microsorum membranifolium*

As always, Terry Turney was a great help with this article. I also consulted David Jones' Encyclopaedia of Ferns, The Fern Dictionary (Wilbur W. Olson), Maidenhair Ferns in Cultivation (Christopher J. Goudey), Ferns of Queensland (S.B.Andrews) and the Web page of Australian Botanic Gardens.

BUYERS' GUIDE TO NURSERIES.

VICTORIA:

Andrew's Fern Nursery / Castle Creek Orchids - Retail. Phone (03)5826 7285.
Goulburn Valley Highway, Arcadia 3813 (20 km south of Shepparton).
Large range of ferns and orchids for beginners and collectors. Open daily 1Oam - 5pm except Christmas Day.

Austral Ferns - Wholesale Propagators. Phone (03)5282 3084.
Specialising in supplying retail nurseries with a wide range of hardy ferns; no tubes.

Coach Road Ferns - Wholesale. Phone (03) 9758 6878. Monbulk 3793.
Retail each Saturday and Sunday at Upper Ferntree Gully Market (railway station car park) Melway Ref, 74 F5.
Wide selection of native and other ferns. Fern potting mix also for sale.

Fern Acres Nursery - Retail phone (03)5786 5031. 1052 Whittlesea-Kinglake Road, Kinglake West 3757.
On main road, opposite Kinglake Primary School. Specialising in Stags, Elks and Bird's-nest Ferns.

Fern Glen - Wholesale and Retail Phone (03)5629 2375,
D & I, Forte, Garfield North 3814. Visitors welcome.

Kawarren Fernery - Wholesale and Retail. Phone (03)5235 8444.
Situated on the Colac-Gellibrand Road, Kawarren (20 km south of Colac),

The Bush-House Nursery - Wholesale and Retail. Phone (03)5566 2331.
Cobden Road, Naringal (35 km east of Warnambool), Ferns - trays to advanced. Visitors welcome.

NEW SOUTH WALES:

Kanerley Fern Exhibition and Nursery - Wholesale and Retail. Phone (049) 872 781.
204 Hinton Road, Osterley, via Raymond Terrace, 2324. By appointment.

Marley's Ferns - Wholesale. Phone (02) 9457 9188. 5 Seaview Street, Mt. Kuring-Gai, 2081.
All Fern Society members welcome. By appointment.

QUEENSLAND:

Moran's Highway Nursery -
Wholesale and Retail.
Phone (07) 442 1613.
Bruce Hwy, Woombye (1 km north of Big Pineapple; turn right into Kiel Mountain Road).
P.O. Box 47, Woombye, 4559.