CALEYI

Australian Plants SOCIETY NSW

NORTHERN BEACHES GROUP
May 2018


pic Andre Porteners

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Next Meeting: **7.15 pm Thursday May 3, 2018** at Stony Range Botanic Garden, Dee Why.
Presentation: All About Stony. Eleanor Eakins.
Supper: Jennifer & Georgine

Coming Up:

APS NSW ANNUAL GENERAL MEETING AND QUARTERLY GATHERING Saturday, 26 May 2018.
The next quarterly gathering will be held in conjunction with the AGM on Saturday, 26 May. The meeting is being hosted by the Parramatta - Hills Group at: Gumnut Community Centre, Gumnut Place, Cherrybrook, NSW. **Full details page 3.**

APS Northern Beaches 10am Sunday May 20 visit **Russell's Patch**, a reserve overlooking the ocean at Curl Curl being regenerated by Russell & friends. Followed by morning tea at **Jan and Russel's home garden**. Penny will email details.

From the Editor
Thankyou David for the Botanica report and Conny for the fungi pic. Please send me articles or photographs that you think the members would enjoy. Jane. email: march@ozemail.com.au

ART IN THE BOTANIC GARDEN 2018
David Drage

Six members of the group, plus one friend, made the Group's annual pilgrimage to the Royal Botanic Gardens in Sydney to see the work of some very talented artists. It was particularly pleasing that Estelle was well enough to join us.

Catleya Goldenzel by Annie Hughes

We started at Botanica where the theme this year was 'Symbiosis'. This meant that there were plenty of insects including bees and ants, spiders and birds included in the paintings along with the plants. As usual, the quality of the work was very high. We then took a break to have some lunch in the courtyard outside the exhibition venue, Lion Gate Lodge.

Life Cycles by Pauline Dewar

Imperfect Leaves by Anna Voytsekhovich

Next stop was the 'Margaret Flockton Award' on show in the Maiden Theatre. This is a scientific botanical exhibition of work in black and white intended for inclusion in scientific publications where precision and accuracy are very important. The award attracts top illustrators from Australia and around the world, some still working with ink or graphite but increasingly with digital drawing techniques. Well worth seeing.

We finished up at the Calyx exhibition space to have a look at the 'Pollination' display with its tall, curved, green wall of plants with different coloured foliage spelling out the word 'Pollination'. This display is a credit to the horticultural staff at the gardens whose work is shown here.

'RIP VAN WINKLE' PLANTS HIDE UNDERGROUND FOR UP TO 20 YEARS

sciencedaily.com April 19, 2018 University of Sussex

An international team of academics has found that at least 114 plant species from 24 different plant families, from widespread locations and ecological communities around the world, are capable of prolonged dormancy as adult plants, remaining alive in the soil but not emerging from the ground every spring. This behaviour enables them not only to survive through difficult times, but to make the best of adversity.

The extraordinary behaviour is seen in many species of orchid, and is reminiscent of the fictional character Rip Van Winkle, who sleeps for 20 years and misses the American Revolution. It also occurs in many other types of plant.

In an article published in Ecology Letters, scientists reveal that dormancy is often a "bet hedging" strategy for the plants, with the short-term disadvantages of missing growth and reproduction in one or more seasons being outweighed by the longer-term benefits of avoiding immediate risks and thereby extending their lives.

A lady's slipper orchid (*Cypripedium calceolus*) photographed in Estonia. Credit: Richard Shefferson

In an article published in Ecology Letters, scientists reveal that dormancy is often a "bet hedging" strategy for the plants, with the short-term disadvantages of missing growth and reproduction in one or more seasons being outweighed by the longer-term benefits of avoiding immediate risks and thereby extending their lives.

Dormancy occurs only in some of the plants in any population or species in any given year, and is dependent on individual circumstances. Co-author Prof Michael Hutchings, Emeritus Professor in Ecology at the University of Sussex, said: "It would seem to be paradoxical that plants would evolve this behaviour because being underground means they cannot photosynthesise, flower or reproduce. And yet this study has shown that many plants in a large number of species frequently exhibit prolonged dormancy. Many of these species have found ways to overcome the loss of opportunities to photosynthesise during dormancy, especially by evolving mechanisms enabling them to obtain carbohydrates and nutrients from soil-based fungal associates. This allows them to survive and even thrive during dormant periods.

"The study has revealed some of the conditions under which dormancy is triggered, and the evolutionary benefits of such behaviour, but more work is still needed to fully explain the influences of factors such as weather conditions, and the threats from herbivores and competition from other vegetation, on the decision to go dormant."

Dormancy in seeds has been widely known about and studied for decades but the phenomenon of dormancy within plants that have left the seed stage behind and embarked upon adult life is far less well-known and understood.

The study, led by University of Tokyo associate professor Richard Shefferson, is the first detailed analysis of the causes, ecological functions and evolutionary significance of adult plant dormancy, using data from a large number of datasets and published studies in which the behaviour has been recorded.

Reasons for plants entering a period of dormancy differ both between species and even between populations of the same species in different geographical locations. They include the risk that buds and new shoots will be lost to herbivores, the occurrence of a poor growing season which prevents the build-up of sufficient resources to produce sprouts in the following year, and, in an increasingly warming world, winters that are so mild that plants do not perceive that spring has arrived.

Moreover, although the research team hypothesized that dormancy would be more prevalent at colder latitudes and higher altitudes, where the growing season is shorter, it was shown to be more common near the equator, where threats from factors such as disease, competition, herbivores and fire are more severe.

Co-author Dr Eric Menges of Archbold Biological Station in Florida, USA, said: "In fire-prone areas, there appears to be an advantage to plants remaining dormant and then sprouting after fire when favourable conditions exist for growth and flowering."

Prof Hutchings added: "Phylogenetic analyses also revealed that dormancy has evolved and persisted numerous times throughout the evolutionary history of the land plants. This suggests not only that it has proved beneficial under many different ecological circumstances, but also that its evolution may be achievable through the occurrence of a small number of mutations at only a few genetic loci."

APS NSW
ANNUAL GENERAL MEETING AND QUARTERLY GATHERING Saturday, 26 May 2018

The next quarterly gathering will be held in conjunction with the AGM on Saturday, 26 May.

The AGM and meeting is being hosted by the Parramatta - Hills Group at: Gumnut Community Centre, Gumnut Place, Cherrybrook, NSW

The day's program.
10am - 12noon

Choice of a visit to Ian Cox's beautiful garden or a scenic and relaxing bush walk.

1. **Ian Cox's garden:** 5 Ivy Place Kenthurst (off Jones Road).
2. **Bush walk** with **Jennifer Farrer**: Meet at the end of Trevor Lane,Cherrybrook, which runs off Purchase Road. The walk leads to an extensive stone outcrop which overlooks Pye's Creek, where the large expanse of sandstone is a fun place to explore. The route passes through typical Hawkesbury sandstone vegetation which includes *Banksia serrata, Corymbia gummifera* and *Eucalyptus haemastoma*. More Banksias such as *spinulosa, oblongifolia* and *marginata* form the understorey. The main attraction of the walk in May, when there isn't much flowering, will be the scenic outlooks experienced along the walk.

1-3pm AGM and Gathering, Gumnut Community Centre, Cherrybrook

1-1.30pm Annual General Meeting.
The agenda is on page 31, Native Plants for NSW, January 2018 or on the Society's website at www.austplants.com.au

1.30- 3pm Talk: When is a Grevillea a Hakea?

Guest speaker is **Peter Olde**. Peter is a Life Member of APS NSW, recipient of the Australian Plants Award at the ANPSA Biennial Conference, Canberra 2015 and the leader of the Grevillea Study Group. He is an excellent and entertaining speaker who will discuss the current state of play regarding the relationships between the two genera. Peter will also discuss some of the new cultivars of Grevilleas and is always keen to share his knowledge of grevilleas with us.

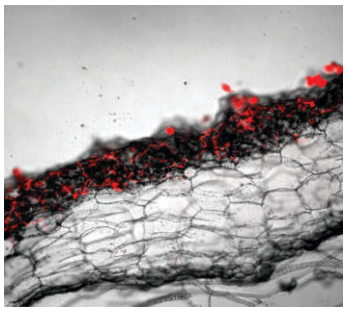
There will also be Australian native plants available for sale

FIRST LAND PLANTS WERE PARASITIZED BY MICROBES

Sciencedaily.com April 4, 2018 University of Cambridge

By studying liverworts -- which diverged from other land plants early in the history of plant evolution -- researchers from the Sainsbury Laboratory at the University of Cambridge have found that the relationship between plants and filamentous microbes not only dates back millions of years, but that modern plants have maintained this ancient mechanism to accommodate and respond to microbial invaders.

Published in the journal Proceedings of the National Academy of Sciences, a new study shows that aggressive filamentous microbial (fungi-like) pathogens can invade liverworts and that some elements of the liverwort's response are shared with distantly related plants.



Microscopy image of cross-section of a Marchantia polymorpha thallus showing the Phytophthora infection (red) in the upper photosynthetic layer of the liverwort plant. Credit: Philip Carella

The first author of the paper, Dr Philip Carella, said the research showed that liverworts could be infected by the common and devastating microorganism Phytophthora: "We know a great deal about microbial infections of modern flowering plants, but until now we haven't known how distantly related plant lineages dealt with an invasion by an aggressive microbe. To test this, we first wanted to see if Phytophthora could infect and complete its life cycle in a liverwort. We found that Phytophthora palmivora can colonise the photosynthetic tissues of the liverwort Marchantia polymorpha by invading living cells. Marchantia responds to this by deploying proteins around the invading Phytophthora hyphal structures. These proteins are similar to those that are produced in flowering plants such as tobacco, legumes or Arabidopsis in response to infections by both symbiont and pathogenic microbes."

These lineages share a common ancestor that lived over 400 million years ago, and fossils from this time period show evidence that plants were already forming beneficial relationships with filamentous microbes. Dr Carella added: "These findings raise interesting questions about how plants and microbes have interacted and evolved pathogenic and symbiotic relationships. Which mechanisms evolved early in a common ancestor before the plant groups diverged and which evolved independently?"

Dr Sebastian Schornack, who led the research team, says the study indicates that early land plants were already genetically equipped to respond to microbial infections: "This discovery reveals that certain response mechanisms were already in place very early on in plant evolution."

"Finding that pathogenic filamentous microbes can invade living liverwort cells and that liverworts respond using similar proteins as in flowering plants suggests that the relationship between filamentous pathogens and plants can be considered ancient. We will continue to study whether pathogens are exploiting mechanisms evolved to support symbionts and, hopefully, this will allow us to establish future crop plants that both benefit from symbionts whilst remaining more resistant to pathogens. "Liverworts are showing great promise as a model plant system and this discovery that they can be colonised by pathogens of flowering plants makes them a valuable model plant to continue research into plant-microbe interactions."

Liverworts (Marchantia)
Liverworts are small green plants that don't have roots, stems, leaves or flowers. They belong to a group of plants called Bryophytes, which also includes mosses and hornworts. Bryophytes diverged from other plant lineages early in the evolution of plants and are thought to be similar to some of the earliest diverging land plant lineages. Liverworts are found all over the world and are often seen growing as a weed in the cracks of paving or on the soil of potted plants. Marchantia polymorpha, which is also known as the common liverwort or umbrella liverwort, was used in this research.

Phytophthora
Phytophthora is a water mould. Although it looks like it, it is not a fungus at all. Instead it belongs to the oomycetes and is a type of filamentous microbe. Phytophthora pathogens are best known for devastating crops, such as causing the Irish potato famine through potato late blight disease as well as many tropical diseases. This research used the tropical species, Phytophthora palmivora, which causes diseases in cocoa, oil palms, coconut palms and rubber trees.

PLANTS REALLY DO FEED THEIR FRIENDS

Science News March 22, 2018 Lawrence Berkeley National Laboratory

Rhizosphere soil for microbial isolations was collected from the Little Buck watershed at the University of California Hopland Research and Extension Center in an area in which Avena barbata are the dominant vegetation. Credit: Heejung Cho

Researchers at the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) and UC Berkeley have discovered that as plants develop they craft their root microbiome, favoring microbes that consume very specific metabolites. Their study could help scientists identify ways to enhance the soil microbiome for improved carbon storage and plant productivity.

"For more than a century, it's been known that plants influence the makeup of their soil microbiome, in part through the release of metabolites into the soil surrounding their roots," said Berkeley Lab postdoctoral researcher Kateryna Zhalnina, the study's lead author. "Until now, however, it was not understood whether the contents of this cocktail released by plants was matched by the feeding preferences of soil microbes in a way that would allow plants to guide the development of their external microbiome."

The study, "Dynamic root exudate chemistry and microbial substrate preferences drive patterns in rhizosphere microbial community assembly," has just been published in the journal Nature Microbiology. The corresponding authors were Berkeley Lab scientists Trent Northen and Eoin Brodie.

Microbes within soil improve the ability of plants to absorb nutrients and resist drought, disease, and pests. They mediate soil carbon conversion, affecting the amount of carbon stored in soil or released into the atmosphere as carbon dioxide. The relevance of these functions to agriculture and climate are being observed like never before.

Just one gram of soil contains tens of thousands of microbial species. Scientists have long known that plants impact the composition of the soil microbiome in the area surrounding their roots by sending out chemicals (metabolites). Prior work by Mary Firestone, Berkeley Lab faculty scientist and a professor of microbiology at UC Berkeley, had shown that plants were consistently selecting or suppressing the same types of microbes over time in the root zone, suggesting some form of synchronization between plant and microbiome development.

Yet, little research had gone into the relationship between specific metabolites that plants release and the microbes consuming them. The new study brought together experts in soil science, microbial and plant genomics, and metabolomics to explore these potential metabolic connections. Their study took a close look at the rhizosphere of an annual grass (Avena barbata) common in California and other Mediterranean ecosystems.

The Berkeley Lab team felt the time was ripe for doing so. As pressure mounts for farmers to grow enough healthy crops to meet a burgeoning population's needs, and for new land management strategies that improve soil carbon storage to reduce atmospheric CO2 and produce healthy soils, the soil microbiome is the subject of more in-depth scientific research than ever before.

The researchers set out to determine the relationship between microbes that consistently bloomed near the grass roots and the metabolites released by the plant. Their first step was to collect soil from the University of California's Hopland Research and Extension Center in northern California. Brodie, deputy director of Berkeley Lab's Climate and Ecosystem Sciences Division, and his group used what they knew about the lifestyles of these soil bacteria to develop specialized microbial growth media to cultivate hundreds of different bacterial species. They then selected a subset that either flourished or declined as roots grew through the soil.

This collection of microbes was then sent to the Joint Genome Institute (JGI), a DOE Office of Science User Facility, where their genomes were sequenced to provide clues as to why their responses to roots differed. This analysis suggested that the key to success for microbes that thrived in the rhizosphere was their diet.

Northen, senior scientist in Berkeley Lab's Environmental Genomics and System Biology Division, is fascinated by the chemistry of microbiomes, and his group has developed advanced mass spectrometry-based exometabolomic approaches to elucidate metabolic interactions between organisms. Zhalnina and Northen combined their expertise to identify what the more successful microbes surrounding the roots of the Avena grasses preferred to eat.

Using a hydroponic setup at the JGI, they immersed plants at different developmental stages in water to stimulate them to exude their metabolites, then measured the metabolites being released by the plants using mass spectrometry. Subsequently, the cultivated soil microbes were fed a cocktail of root metabolites, and the researchers used mass spectrometry to determine which microbes preferred which metabolites.

They found that the microbes that flourished in the area around plant roots preferred a diet more rich in organic acids than the less successful microbes in the community. "Early in its growth cycle, the plant is putting out a lot of sugars, 'candy', which we find many of the microbes like," Northen said. "As the plant matures, it releases a more diverse mixture of metabolites, including phenolic acids. What we discovered is that the microbes that become more abundant in the rhizosphere are those that can use these aromatic metabolites."

Brodie describes these phenolic acids as very specific compounds released by plants throughout their development. Phenolic acids are often associated with plant defenses or plant-microbe communication. This indicates to Brodie that as they establish the microbial community within the rhizosphere, plants could be exuding metabolites like phenolic acids to help them control the types of microbes thriving around their roots.

"We've thought for a long time that plants are establishing the rhizosphere best suited to their growth and development," said Brodie. "Because there are so many different types of microbes in soil, if the plants release just any chemical it could be detrimental to their health. "By controlling the types of microbes that thrive around their roots, plants could be trying to protect themselves from less friendly pathogens while promoting other microbes that stimulate nutrient supply."

Zhalnina, Firestone, Northen, and Brodie believe their findings have great potential to influence additional scientific and applied research. Zhalnina points out that a lot of research and development is currently underway by government and industry to harness the power of microbes that improve plant yield and quality of soil to help meet society's growing demands for a sustainable food supply.

She said, "It's exciting that we can potentially use the plant's own chemistry to help nourish beneficial microbes within soil. Population growth, especially, has created a demand for identifying more reliable ways to manipulate the soil microbiome for beneficial outcome."

ANCIENT ABORIGINAL PATCH BURNING HELPING UNDERSTAND FIRE IMPACT ON TASMANIAN LANDSCAPE

abc.net.au April 18, 2018 Damian McIntyre

Photo: Researchers are studying what happens to biodiversity after bushfires. (ABC News: Carla Howarth)

Tasmania's Aboriginal community is working with a Midlands farmer on a research project using ancient fire methods as an alternative to modern fuel reduction burns. It is part of a University of Tasmania research project exploring different ways of preventing major bushfires and looking after plants and animals. The Aboriginal community is conducting what is known as patch burning at Beaufront, a privately-owned farm near Ross.

Andry Sculthorpe from the Tasmanian Aboriginal Centre said the project was important for building fire knowledge and skill. "But also coming out to this important cultural landscape to experience the riches that it has," he said. "This landscape has evolved with fire and it's evolved with people in it, but it's working out what is the right type of fire, what is the right intensity, the right frequency to actually make sure the landscape increases in its health."

Landowner Julian von Bibra said it is an important project. "[It's] very important for us to reduce that fuel load, open up these grasslands that are now becoming rank and there's a lot of shading taking place, so we'll get greater biodiversity by opening it up," he said. "We're presented with a huge fuel load and this was an opportunity to reduce that fuel load and at the same time engage with the Aboriginal community which historically would have conducted these burns and they shaped the landscape in the first place."

He said the Aboriginal involvement has been pivotal. "They don't have a presence in this landscape the way they used to and for us it was an important aspect to re-engage with the Aboriginal community and open up communication."

Scientists are exploring the impacts of landscape fire on native animals like pademelons, wallabies and kangaroos and non-native animals, such as sheep, deer and rabbits and how it impacts on biodiversity.

Professor David Bowman from the University of Tasmania said the results would be valuable. "We're designing the experiment with baseline data so we can actually understand the impact of the fire so we know what was there before and then we've got camera traps to look at the animals that are being attracted to the burning," Professor Bowman said. "We've got plots where we are looking at the biodiversity that comes up after the fires. "The point of the experiment is we're going to be able to design a best practice for managing the fuels and maintaining the biodiversity."

For the experiment patches of multiple sizes are burnt, with researchers monitoring herbivore feeding patterns before and after. They will also study the effects of fire and grazing on vegetation. "We're trying to understand the relative effect of all of those animals on the regrowth that will come up after the fire and particularly the tree regeneration," Professor Bowman said.

GOLDEN ORBS SPINNING KEY TO NEW SYNTHETICS

australiascience.tv April 3, 2018 Genevieve Kerr

The common Australian golden orb spider may be spinning the key to new super-tough synthetic materials and surgical products, USC researchers have found.

Honours researcher Genevieve Kerr tested the silk of garden variety golden orb spiders and that of their much larger cousins found in Australian rainforests, and believes what she found could transform the future of synthetic materials.

“The Australian golden orb's silk could be used as a baseline for creating synthetic products possibly up to 100 times tougher than those used today,” Mrs Kerr said.

“Synthetics based on spider silk could be far tougher than what surgeons use at the moment for ligament reconstruction, skin grafts and sutures, all of which have limited lifespans,” she said.

“Spider silk also has biocompatible properties so, in theory, your body won't reject it.”

Her research paper can be found at bio.biologists.org/content/7/2/bio029249.

Mrs Kerr and a small team used a stress-testing machine to test the tensile strength of the spider's silks, measuring the force required to break it.

“We found that golden orb spiders produce particularly tough silk and the larger spiders from the rainforest, which can grow up to 20cm in diameter, produce the strongest yet thinnest silks,” she said.

“The natural product is just amazing, but spiders can't be farmed like a silk worm because the spiders just eat each other.”

Mrs Kerr said her study showed that it would be worthwhile to investigate the molecular structure of the silk with the goal of replicating it artificially.

Her supervisor Associate Professor Joanne Macdonald said the research was borne out of a theory that the Australian golden orb could potentially weave one of the toughest silks in the world.

“There has been a lot of research on silks overseas, but not a lot on Australian spiders,” Associate Professor Macdonald said.

“Folklore around the rainforest golden orb's web suggested the silk was particularly tough. It's also one of the largest golden orb spiders worldwide. We chose to study it because we thought maybe it would need particularly tough silk to support its weight and to capture enough prey to maintain its size.

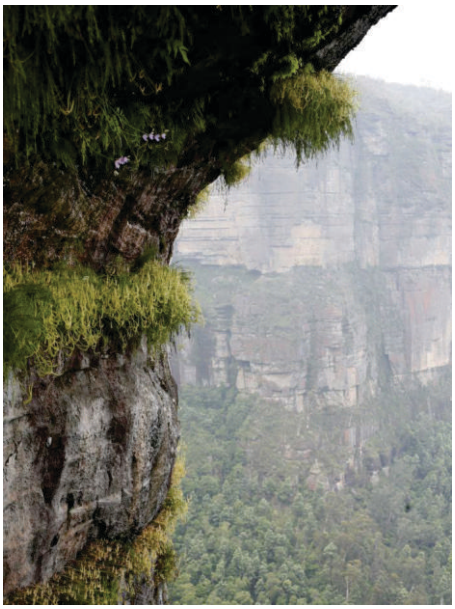
“Spider silk has so much potential. This could include fishing nets, lightweight clothing and strong thread, if you can get enough of it.”

FLORA FATALE: THE CARNIVOROUS PLANT THAT SCARED CHARLES DARWIN

ABC Science April 1, 2018 Ann Jones for Off Track

Who do you barrack for: the hunter or the prey? The leopard or the gazelle? The frog or the snake? The fly or the flytrap? Enter the glittering and sensual world of plants with a thirst for blood.

Homicidal greenery



This hanging swamp is home to thousands of carnivorous plants. (Greg Bourke)

The hanging swamps of the Blue Mountains waterfalls plunge off cliffs so high, with winds so gusty, that the water rarely hits the ground. Lining the rock face is the most impressive display of carnivorous Drosera binata in the world.

At any given moment there are hundreds of thousands, or more, insects drowning on this cliff face. They are being consumed alive in their very own hellish little shop of horrors by this waving ocean of Drosera binata.

Bright, sparkling, green lines streak across the precipice, formed from thousands of the Drosera's V-shaped leaves. Each is covered in filaments that glint in the sunlight. It is not a leopard stalking a crocodile, pouncing, rolling, biting and overcoming its prey. But it is just as dramatic.It is a cliff-face of plants with a thirst for blood.

The glistening, sticky droplets are what gives these plants the common name 'sun dews'. (Ann Jones)

Murderous plants

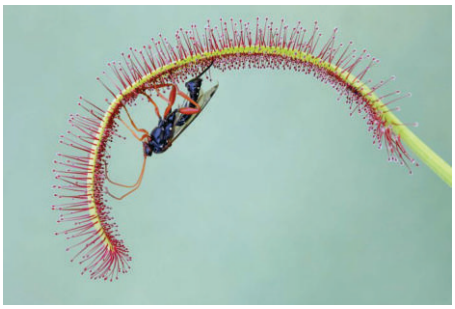
When Greg Bourke finished school, he went off to become an electrician. He spent years working that trade, rising up the ranks through telecommunications and travelling much of the continent. But plants were always his thing. Even when he was working on installations at remote sites, he would find time to wander the surrounding tracks, closely examining the ground for minuscule herbaceous plants.

Greg Bourke is one of a small group of intrepid explorers who study the world's carnivorous plants. (Ann Jones)

"Bushwalking with my parents at four, five years old near my home in the Sutherland Shire I'd see sundews in the wild, and I used to go back to these little red glistening sundews on the forest floor, every time, and think these things are amazing," Mr Bourke said.

"The bigger, more vicious, carnivorous plants, the pitcher plants of Borneo, the North American pitcher plants, the real killers of the jungle — that really captured my imagination. "I've grown vegetables and flowers and bonsai — all these other things — but carnivorous plants were just something else."

His love for these killer plants convinced him to hang up his electrician's toolbelt — he is now curator of the Blue Mountains Botanic Gardens at Mt Tomah just west of Sydney.



The more the insect prey struggles, the more trapped it becomes. (Greg Bourke)

He is also one of the authors behind an encyclopaedic book series called *Drosera of the World*, listing the knowledge to date of the broad family of plants commonly called sundews.

"Carnivorous plants cover close to 97 per cent of the continent," Mr Bourke said. "We've got the most diverse range of carnivorous plants on the planet - close to 240 species." We have so many sundews in Australia because the fertility of our soil has been leached out over millions of years. To get around the lack of fertiliser, these plants have developed a survival system: they murder insects and compost their bodies.

Glittering killer

These W A Drosera purpurescens put on a show with their hot-pink clusters. (Greg Bourke)

Though they vary wildly in shape, Drosera leaves can often look like undersea creatures, with tiny stalks coming off the main surface,

protruding into the atmosphere. These matchstick shapes can be all different colours and lengths, even on the same plant, like meaty tentacles on an anemone.

The common name "sundew" for Drosera is derived from the effect of sunlight refracting through the glistening droplets of digestive enzymes on the plant's tentacles, Mr Bourke says. "They have this fantastic sticky substance on them that captures a prey item when it touches the plant," he said.

As the insect struggles and flails to try to free itself, it inadvertently makes contact with other glands and becomes increasingly incapacitated. On top of that, many sundews can move to embrace their prey in a moist grip of deathly goo.

In fact, their lethal speed can be faster than a cheetah at full gallop. One Australian species might just be the fastest moving plant in the world.

"Drosera glanduligera, moves so rapidly it's faster than the eye can see. It's a couple of hundredths of a second," Mr Bourke said. "And an ant or prey will walk on that gland and the gland will actually flick that prey item into the centre of the leaf. There is no escape."

Death by drowning

A moth falls victim to Drosera's sticky tendrils. (ABC: Ann Jones)

"The insect will often be overcome by the quantity of mucilage that is smothering it, and it will actually drown," Mr Bourke said. "Or they become so exhausted from trying to escape that the plant just overwhelms them, and pretty much digests them alive. "It is a slow and painful death."

The next step is digestion. Using a technique that resembles an arachnid rather than a mammal, the plant exudes enzymes onto the wretched prey, liquefying the insect within its own exoskeleton.

It is this aggressive composting strategy that gives the sundews an advantage over other plants in their environment: they find - no, slaughter or harvest - nutrients to grow in an environment where plants would otherwise fail from malnourishment. "They're out-competing the opposition," Mr Bourke said. "They're pioneers. We're seeing, I guess you could call it rapid evolution of these plants.

Carnivorous plants are found across more than 90 per cent of the Australian landmass. (Greg Bourke)

"They're constantly moving and changing. If there's a disturbed area, the carnivorous plants are often the first ones to move in. Because they can get in, get their nutrients and get a foothold.

"There is a group called ... Indian sundews from central and northern Australia that've done away with the ability to bring nutrients from the soil itself. They can't actually feed off the soil and bring that nitrogen that they need up to the plant. They have to feed off animal prey to get that nutrient."

But their uncompromising compost strategy remained secret until 1875.

The plant that frightened Darwin

It was an astounded Charles Darwin who scientifically confirmed that plants could capture and digest prey, after years drawing them, studying them and becoming immersed in their intricate biology.

He wrote in 1860: "I care more about Drosera than the origin of all the species."

In the same letter, he noted: "I am frightened and astounded at my results ... Is it not curious that a plant should be far more sensitive to a touch than any nerve in the human body!"

Mr Bourke says: "Of course, at the time it was blasphemous to suggest that a plant could've turned the tides and be eating animal prey, but Charles Darwin was fascinated by this plant. I think it took quite some time for Charles Darwin to release the information for fear of being locked up for being insane.

Darwin delayed the publication of his thesis on insectivorous plants for another 15 years.

Drosera aquatica feeds on insects that hatch in the waters where it grows.(Greg Bourke)

"We still just know so little about these plants," said Mr Bourke, who is one of a small band of intrepid and very dedicated plant biologists and enthusiasts who are slowly discovering more carnivorous plants in Australia and the world.

One of their recent finds is an incredible floating plant that lives in Northern Australia.

"The plants just simply float and they capture their prey on the surface of the water," Mr Bourke said. "They're getting the first insects that are coming out of that water that are hatching and flying away. It looks like a miniature pine tree, this glistening little puff of plant on the water's surface."

And just like Darwin before him, Mr Bourke will take risks for his beloved Drosera. "I've been known to venture into a few croc-infested swamps. But when you're passionate about these plants, you weigh up the risks and say, 'Well, we'll give it a shot'."

The complex killer

Carnivorous plants are not just one-faceted heinous herbs; they actually have complicated relationships with insects that extend well beyond the killer and the quarry. They rely on insects for sexual reproduction and set flowers to attract would-be pollinators.

Of course, it would be unwise to bite the proboscis that pollinates you, so

Though they eat some insects, sundews rely on others to pollinate their flowers.(G. Bourke)

the flowers often grow on long stalks, well away from the lethal leaves.

Fittingly enough for a carnivorous plant, they also enter into symbiotic relationships with assassin bugs. "Some species of insects are actually employed by the plant to help with the digestion," Mr Bourke said. "These guys are able to walk around on the leaf's surface without getting captured," he said, pointing to a bug that weaves through a miniature plantation of glands. They feed on the prey of the sundew. It comes across and actually sucks the juices from the prey and then deposits it's droppings directly onto the leaf of the sundews. It's like a little package of fertiliser. "Pure symbiosis — that's as interesting as the plants themselves."

The Linx spider links the sticky leaves and stems of Goodenia grandiflora with a basic web to allow it to sense prey that is trapped by the plant. (Greg Bourke)

As more and more plants are being studied, more and more intricate symbiotic relationships are also being uncovered, including a plant in the family Goodeniaceae, which is predominantly an Australian group.

"Spiders live on the plants and they hide in between the leaves and they wait for insects to be caught by the plant," Mr Bourke said. The spider unfurls a tension wire between the leaves of the plant, then waits for vibrations of stricken prey. "The leaves are effectively an extension of the web. The spider doesn't need to produce this big, beautiful orb that most spiders do," he said.

Insects trapped in the sticky goo of a Drosera plant. (ABC: Ann Jones)

While they do not stalk their victims, sundews grow in places that prey will traverse or be blown through on winds. They can even employ sneaky tactics, with recently published research indicating that sundews can be kleptoparasitic, stealing the pollinating insects right from adjacent plants' flowers.

Not the ideal neighbour then.

Fatal flora

Everywhere you look in Australian bushland, a cycle of death, dying and digestion is going on. Crawling along on hands and knees, Mr Bourke can see things the average human just glances across.

"That's a Utricularia - it has these tiny little bladder-like traps, suction traps that are in the substrate. It's feeding on nematodes and mosquito larvae that are in the soil surface. It sucks them into the traps and then slowly digests them," he said.

He brushes a finger delicately on a plant.

You can't feel it digesting you, no. It feels a bit like snot. But beautiful snot.
"You can see on this leaf, maybe a dozen prey items. There's a mosquito, a couple of small flies. And you can see the different stages at which they're digesting those insects."

The leaf looks like it has a collection of dryer lint sneezed along its length.
"The remains of a crane fly there. It's like a meditation for me, I just love being out in nature. That's where I'm truly relaxed," he said. "Every plant has a story to tell. With the sundews, when they're feeding like this, it's almost like every leaf has a story to tell.

"So, if we lose the carnivorous plants, its a bit like the frogs — if we lose the frogs we lose the habitat, and the carnivorous plants are great indicators for habitat health. "If we lose the carnivorous plants, we'll lose the stories that they tell.

"But life on the edge is tough."

"We still just know so little about these plants," but Greg Bourke is working to find out more. (ABC: Ann Jones)

FUNGI FINDING

Conny found this exceptional fungi in Belrose. Phallus rubicundus is one of the stinkhorn family.

Phallus rubicundus. Pic Conny Harris.