CALEYI

Australian Plants SOCIETY NSW


pic Andre Porteners

NORTHERN BEACHES GROUP

austplants.com.au/northern-beaches **July 2019**

Australian Plants Society Northern Beaches
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CALENDAR
APS Northern Beaches meeting Thursday July 4, 2019 at Stony Range Botanic Garden, Dee Why.
7.00 pm Committee Meeting
7.30 pm Plant family. Epacridaceae - **Harry Loots**.
7.45 pm Presentation: Trevor Wilson, Royal Botanic Garden Sydney**:** "Building species up, or knocking them down? Population genetics and its relevance to rare and threatened species"
Supper: Georgine & Jane

APS Northern Beaches Walk 10.30 am Sunday July 21, 2019. The **Chiltern North Road** walk was rained out in June so now rescheduled. An email will be sent closer to the date to ascertain attendance and numbers for lunch booking.

APS NSW Get-Together Newcastle Sat 17 & Sun 18 August, 2019 (See p. 3)

2019 ANPSA 'Blooming Biodiversity' Sunday 29 Sept. to Friday 4 Oct. 2019 **Albany, WA.**

APS NSW Quarterly Saturday November 16 hosted by **APS Northern Beaches Group** at Warriewood.

As usual we seek contributions of any articles or photographs that you think will interest our members.
Editor march@ozemail.com.au

APS NORTHERN BEACHES JUNE MEETING

Russell Beardmore

Presentation by Estelle on family Campanulaceae


Whalenbergia pic APS Sutherland

This family is represented in the Sydney area by species of Wahlenbergia. Estelle showed samples of one species, probably W. gracilis, with very small flowers. Another well known species is W. stricta with relatively large blue flowers.
It was also noted that the family Lobeliaceae has now been incorporated into Campanulaceae. Lobelia alata is a common plant, occurring on coastal headlands and estuaries.

Talk by Catriona Wagg

For a number of years, the Northern Beaches Council has operated a propagation nursery in the Council depot at Manly Dam. Two months ago, a second nursery was opened on the site of the Senior Citizens Centre at North Curl Curl. Catriona is employed by Council to supervise the work of volunteers in both nurseries.


pic:David Drage

The function of the nurseries is to supply native plants for "clients" - mainly Council officers in various departments who use the plants in parks and garden, coastal dunes, stream bank regeneration etc. Bush care groups are also "clients".

Cuttings and seeds for propagation are collected from locations throughout the Northern Beaches, usually locations where the established plants will be used. This way, the "provenance" of the plants is maintained. For example, collections from Long Reef will eventually be planted out in that area.

The output from the nurseries has grown over the years in keeping with increasing demand for the use of native plants to enhance the natural environment. Last year the Manly Dam nursery produced nearly 20,000 plants. The new nursery at North Curl Curl is away to a good start. The focus here will be on plants suitable to coastal environments.

MATHEMATICS OF PLANT LEAVES

sciencedaily.com/ June 6, 2019 University of Tokyo

A Japanese plant species with a peculiar leaf pattern recently revealed unexpected insight into how almost all plants control their leaf arrangement.

Leaves can be enjoyed for their shade, autumn colors, or taste, and the arrangement of leaves on a plant is a practical way to identify a species. However, the details of how plants control their leaf arrangement have remained a persistent mystery in botany. A Japanese plant species with a peculiar leaf pattern recently revealed unexpected insight into how almost all plants control their leaf arrangement.

"We developed the new model to explain one peculiar leaf arrangement pattern. But in fact, it more accurately reflects not only the nature of one specific plant, but the range of diversity of almost all leaf arrangement patterns observed in nature," said Associate Professor Munetaka Sugiyama from the University of Tokyo's Koishikawa Botanical Garden.

All in the angles

To identify the leaf arrangement of a plant species, botanists measure the angle between leaves, moving up the stem from oldest to youngest leaf.

Common patterns are symmetrical and have leaves arranged at regular intervals of 90 degrees (basil or mint), 180 degrees (stem grasses, like bamboo), or in Fibonacci golden angle spirals (like the needles on some spherical cacti, or the succulent spiral aloe).

The peculiar pattern that Sugiyama's research team studied is called "orixate" after the species Orixa japonica, a shrub native to Japan, China, and the Korean peninsula. O. Japonica is sometimes used as a hedge.

The angles between O. Japonica leaves are 180 degrees, 90 degrees, 180 degrees, 270 degrees, and then the next leaf resets the pattern to 180 degrees. "Our research has the potential to truly understand beautiful patterns in nature," said Sugiyama.

The math of a plant

Sugiyama's research team began their investigation by doing exhaustive testing of the existing mathematical equation used to model leaf arrangement.

Leaf arrangement has been modeled mathematically since 1996 using an equation known as the DC2 (Douady and Couder 2). The equation can generate many, but not all, leaf arrangement patterns observed in nature by changing the value of different variables of plant physiology, such as the relationships between different plant organs or strength of chemical signals within the plant.

The DC2 has two shortcomings that researchers wanted to address:

No matter what values are put into the DC2 equation, certain uncommon leaf arrangement patterns are never calculated.

The Fibonacci spiral leaf arrangement pattern is by far the most common spiral pattern observed in nature, but is only modestly more common than other spiral patterns calculated by the DC2 equation.

A peculiar pattern

At least four unrelated plant species possess the unusual orixate leaf arrangement pattern. Researchers suspected that it must be possible to create the orixate pattern using the fundamental genetic and cellular machinery shared by all plants because the alternative possibility -- that the same, very unusual leaf arrangement pattern evolved four or more separate times -- seemed too unlikely.

One fundamental assumption used in the DC2 equation is that leaves emit a constant signal to inhibit the growth of other leaves nearby and that the signal gets weaker at longer distances. Researchers suspect that the signal is likely related to the plant hormone auxin, but the exact physiology remains unknown.

Rare patterns and common rules

"We changed this one fundamental assumption -- inhibitory power is not constant, but in fact changes with age. We tested both increasing and decreasing inhibitory power with greater age and saw that the peculiar orixate pattern was calculated when older leaves had a stronger inhibitory effect," said Sugiyama.

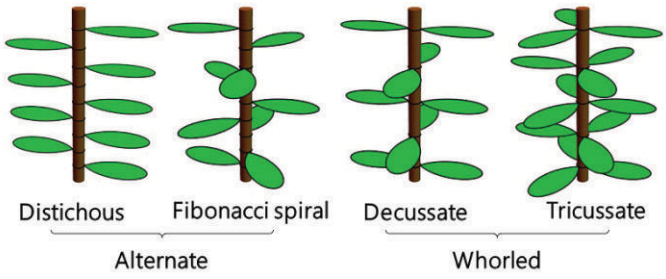
This insight into the inhibitory signal power changing with age may be used to direct future studies of the genetics or physiology of plant development.

Researchers call this new version of the equation the EDC2 (Expanded Douady and Couder 2).

First author of the research paper, doctoral student Takaaki Yonekura, designed computer simulations to generate thousands of leaf arrangement patterns calculated by EDC2 and to count how often the same patterns were generated. Patterns that are more commonly observed in nature were more frequently calculated by the EDC2, further supporting the accuracy of the ideas used to create the formula.

"There are other very unusual leaf arrangement patterns that are still not explained by our new formula. We are now trying to design a new concept that can explain all known patterns of leaf arrangement, not just almost all patterns," said Sugiyama.

Do it yourself -- ID the pattern



Experts recommend looking at a group of relatively new leaves when identifying a plant's leaf arrangement, or phyllotaxis, pattern. (In Greek, phyllon means leaf.) Older leaves may have turned (due to wind or sun exposure), which can make it difficult to identify their true angle of attachment to the stem.

Think of the stem as a circle and begin by carefully observing where on the circle the oldest and second-oldest leaves are attached. The angle between those two leaves is the first "angle of divergence." Continue identifying the angles of divergence between increasingly younger leaves on the stem. The pattern of angles of divergence is the leaf arrangement pattern.

Common leaf arrangement patterns are distichous (regular 180 degrees, bamboo), Fibonacci spiral (regular 137.5 degrees, the succulent Graptopetalum paraguayense), decussate (regular 90 degrees, the herb basil), and tricussate (regular 60 degrees, Nerium oleander sometimes known as dogbane).

APS NSW GET-TOGETHER IN THE NEWCASTLE AREA 17 TO 18 AUGUST 2019

Saturday morning – Hunter Region Botanic Gardens
We'll start at the award-winning Hunter Region Botanic Gardens (https://huntergardens.org.au). The Newcastle Group has been involved with the Gardens since its creation in 1986. The Gardens covers 133 hectares of Eucalypt forest on the deep sands of the Tomago sandbeds. There are many themed gardens amongst the forest that show our flora, both local to the Hunter Valley and the rest of Australia.

The morning features a talk by Dr Stephen Bell on the "Endemic Flora of the Hunter Region", before guided walks around the Gardens.

Enjoy morning tea and a catered lunch at the Gardens.

Saturday afternoon – Walks in Port Stephens area
We'll head towards the Port Stephens area for walks, guided by our local members. These will feature a range of different plant communities and the coastal flora as well as some spectacular coastal scenery.

Saturday evening – Dinner at Mayfield
From 6 pm, meet at Wests in Mayfield for dinner (at own expense). There is a good range of food choices to cater for a range of tastes. https://www.westsnewcastle.com.au/casual-eats/the-bistro

Sunday morning – Two walks: Glenrock Scout Camp and Awabakal Reserve
There are two walks, with time to do both.
1. Visit the Glenrock Scout Camp to see the garden of John Le Messurier, the 2018 ABC Gardener of the year.
(https://www.theherald.com.au/story/5824155/glenrock-lagoon-pioneer-named-australias-best-gardener/)
2. Walk out to the bluff at the Awabakal Nature Reserve, the destination for the annual "Awabakal Wildflower Walk". We will be visiting at the spring peak for wildflowers.

Sunday afternoon – Hunter Wetlands Centre
Enjoy a catered lunch at the Hunter Wetlands Centre, the home base for APS Newcastle Group (https://wetlands.org.au), followed by guided walks around the wetlands and a visit to the Newcastle Group's nursery for an opportunity to buy plants from the wide range of native plants produced by the "Thursday Mob.

Please register and pay by 2nd August 2019
Registration for the weekend is $40 and includes lunch and morning tea on both Saturday and Sunday.

Please fill out and return the attached form with payment (either by bank transfer or cheque) https://aps.wildapricot.org/EmailTracker/LinkTracker.ashx?linkAndRecipientCode=E1oQ8BISx5NydpGDKALWHQb95x8TVbJB1xYSLi3%2ffAF57jCyX9GFPONsGCbTYkwnRGs82R1N2DHDCRwU6740riNryKMwMIRVEZvR7fc6Zb8%3d and email or post with payment.

Accomodation
Newcastle and the surrounds are well served by a variety of hotels and motels. There are a number of motels centrally located in the Mayfield area – both along Maitland Road (Pacific Highway and there is also the Gateway Inn next to the Saturday evening dinner venue (West at Mayfield).

SATURDAY 16 NOVEMBER – APS NSW QUARTERLY GATHERING

Keep the date free. Northern Beaches Group will be hosting our final gathering of the year at Warriewood.

BUG-EATING PITCHER PLANTS FOUND TO CONSUME YOUNG SALAMANDERS, TOO

Sciencedaily.com June 7, 2019 University of Guelph

Pitcher plants growing in wetlands across Canada have long been known to eat creatures -- mostly insects and spiders -- that fall into their bell-shaped leaves and decompose in rainwater collected there. But researchers have discovered that vertebrates -- specifically, salamanders -- are also part of their diet.

Pitcher plants (stock image).Credit: © maljalen / Adobe Stock

Call it the "Little Bog of Horrors." In what is believed to be a first for North America, biologists at the University of Guelph have discovered that meat-eating pitcher plants in Ontario's Algonquin Park wetlands consume not just bugs but also young salamanders.

In a paper published this week in the journal Ecology, the research team reports what integrative biologist Alex Smith calls the "unexpected and fascinating case of plants eating vertebrates in our backyard, in Algonquin Park."

Pitcher plants growing in wetlands across Canada have long been known to eat creatures -- mostly insects and spiders -- that fall into their bell-shaped leaves and decompose in rainwater collected there.But until now, no one had reported this salamander species caught by a pitcher plant in North America, including Canada's oldest provincial park, a popular destination where the plants have been observed for hundreds of years.

Noting how long the park has held its secret -- despite generations of visiting naturalists, its proximity to major cities and a highway running through its southern end -- Smith said, "Algonquin Park is so important to so many people in Canada. Yet within the Highway 60 corridor, we've just had a first."

In summer 2017, then undergraduate student Teskey Baldwin found a salamander trapped inside a pitcher plant during a U of G field ecology course in the provincial park. He's a co-author on the new paper along with other researchers at U of G and the University of Toronto.

Monitoring pitcher plants around a single pond in the park in fall 2018, the team found almost one in five contained the juvenile amphibians, each about as long as a human finger. Several plants contained more than one captured salamander.

Those observations coincided with "pulses" of young salamanders crawling onto land after changing from their larval state in the pond. Smith said these bog ponds lack fish, making salamanders a key predator and prey species in food webs.

He said some of the animals may have fallen into the plants, perhaps attracted by insect prey. Others may have entered the plants to escape predators.

Some trapped salamanders died within three days, while others lived for up to 19 days.

Prey caught inside the plant's specialized leaves is broken down by plant digestive enzymes and other organisms in the water held inside the leaf. Smith said other factors may kill salamanders in pitcher plants, including heat, starvation or infection by pathogens.

He said pitcher plants may have become carnivorous to gain nutrients, especially nitrogen, that are lacking in nutrient-poor bog soil.

Other flesh-eating plants grow in nutrient-poor environments around the world. They include sundews, which use their sticky leaves to catch insects, and the Venus flytrap, whose carnivory partly inspired the Seymour plant in the sci-fi musical Little Shop of Horrors.

Meat-eating pitcher plants have been known since the eighteenth century. One species discovered a decade ago in Asia consumes mostly insects and spiders but also captures small birds and mice.

Smith said the Algonquin Park discovery opens new questions for biologists. Are salamanders an important prey source for pitcher plants? Are the plants important "predators" of the amphibians? Might the salamanders compete with plants for insect prey -- and even "choke" the plant?

Tongue-in-cheek, he added that the find may also prompt park officials to rewrite interpretive materials. "I hope and imagine that one day the bog's interpretive pamphlet for the general public will say, 'Stay on the boardwalk and watch your children. Here be plants that eat vertebrates.'"

Mark Marathon via Wikipedia, CC BY-SA

THE MIGHTY MULGA GROWS DEEP AND LIVES LONG

The Conversation June 21, 2019 Gregory Moore, Doctor of Botany, University of Melbourne

Among the nearly 1,000 species of Australian acacias, there are few with a reputation for hardiness, resilience and endurance to match mulga. Once the higher rainfall of the coastal fringes of the continent diminishes, from west to east and south to north, the mulga prevails.

It grows over the vast expanse of about 20% of our continent and is often the dominant woody species of the grassland communities that are themselves known as the mulga. It is also an important shrub component of inland woodlands, such as those dominated by poplar box, Eucalyptus populnea.

Any species that covers 1.5 million km² of any landmass is clearly a vital part of its ecosystems.

The scientific name of mulga is Acacia aneura, which refers to the lack of a prominent mid-rib in their leaves (a means “no” and neura means “nerve”). Interestingly, like most Australian acacias, mulga lacks spines which their African relatives possess in abundance on their foliage, and they don’t actually have leaves.

The structures that appear to be leaves are actually flattened leaf stems called phyllodes. They function as leaves, but are very efficient in arid conditions. The narrow and rolled mulga leaves often have a sharp tip, so while they are not spiny they are still prickly.

Mulga plays an important ecological role in drier parts of Australia. It is a nitrogen-fixing species that enriches often impoverished soils, provides habitat for birds, insects, reptiles and mammals, and is important for honey production.

They drop many of their phyllodes during very dry spells, which not only reduces demand for water, but provides a vital mulch to their ecosystems during tough times. Acacia aneura is fire-sensitive, and changes to fire regimes can see it displaced by grass species. In parts of the outback, the species is not regenerating, and as the old specimens die the mulga is disappearing.

Frugal lifestyle

Mulga are brilliantly designed for coping with the arid Australian interior, as they do not get too big in places where resources are limited. In good conditions they are small trees that can grow taller than 10m, but in dry conditions they may be shrubs little more than 2-3m tall. They have a very deep root system that begins with a tap root 3m or more in length when the tree is only 20cm tall, and which exploits a large volume of soil for water.

This biology often leads to individual specimens being evenly spaced in the landscape as if they were positioned by design. The roots may be considerably longer than the tree is tall!

The little apertures on the phyllodes that regulate water loss and gaseous exchange (stomata) are located at the bottom of deep pits called stomatal crypts, which further slows water loss.

It is common for gardeners to think of acacia species as being short-lived, but with nearly 1,000 different species there is great variation in the age that various species can reach. While many shrubby species might only survive for a decade or two,

Acacia aneura can live for three centuries or more. It is hard to believe many of the scrubby little specimens only a metre or two high growing in the arid heart of Australia are such a venerable age.

Mulga can be very slow-growing, and its wood can be both strong and durable. It grows a light cream sapwood that surrounds a dark reddish-brown or black heartwood. The combination is ideal for wood carving, especially of ornaments, utensils, and of course prized souvenirs of a trip to the red centre. It is durable as indigenous weapons, digging sticks or modern fence posts, and its foliage can provide emergency fodder for stock during prolonged dry periods. Resin from the leaves is also used for sealing cracks and splits in cups and bowls.

Like many acacia species, the seeds of mulga are protein-rich and have made an excellent food source for many centuries, particularly in seed cakes. Boiling young leaves and twigs in water has been used for treating colds, and lerps – the sticky protective coverings of insects that grow on the leaves – provide a sugary treat.

Many of those who have never seen the outback of Australia imagine it to be a vast and barren red sandy desert. However, for those areas where mulga rules, it is a place of diversity and complex ecosystems. Acacia aneura typifies the resilience of a huge part of the Australian landscape, and its wonderful biology deserves to be better known.

HONEYBEES GET THE CONCEPT OF SYMBOLS AS NUMBERS

australiascience.tv June 6, 2019 Nick Carne

We know that bees can understand zero and do basic math. But now a new study shows they may be able to connect symbols to numbers.

Honeybees continue to impress in the intellectual stakes. Not only can they understand zero and do basic maths, it appears they may be capable of connecting symbols to numbers.

The same team of Australian and French researchers that discovered the zero trick has now trained honeybees to match a character to a specific quantity – a finding that sheds new light on how numerical abilities may have evolved over millennia.

It may also point to new approaches for bio-inspired computing that can replicate the brain's highly efficient approach to processing, the researchers suggest.

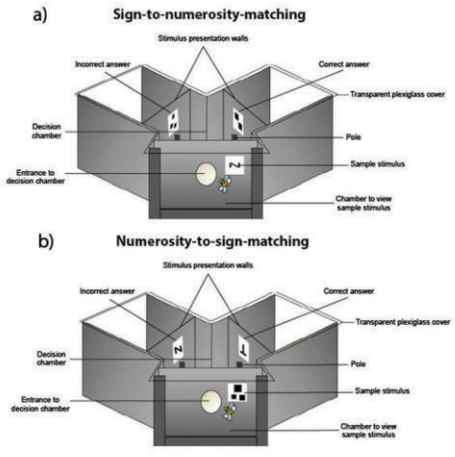
Study could open up new pathways for communication across species. "We take it for granted once we've learned our numbers as children, but being able to recognise what '4' represents actually requires a sophisticated level of cognitive ability," says Adrian Dyer, who oversaw the research at RMIT University.

"Humans have over 86 billion neurons in our brains, bees have less than a million, and we're separated by over 600 million years of evolution," he adds. "But if bees have the capacity to learn something as complex as a human-made symbolic language, this opens up exciting new pathways for future communication across species."

Such complex cognitive capacity is not unique in the animal world. A dozen years ago a chimpanzee beat students at a computer game, for example, while an African grey parrot called Alex was able to learn the names of numbers and could sum the quantities.

However, Dyer says their study is the first to show that non-vertebrates can use their brains, too.

How the honeybees were tested



(Howard et al., Proceedings of the Royal Society B, 2019)

In a Y-shaped maze, individual bees were trained to correctly match a character with a number of elements.

They were then tested on whether they could apply their new knowledge to match the character to various elements of the same quantity (in the same way that "2" can represent two bananas, two trees or two hats).

A second group was trained in the opposite approach, matching a number of elements with a character.

Honeybee math numbers experiment

While both could grasp their specific training, the different groups were unable to reverse the association and work out what to do when tested with the opposite model (character-to-number or number-to-character).

"This suggests that number processing and understanding of symbols happens in different regions in bee brains, similar to the way separate processing happens in the human brain," says Scarlett Howard, from the Research Centre on Animal Cognition in Toulouse, France.

"Our results show honeybees are not at the same level as the animals that have been able to learn symbols as numbers and perform complex tasks, but the results have implications for what we know about learning, reversing tasks, and how the brain creates connections and associations between concepts.

"Discovering how such complex numerical skills can be grasped by miniature brains will help us understand how mathematical and cultural thinking evolved in humans, and possibly, other animals."

The findings are reported in the journal Proceedings of the Royal Society B.

WOLLEMI PINE GENOME PROJECT ASKS WHETHER THE ENDANGERED TREE CAN SURVIVE THE MODERN WORLD

ABC news June 16, 2019 Jonathan Hair

Photo: Mapping the Wollemi Pine genome could take until the end of 2020. (ABC News: Jonathan Hair)

Hidden in a top secret location within a national park near Sydney, are some of the rarest trees on earth — so rare that anyone found putting them at risk can be handed huge fines, or jailed.

The severe safeguards are for good reason — the Wollemi Pine, a tree which outlived the dinosaurs, is so critically endangered that the wild population could be wiped out by disease in an instant.

But a new research project is aiming to unlock the secrets of the ancient species, by mapping its genome for the first time.

"There's about 140 individual plants in the wild, and that's it," said David Crust from the NSW National Parks and Wildlife Service. "And the other thing that makes it really rare is it's confined to a really small geographic area," he said.

That geographic area is the Wollemi National Park, located to the north-west of Sydney.

Photo: The Wollemi Pine's genome is twice the size of the human genome. (ABC News: Jonathan Hair)

Until recently, the Wollemi Pine was thought to be extinct because it was only found in fossils that were millions of years old.

But in 1994, ranger David Noble discovered the trees growing in the wild.

Since then, huge efforts have been made to protect the pines, including making their location top-secret and restricted — because they are extremely susceptible to disease. "There's really serious penalties … fines of up to $220,000 and imprisonment of up to two years for any act that endangers the plant," Mr Crust said."The reason [the locations] are confidential is so we can protect the pines from any kind of disturbance or damage," he said.

Researchers from the National Herbarium of New South Wales and Deakin University have teamed up to map the Wollemi's genome — a huge task which could take until the end of next year.

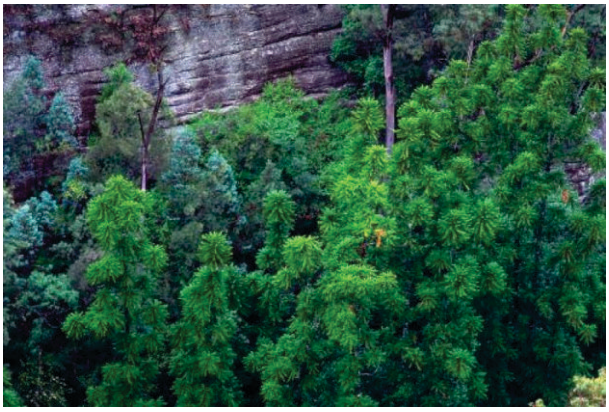


Photo: The exact location of the pines is kept secret to protect them from damage. (Jaime Plaza/Botanic Gardens Trust)

It will help the scientists to better understand why the Wollemi's wild population has declined to critical levels.

"The question we're asking is, does the Wollemi Pine have the genetic infrastructure to provide resistance and a defence against those diseases," Dr Maurizio Rossetto said. "We'll have a better understanding of how to manage it on site, but also how to translocate it into a new location, if that's what we decide to do in the future," he said.

"Maybe being in that location for such a long time, it didn't need as much protection," Larry Croft from Deakin University said.The work is not easy — the pine's genome is twice the size of the human genome.

When asked if there is a chance the Wollemi is not equipped to survive in the modern world, Dr Rossetto concedes it is a possibility."Unfortunately it is one of the possible reasons why it's rare," he said. "It doesn't have the genetic make-up to resist some of the introduced, or even the native natural diseases."

If that's the case, saving the Wollemi Pine's wild population will take more than keeping its location top-secret.

BEE POST GETS THE MAIL THROUGH.

David Drage

We have been made aware via the media of the possible dangers from pests and diseases from overseas to the European honey bee population here in Australia. These bees are important commercially as pollinators of food crops and prolific producers of honey.

However, native bees, of which there are more than 1500 species found throughout Australia, are important pollinators of the native flora and a vital part of the country's biodiversity. Like many other native species bees face challenges from climate change as well as habitat destruction and fragmentation.

On the 14th May this year Australia Post issued a set of four $1 postage stamps depicting species from the four main native bee families found here.

'The Resin Bee', *Megachile macleayi*, is a solitary bee of northern Australia with a penchant for the nectar of legume flowers. It nests in narrow holes in timber which it seals off with gums and resins collected from plants it visits.

'The Green and Gold Nomia Bee', *Lipotriches australica*, is also a solitary bee and is found throughout eastern Australia. It nests in the ground but males, after feeding and searching for mates, roost together on twigs and stems overnight. (Just like the Blue banded bees, *Amegilla cingulata* we see a lot of).

'The Wasp-mimic Bee', *Hyleoides concinna*, another solitary bee found in eastern Australia, feeds on eucalypt flowers and nests in tree stumps or logs. The female secretes a cellophane-like material to line the nest wit. This bee gets its name from its black and orange colouring which makes it look like a wasp and so discourages predators.

'Neon Cuckoo Bee', *Thyreus nitidulus*, once again a solitary bee which is found in both eastern and northern Australia. It gets its common name 'Neon' from its bright, metallic blue colouring, and 'Cuckoo' because it lays its eggs on the pollen balls inside the ground nests of Blue-banded bees, *Amegilla cingulate*.

For more information about this postage stamp issue see the Australia Post 'Stamp Bulletin" Issue No.359 / May-June 2019 or the website, australiapostcollectables.com.au

Members should note and identify the native plant flowers in the images. (Sorry they didn't include my favourite 'Teddy Bear Bee' *Amegilla bombiformis*. Ed.)