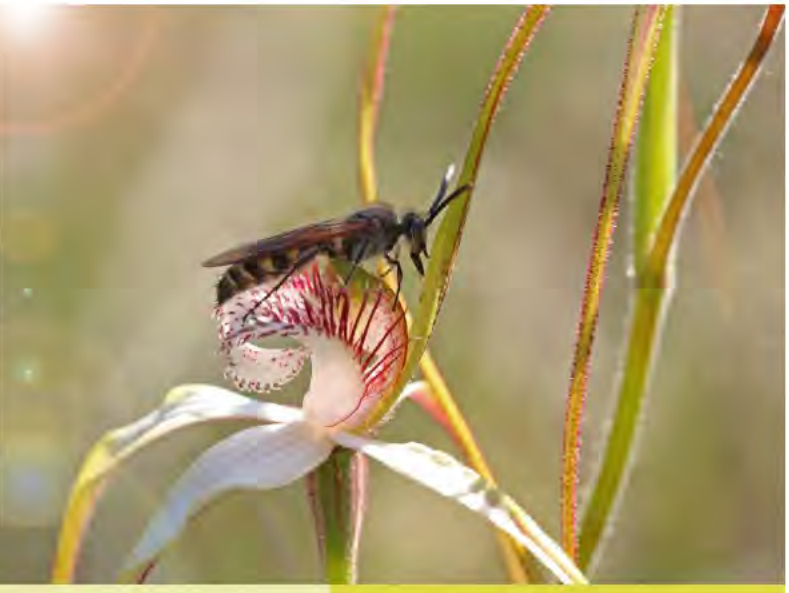
ISSUE 3 - MAY 2020

WANOSCG

The Official Bulletin of the Western Australian Native Orchid Study & Conservation Group



The Entomology Special Edition

A huge thank you to all our members who submitted their favourite images of creepy crawly critters on orchids to help create this special entomology edition of the bulletin. Our May issue is traditionally filled with Bunny, Hare and Winter Spider orchid images so this has been quite a fresh and colourful edition to compile. Amidst the current enforced home isolation, many people have found they have the time to finally go back through their archives of photos, work on identification of species and relive fond memories through their favourite snaps. It has been lovely to see a recent increase in member participation on the Facebook website thanks to the guidance of our new administrator Nathan Piesse. If you haven't checked out the Facebook page in a while then I encourage you to log on for an enjoyable diversion, take a look at some amazing images, learn some new things from others posts and feel free to get involved and ask questions. The situation in Western Australia is thankfully looking more hopeful than it was a month ago when the last bulletin went out so we may find regional travel restrictions get lifted in time for Spring with any luck. In the meantime, check out your local patch of bush or nearby reserves, see what you can find and send Ramón some data!

Image above by Rachel Halls: *Caladenia huegelii* x *Caladenia speciosa* hybrid with crab spider

IN THIS ISSUE:

Next General Meeting:

Kings Park Administration Building

Next date to be advised

The Committee:

President – Ramón Newmann
Vice President – Ian Puddey
Secretary – Pat Richards
Treasurer – Jay Steer
Committee Members – David Lawson, Kevin Uhe, Debbie Proudfoot, Andrew Brown, Bill Gaynor

"Spiders on Orchids – Friend or Foe" By Ian Puddey

Anyone out in the field with a macro-camera will be very conscious of the ubiquitous presence of spiders on our native terrestrial orchids and other native flowers during the spring. The most commonly observed are crab spiders, also known as flower spiders, members of the Thomisidae spider family. They are widespread, ranging from our coastal heaths and forests to our drier inland regions, and are found not just on flowers, but on leaves, leaf litter and bark, with over 40 species reported in WA.

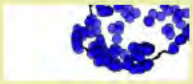


Image left: Thomisidae occurrence records Western Australia (from Atlas of Living Australia)
Image centre: *Caladenia longicauda* subsp. eminens and Image right: *Caladenia paludosa* with crab spiders

They are approximately 4-7 mm in size, males smaller than females, and they vary remarkably in colour, sometimes entirely white, sometimes predominantly green, but commonly a combination of green, yellow and brown with dark stripes and slashes on the head, abdomen and legs. They may actually change their colour to more closely match the flower colour. This colour variation enables such clever camouflage that you often won't see the spider until you get home and enlarge your orchid photographs on the screen. They are called crab spiders because of the enlarged, heavier and strongly spined two front legs with which they seize their prey as well as the shape of their carapace and the way they crawl sideways across the flower when disturbed. They are known as 'sit and wait predators' because they remain motionless on the flower ready to pounce on a fly, bee, beetle or other visiting insect and will often grab insects that are more than twice their body size, before injecting them with venom and sucking their juices.

In contrast to those crab spiders that use their colour for camouflage to hide them from visiting insects, some white crab spiders can utilise their ultraviolet reflective properties to attract pollinators to a flower (1). They may not be hidden well on white flowers, because they reflect ultraviolet light strongly, while white flowers do not. Pollinators such as bees may be attracted to this contrast with evidence that they are more strongly attracted to white and yellow flowers when a white spider is present (2), especially when the crab spiders are larger (3). Whether such properties are relevant to pollinator interaction with white crab spiders on Western Australian terrestrial orchids is unknown, but anecdote suggests the white colouration is more likely used as camouflage than as an attractant. Crab spiders may use visual cues to select their floral host and male crab spiders might be attracted to females depending on the colour background on which the female is located (4). Crab spiders may also be attracted to a specific plant by 'eavesdropping scenarios' where the attraction relies on the same scent that attracts a specific pollinator (5). Although an interesting phenomenon, whether such a scenario exists for any crab spiders on orchids in Western Australia is unknown, with up to half the orchids inhabited by crab spiders not relying on the production of insect pheromones to deceptively attract pollinators.

Caladenia christineae with crab spider

"Spiders on Orchids" continued...

The other major unanswered question is whether there is any overall impact of a 'sit and wait predator' like the crab spider on the ecology of the orchids it inhabits, particularly through any effects it may have on visiting pollinators. This will depend on the percentage of orchids occupied by spiders (generally relatively few), how often pollinators visit a plant as a consequence, how many plants they visit and how long they stay on each plant. In an Australian context such information is largely uncharted. Although crab spiders do not produce webs, it is of historical interest that in the first work that Darwin wrote after 'On the Origin of Species...' ('The various contrivances by which orchids are fertilized by insects', 1862), he also, at least in passing, considered a similar question when his son was struck with the number of spider webs spread over orchid plants, "as if the spiders were aware how attractive the Listera was to insects" (6)

Caladenia harringtoniae

Caladenia brownii

Impacts of predators on their plant hosts have been broken down into direct effects, where the pollinator is part of the spider's diet, and indirect effects, such as the influence of the presence of the predator itself or its dead prey on pollinator visitation to a plant (7). Some studies indicate that the crab spider is a commensal, with no adverse effects on fruit and seed set of an orchid, especially for those orchids that attract pollinators by deception rather than reward (7). Others suggest that pollinators may detect a visual signal or an odour from a crab spider or its dead prey and then deliberately avoid plants that crab spiders use as their hunting platform, reducing the frequency and/or duration of visits to their flowers (1;8).

All images featured in this article by Ian Puddey

Clockwise from left:
Caladenia polychroma
Cyanicula ixioides subsp. candida
Caladenia marginata
Caladenia longicauda subsp. eminens

"Spiders on Orchids" continued...

On the other hand, predators could conceivably have beneficial effects by catching and killing more florivores and herbivorous insects than pollinators, thus protecting a plant from insect damage (9). In WA the majority of orchids rely on pollinator deception with false rewards to attract pollinators (emission of insect pheromones or visual signals that mimic flowers that have nectar), thereby conserving valuable plant resources in what are often semi-arid environments with nutrient poor soils and often low rates of effective pollination. Any additional negative effects of the presence or absence of flower spiders on orchid pollination in such environments (and ultimately fruit and seed set) has largely been unstudied. Such studies would need to also consider the multiple influences of climate (and climate change) on crab spider density and behaviour in better defining the ecological interactions of these sit-and-wait predators with their orchid hosts. So are they friend or foe for our terrestrial orchids – the jury is still out, but future careful research may provide the necessary insight.

References

(1) Huey S, Nieh JC. Foraging at a safe distance: crab spider effects on pollinators. Ecological Entomology 2017;42:469-76.
(2) Heiling AM, Chittka L, Cheng K, Herberstein ME. Colouration in crab spiders: substrate choice and prey attraction. J Exp Biol 2005;208(Pt 10):1785-92.
(3) Llandres AL, Rodriguez-Girones MA. Spider movement, UV reflectance and size, but not spider crypsis, affect the response of honeybees to Australian crab spiders. PLoS One 2011;6(2):e17136.
(4) Su Q, Qi L, Yun Y, Zhang W, Peng Y. Visual preference of flower-visiting crab spiders (*Ebrechtella tricuspidata*) for host flowers. Ecological Entomology 2020;DOI: 10.1111/een.12835.
(5) Knauer AC, Bakhtiari M, Schiestl FP. Crab spiders impact floral-signal evolution indirectly through removal of florivores. Nat Commun 2018;9(1):1367.
(6) Roberts DL, Bateman RM. Do ambush predators prefer rewarding or non-rewarding orchid inflorescences? British Journal of the Linnian Society 2007;92:763-71.
(7) Quintero C, Corley JC, Aizen MA. Weak trophic links between a crab-spider and the effective pollinators of a rewardless orchid. Acta Oecologica 2015;62:32-9.
(8) Romero GQ, Antiqueira PA, Koricheva J. A meta-analysis of predation risk effects on pollinator behaviour. PLoS One 2011;6(6):e20689.
(9) Welti EAR, Putnam S, Joern A. Crab spiders (Thomisidae) attract insect flower-visitors without UV signalling. Ecological Entomology 2016;41:611-7.

Photos of Crab Spiders on Orchids by WANOSCG Members

Clockwise from top left: *Caladenia longicauda* subsp. *crassa* - Nathan Piesse, *Caladenia chapmanii* – and *Drakaea glyptodon* - Robin Parsons, *Thelymitra macrophylla* - Heather Adamson, *Caladenia harringtoniae* - Rachel Halls

Photos of Spiders on Orchids by WANOSCG Members

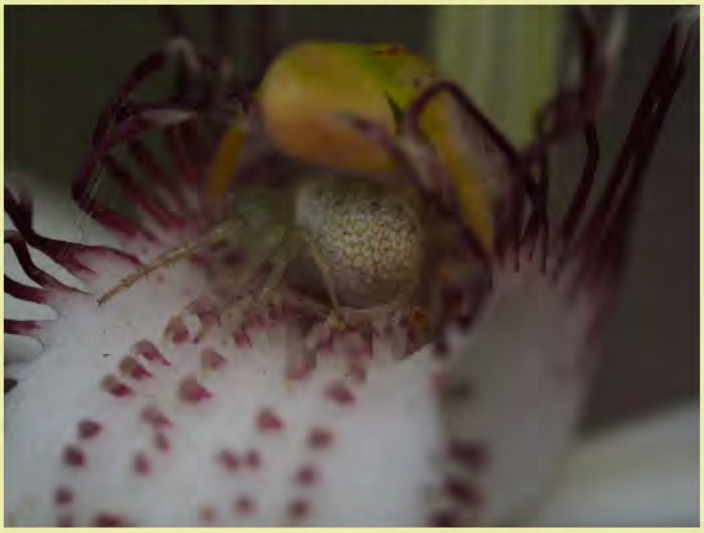


Image top left and top right by Leif Jamvold - *Caladenia splendens*

Image left by Jeremy Storey – *Caladenia infundibularis*, Image centre by Margaret Petridis – *Caladenia longicauda*, and Image right by Nathan Piesse - *Caladenia reptans* subsp. *reptans*

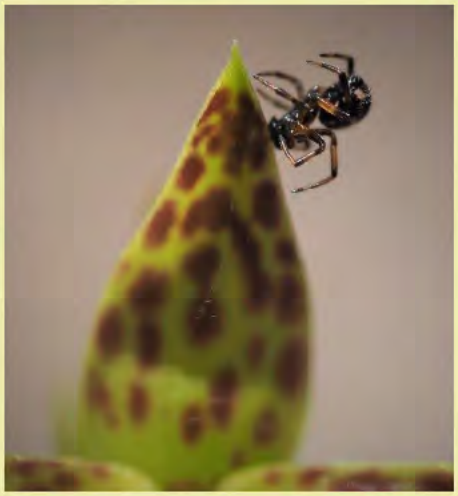


Image left by Margaret Petridis – *Caladenia christineae* x *harringtoniae*, Image centre by Brian Trainer – *Thelymitra benthamiana*, Image right by Mick Hurdus – *Microtis sp.*

"Recollections – Part II" by Alex George

In 1957, John Tonkinson and I, sometimes with other friends, began exploring beyond the environs of Perth on day trips and in August, our first trip farther afield. From the 23rd to 30th August we headed to Ravensthorpe and Hopetoun, across to the Stirling Ranges, Albany and home. At that time, the sealed road did not reach Lake Grace, then it was gravel almost until Albany and even stretches of the Albany Highway were still unsealed. After Lake Grace, the land was uncleared except for a few farms around Newdegate and Ravensthorpe. Likewise, heading west to Ongerup was all uncleared. It was a pretty rough road to Hopetoun and across to Ongerup (Jerramungup wasn't thought of yet). By this time my wider interest in flora was growing and I sometimes found it hard to focus on orchids. We saw many species, however, the highlights of that trip finding, for the first time, *Pterostylis mutica* and *P. allantoidea*, *Caladenia sigmoidea*, *C. graminifolia* (then unnamed), *C. plicata* and what we first thought were blue *C. saccharata*, later decided that they were *C. caerulea*, and still later were named *C. aperta*. The eastern end of what is now the Fitzgerald River National Park had been burnt the previous summer and on East Mt Barren we found *Lyperanthus* (now *Pyrorchis*) *nigricans*, *Prasophyllum cucullatum* and *P. fimbria* in flower.

Over the weekend of the 21st to 22nd September, we went to Narrogin and back via York for another productive time. Finds included *Prasophyllum sargentii* and on Mt Bakewell, *Caladenia integra*. On the 7th to the 8th December we went southwards and along a bush track to the Donnelly River, between Pemberton and Nannup. We found *Prasophyllum regium*, *Gastrodia*, *Thelymitra tigrina*, *Lyperanthus* (*Pyrorchis*) *forrestii* (strongly scented but so easily bruised), *Microtis alba* and *M. gymnadenioides* (now *pulchella*), and the spider that I later named *C. corynephora*.

Image left: *Eriochilus dilatatus* a specimen with the petals modified in the form of lips, brought in to the WA Herbarium in the 1960s.

I first saw the Leafless Orchid near the Old Boulder Mine, Collie, in April 1958. Among several country trips that year was one to Pemberton in late June to find *Corybas*, which we were surprised to find also in the Ludlow Pine Plantation (I brought home a few plants and for several years they survived in the Somerville Pine Plantation near my home). *Pterostylis robusta* (now *aspera*) thrived in the humid conditions in this plantation.

In June 1959, I joined the staff of the then-State Herbarium (while Charles Gardner was still Government Botanist). My interest in flora was even further stimulated, but orchids continued to be my chief interest. The job gave me opportunities for more field work around the South-West, then from 1960, into the North-West and desert regions. Being paid to go bush—I was in heaven!

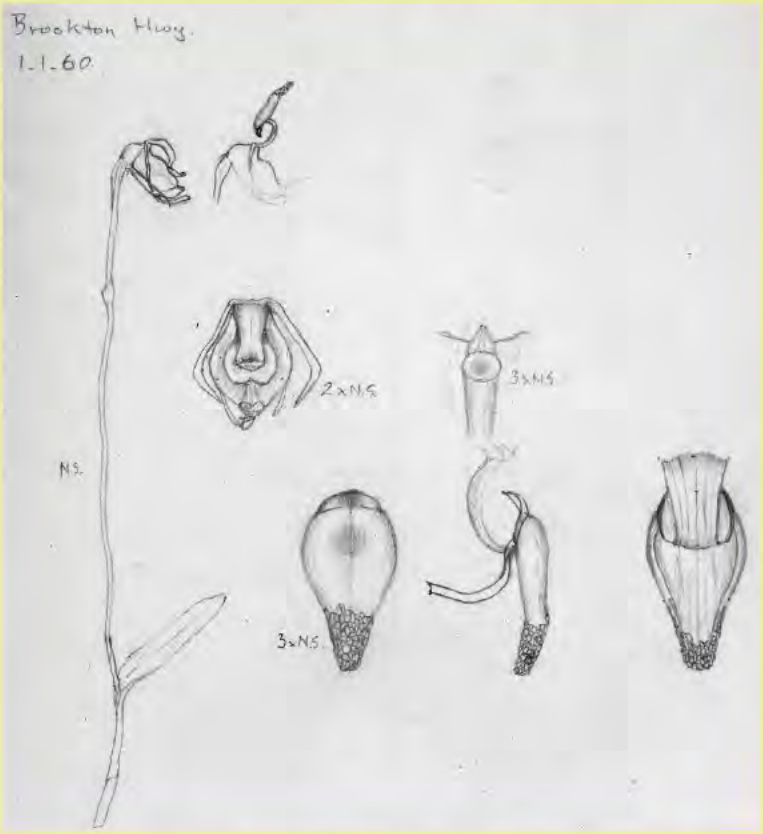
Pterostylis aspera in the Somerville Pine Plantation, 1960s. Several greenhoods flourished in the humid conditions of the plantation

"Recollections" continued...

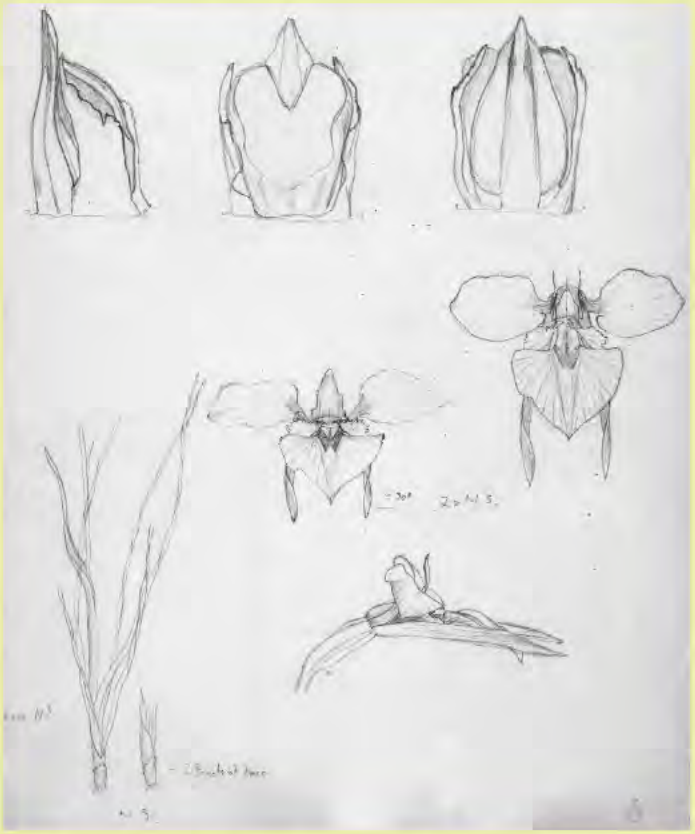
A few highlights from the '60s. At Wongan Hills we found the Winter Spider Orchid which, at the time, we called *Caladenia glossodiphylla* until John Tonkinson, on a visit to Britain, went to the herbarium at the Royal Botanic Gardens, Kew, and discovered that it was really *C. drummondii* – the poor state of Drummond's original collection led to Bentham's description of 1870 being quite misleading. During these years I found the new species later named *Pterostylis angusta* south of Bunbury and *Pterostylis macrocalymma* at the Murchison River.

I was most surprised to find a Flying Duck on the Brookton Hwy on 1 Jan 1960. At the time I thought it was just an unusual plant of *Caleana nigrita*. It's now *Paracaleana brockmanii*.

On 18 March 1961, south of Northcliffe, I found the first flower of *Caladenia aphylla* for the season and the last of *Cryptostylis ovata*. Later that year I discovered a Queen of Sheba near Badgingarra (then just a homestead, reached by a rough gravel road from Dandaragan – long before the Brand Highway was built). These specimens had fine tips to the ears of the column and later became *T. variegata* var. *apiculata*, now *T. apiculata*.



My pencil drawing of the Flying Duck found on the Brookton Highway, 1 January 1960, now *Paracaleana brockmanii*



My pencil drawing of *Diuris purdiei* from Nicholson Road, Canning Vale, 19 September 1959

In November 1963, I found the sweetly scented *Thelymitra sargentii* near Queen Victoria Spring, c. 250 km east of Kalgoorlie. I thought it might have been the most inland record of an orchid until I later saw a specimen collected in 1891 on the Elder Exploring Expedition well into the Great Victoria Desert preserved in the National Herbarium of Victoria.

Botanists have a responsibility to make their findings available to the public through publishing papers and books. So my first two papers on orchids appeared in *The Western Australian Naturalist* in 1961 and 1963. The first resolved the application of several names and discussed the Lost Orchid (described as *Goadbyella gracilis* in 1927) which I found was an aberrant plant of *Microtis*. By this time, I knew the eastern species in the genus *Glossodia* and came to realise that our species (then placed in the same genus) were markedly different. In my second paper I described a new genus, *Elythranthera*, for these species.

From late 1967 my field work was put on hold for a year while I served as Australian Botanical Liaison Officer at the Royal Botanic Gardens, Kew—but that exciting adventure is a story in itself.

Road widening success by Kevin Uhe

The Crested Spider (*Caladenia cristata*) has been monitored under ADORP since 2011, including three small populations north of Wongan Hills. These are the only three known populations in this area with one population situated on a road reserve which was always at the danger of any road widening.

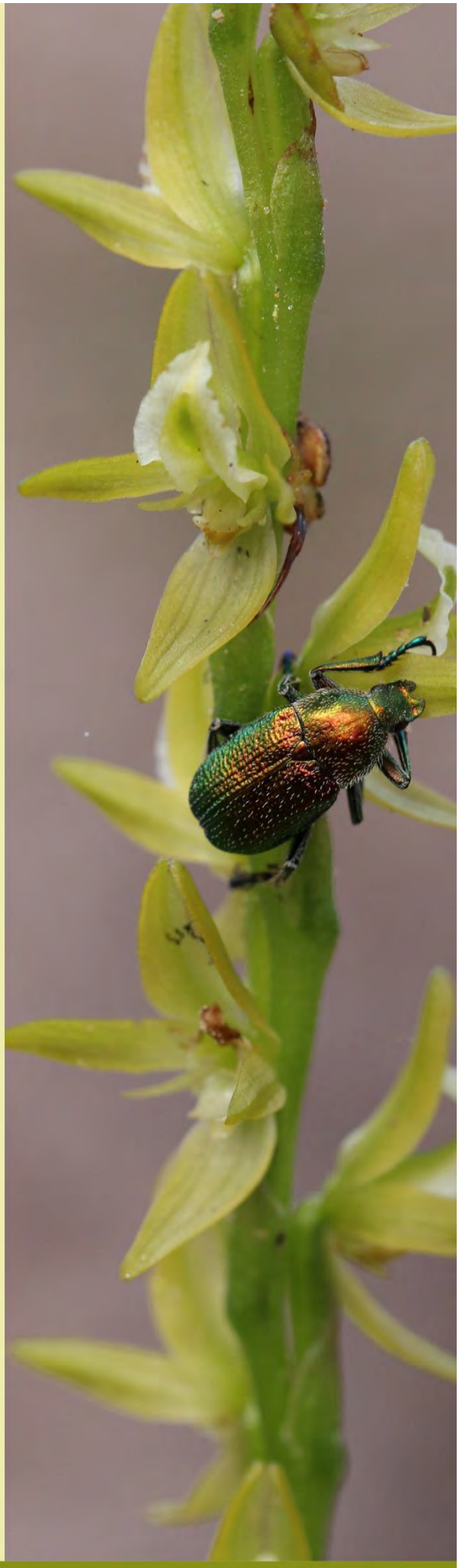
In 2018, member Gail Reed, raised the alert that road widening was going to occur in the area and that this population was at risk. Unfortunately, when Main Roads did a vegetation survey of the road reserve, the presence of *Caladenia cristata* was not noted so this population was in real danger of being destroyed.

Thanks to Gail's contacts with the local DBCA Conservation Officer, a meeting was arranged in 2019 between Main Roads, DBCA and WANOSCG to alert Main Roads to this population and try and see if there was a way to save this population from the proposed road widening.

Main Roads, to their credit, managed to slightly alter the road works to avoid the population. A visit to the area by Gail in late March this year confirmed that the road works had been completed without any damage to the orchid habitat.

Many of our Threatened and Priority orchids are situated on road reserves and it pays to keep notice of any proposed road works that might affect these populations and alert the DBCA accordingly.

Many thanks to Gail Reed for her efforts in helping to save this population.



Regional Travel Restrictions

A reminder to all members that as tempting as it is to go for a road trip to look for orchids, regional travel restrictions are still currently in place.

In order to reduce the community spread of COVID-19, the Western Australian government has introduced intrastate travel restrictions. From Tuesday 31st March, people will not be able to travel outside of their designated region e.g. Perth and Peel, South-west, Great southern, Mid-west, Goldfields. Some exemptions occur for people travelling for work or medical appointments, compassionate grounds and a few other reasons.

As this is a rapidly evolving situation, these restrictions may change on any given day so it is best to check the WA government website for instructions when considering travelling beyond your region. If you are heading out into the bush on your own because of social distancing then please make sure you have appropriate water and supplies and have notified someone of your intended destination and approximate expected return time.

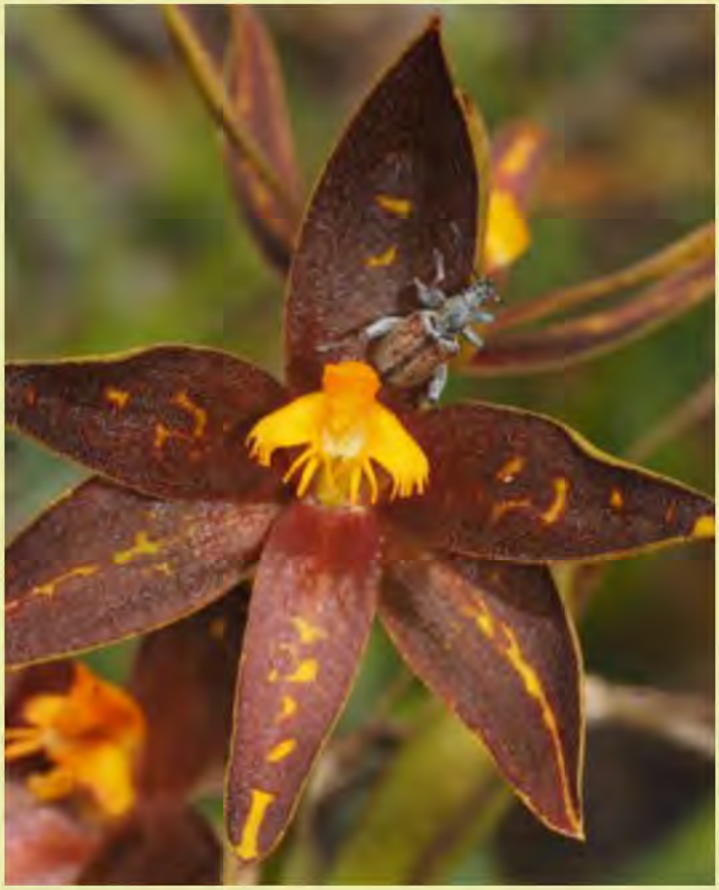
"Thelymitra jacksonii"
Attractive to weevils and beetles... as well as humans!
By Margaret Petridis

In December 2011, Kevin and I went down to the Walpole area to look for and count Jackson's Sun orchid, *Thelymitra jacksonii*. On the 11th December we visited the marked population on the side of the SW Highway and found the orchids just starting to open. We noticed there were small grey beetles/weevils on some of the flowers and they appeared to be very amorous, as several co-joined pairs were seen on the petals and in the centre of some of the flowers.

The creatures in the centre of the flowers had disrupted the pollen in some flowers, and scattered it on the petals and sepals with their activity. The flowers were freshly open and had a strong cinnamon aroma. We deduced that this heady aroma had stimulated the sexual activity of the weevils but do not know if they are in fact, the pollinators for this species.

Has anyone else seen this on *Thelymitra jacksonii* or any of the other Sienna sun orchids?

In December 2017 we saw another type of beetle/weevil on one plant but it was solitary (see last photo) and Kevin found the grey weevils again on one flower stalk in 2019. I think this is a very interesting phenomenon and I am interested to receive feedback of similar experiences from WANOSCG members.



Images of *Thelymitra jacksonii* with weevils by Margaret Petridis

Seed Planting in Warwick Bushland by Tim Hodgkins

For the second year, Friends of Warwick Bushland, led by Dr Mark Brundrett, have planted orchid seeds into four designated areas of the Warwick Bushland.

The four transects had been selected because they are relatively close to existing paths (for people to access orchids) and habitats are suitable for orchids.

This year's planting took place on Sunday April 26th and used three separate methods of seed preparation, seed pouches, seeds in sand and seeds in water. Transects are 25-30 meters in length and each seed group is distributed and recorded along the length of each.

Seeds from several varieties of orchids, all found within the Bushland are used, from the collection of Mark Brundrett:

- Caladenia arenicola
- Caladenia discoidea
- Thelymitra fuscolutea
- Thelymitra benthamiana
- Diuris magnifica

It is anticipated that this program will continue into the future to build knowledge in the area of orchid propagation.

Above image by Tim Hodgkins - The photograph shows Dr Mark Brundrett with volunteers Karen Clarke and Steph Murphy preparing for planting in the second transect.

A New Bunny Orchid Taxonomy Paper by Mark Brundrett

A detailed study of the white bunny orchids (*Eriochilus dilatatus* complex) in Western Australia found that there were no consistent differences among most subspecies in herbarium specimens or living plants. This was due to a lack of consistent differences in leaf size and shape, flower numbers, distribution patterns, flowering times, or soils where they occur between most subspecies. Consequently, *Eriochilus dilatatus* subsp. *magnus* and subsp. *multiflorus* are merged into subsp. *dilatatus* and subsp. *undulatus* and subsp. *orientalis* are merged into subsp. *brevifolius* (the oldest name). The two remaining subspecies (*dilatatus* and *brevifolius*) can distinguished by plant height, flower numbers and leaf morphology, except for some intermediate plants that occur where their ranges overlap.

A new key to all bunny orchids in WA is provided below. We also discuss reasons why taxonomic issues are relatively common for Western Australian orchids and recommend a research program to resolve these issues. Note that it may take some time for the West Australian Herbarium to review and implement these proposed taxonomic changes. This paper is available by requesting a copy from me on ResearchGate. (www.researchgate.net/profile/Mark_Brundrett)



Images from left by Brian Trainer - *Eriochilus helonomos*, Robin Parsons – *Eriochilus dilatatus* subsp. *multiflorus* and Ian Puddey – *Eriochilus scaber* subsp. *scaber*

Key to Western Australian *Eriochilus* species

1. Leaf inserted part way up flowering stem, or raised on wiry petiole on non-flowering plants 2
1: Leaf basal on flowering and non-flowering plants 6
2. Plants usually 15–50 cm tall, with relatively large leaf (2–10 cm long) and larger multiple flowers (most lateral sepals >1 cm long) 3
2: Plants 5–15 cm tall, leaf very small (<2 cm long), flowers single or few (1–4) and small (lateral sepals <1 cm long)..... 5
3. Leaf on Flowering plant thin and stem wiry, usually not on granite rocks..... 4
3: Flowering plant leaf and stem fleshy, grows on granite rocks..... *E. pulchellus*
4. Flowering leaf large or small (1–7 cm long) with smooth margins, (1) 4–20 flowers, usually over 30 cm tall, widespread, usually grows in relatively wet near-coastal areas .....*E. dilatatus* subsp. *dilatatus*
4: Flowering leaf small (0.5–3 cm long), often with undulate margin, 1–3 (5) flowers, usually under 30 cm tall, primarily growing in the wheatbelt.....*E. dilatatus* subsp. *brevifolius*
5. Lip with scattered purple bands across entire width, widespread especially on granite, not fire responsive.....*E. helonomos*
5: Lip with green vertical band between red-purple sides, growing near south coast in swamps, usually seen after fire.....*E. valens*
6. Short flowering stem (<10 cm), winter flowering often after fire, leaf on flowering plant ovate, leaf of non-flowering plants variegated with white stripes, widespread in upland or damp habitats. *E. scaber*
6: Taller flowering stem (10–25 cm), spring flowering after fire, leaf not variegated, restricted to peaty soils in swamps..... *E. tenuis*

Brundrett M, Hammer T (2020) The *Eriochilus dilatatus* (Orchidaceae) complex in Western Australia: subspecies taxonomy is not supported by consistent differences in morphology or distribution. *Australian Systematic Botany* 33, 329–345.

Another new open access orchid reference:
Brundrett MC (2020) A proposed framework for efficient and cost-effective terrestrial orchid conservation. *www.preprints.org*. doi:doi:10.20944/preprints202004.0465.v1.

2020 Proposed Field Trips

At this stage, there will be no planned field trips for 2020 until we have the green light to safely travel and socialize once again. The role of Field Trip Coordinator is also yet to be filled. We had hoped this year to explore more areas of bush that have not been thoroughly surveyed to see what discoveries can be made as well as surveying some of the lower priority orchids. Keep in mind for later this year or likely next year, any potential suggestions that you may have for destinations. A list of burn sites from last year has been circulated with this newsletter and there are several locations in there that may be worth checking out this year.

General Meeting Rosters

All official WANOSCG meetings are suspended at this stage until we receive any further directives from the Western Australian government. We will keep members updated on any changes through email.

Memberships 2020

A reminder to everyone that membership fees are now overdue for the 2020 season. Details of how payments may be made are found on our website at www.wanoscg.com/members/.

WANOSCG Database

Please submit your orchid sightings on the latest template that was sent out by email to keep our database up to date as this is important for assisting with conservation works around the state. Without evidence it is difficult to protect land from clearing or road widening.

Conservation News

Members may have seen in the media lately some news in relation to a national Orchid Conservation Program led by Research Scientist Noushka Reiter who has a special interest in threatened flora. This program has been responsible for collecting seed from over 150 species nationally and has grown plants from 44 endangered species within labs.

Through collaboration between the researchers of the Royal Botanic Gardens of Victoria and Kings Park Botanic Garden led by Belinda Davis, lab teams have now been able to successfully germinate and grow *Thelymitra variegata* at both botanic gardens. The next challenging step will be translocating these threatened species back into their original environments.

Similarly, to the seed bank at Kings Park Botanic Garden, the South Australian Seed Conservation Centre in SA has been collecting and banking threatened native plant species in storage for research and recovery. More than 50% of the orchid species in SA are threatened and most of these species have not had attempts at propagation within labs. Through these collections, researchers will be able to germinate seeds and identify the specific orchid mycorrhizal fungi each species relies on. This program has involved young science students being involved in hand pollination and seed collection in the field to germination in the lab. So far, four species of threatened orchids have been successfully translocated back into the native environment as of the end of 2019. These accomplishments are important developments for the conservation of native orchids around Australia.

References:

- www.rbg.vic.gov.au
- Seeds and Students of South Australia. Jenny Guerin and Dan Duval. Australasian Plant Conservation Vol 28, No 3, December 2019 - February 2020

"Pollination by Insects" by Rachel Halls

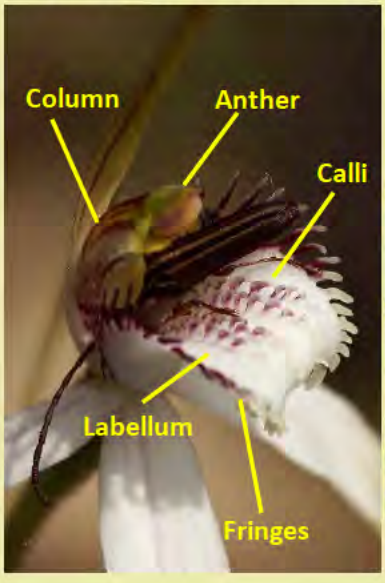
It wouldn't be a complete issue about insects on orchids if we didn't take a closer look at why particular insects are attracted to orchids in the first place and why this interaction is important. For many of the more experienced members, the following information will be well known but hopefully for the rest there may be a few new facts to add to your knowledge of the intricacies of orchid pollination by insects.

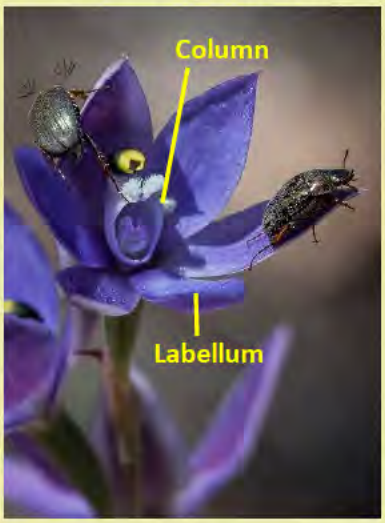
If you have spent a fair bit of time in the bush, you would have noticed that many different insect species visit native orchids and you've probably wondered whether or not the insect you see interacting with the orchid is a pollinator, predator or a harmless visitor. The main groups of insects found to be responsible for cross-pollination are bees, wasps, gnats and flies[1]. These are just a few of the many other insects you may have seen crawling on orchids.

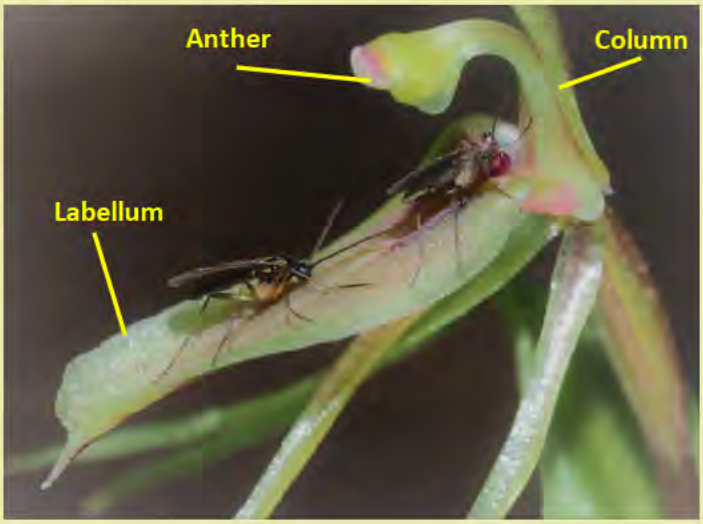
Images of the main groups of pollinators by Rachel Halls *Prasophyllum gracile* with bee, *Pterostylis ectypha* with gnat, *Thelymitra latiloba* with Hoverfly and *Caladenia brownii* with wasp

Orchid Structure:

Several distinct mechanisms exist to encourage insect pollination. These include the orchid morphology and colour, it's similarity in appearance to female insects in particular wasp species and inbuilt triggers or hinges to temporarily trap potential pollinators. One of the most intriguing aspects of orchids is their unique architecture. Orchids are structurally designed to encourage and guide insects to pollinate them[1]. When you look close up at the labellum of a Spider Orchid, you can see how the shape of the lip angles down towards the inner surface of the column, the fringes curl upwards to create a low fence and the anther is positioned posterosuperior to where the insect enters the orchid. As the insect travels down the landing pad of the labellum of the orchid, the back of the insect touches the anther and receives pollen which it can then transfer to the next plant that it visits resulting in cross-pollination[1].







Images from left: Krystyna Rees – *Caladenia longicauda*, Mick Hurdus – *Thelymitra macrophylla* and Brian Trainer – *Cyrtostylis huegelii*

Orchid Mechanics:

As discussed on the previous page, orchid sizes and structural shapes are designed to attract particular insect pollinators with many species only pollinated by a single insect species[2]. In addition to these features, many orchids also have mechanical features to aid in probability of pollination when visited by an insect.

Pterostylis species all feature prominent labellums that trigger in response to pressure[1]. As the pollinator lands on the labellum, it swings superiorly which results in the insect being momentarily trapped inside the orchid.[3]

Image top left by Mick Hurdus – *Pterostylis sargentii*

Image right by Brian Trainer – *Pterostylis vittata* with Fungus Gnat

Image centre left by Mark Brundrett - *Pterostylis sanguinea* with Fungus Gnat

As the insect struggles to escape through the only available route, it contacts with the column for pollen transfer to occur[3]. After this triggering has occurred, the labellum may take a couple of minutes to up to an hour to reset depending on the surrounding air temperature[4].

Paracaleana, Spiculaea and *Drakaea* species similarly feature a weighted hinge mechanism that closes up the flower when activated. This closure pushes the insect into the anther and in position to receive pollen from the orchid onto its back. In *Paracaleana* the insect is trapped into a column bowl to achieve pollen transfer[5]

Image bottom left: Lyn Alcock – *Spiculaea ciliata* with Thynnoturneria sp., Centre: Ian Puddey – *Paracaleana nigrita*, Bottom right: Robin Parsons – *Drakaea livida* and *Paracaleana nigrita*

"Pollination by Insects" continued...

Pollination by Sexual Deception:

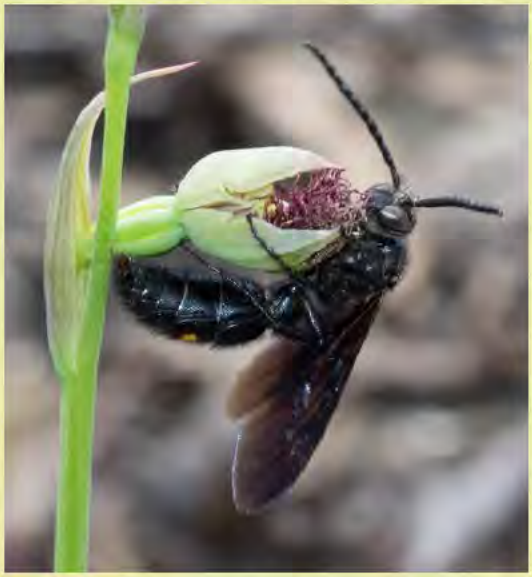
Orchids can sexually deceive insects for pollination purposes by two different means. Firstly, they can attract pollinators through pheromones that are emitted in the glands located in the clubs and some of the more prominent calli of the *Caladenia* genus[2]. Orchids mimic female wasp sex pheromones by producing a combination of semiochemicals designed to attract a particular species of wasp[6]. These semiochemicals have been found to be a blend of chemically and biosynthetically related compounds that mix to emit a pheromone that is appealing to a targeted pollinator species[6]. The specificity of attracting a particular pollinating species is important to filter out unwelcome herbivores that may be attracted to feeding on the orchid by its scent[7].

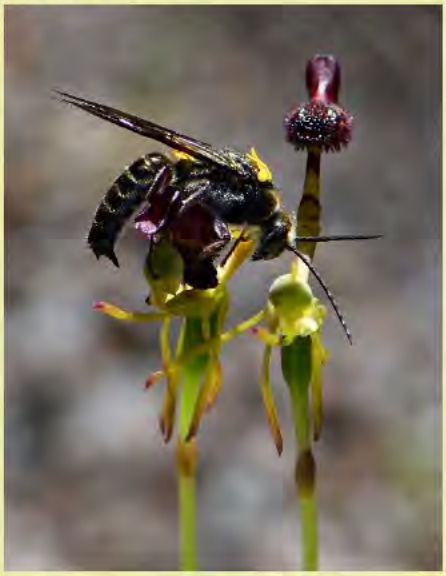


Images from left: Heather Adamson – *Caladenia paludosa*, Kevin Uhe – *Caladenia douchiae* and Mark Brundrett – *Caladenia Arenicola*

The selectivity of many sexually deceptive orchids for a single pollinator species threatens its long-term survival given its reliance on an insect species remaining at a habitat. Phillips et al.[8] identified that for *Drakaea livida* orchid to be pollinated by thynnid wasps, the environment requires appropriate nectar plants for feeding and scarab beetle larvae for laying eggs. Further studies by Phillips et al. have looked into the possibility of evolution of pollinator switching in orchids by semiochemical production flexibility.

The second means by which orchids can sexually attract pollinators (usually wasps) is by imitating the appearance and posture of a female wingless wasp so the male wasp attempts to mate with the orchid[1]. Stoutamire et al.[2] noted the orchids that rely on wasp pollination are often situated to take advantage of the flight behaviour of wasps at 20-30cm height. These types of orchids will be pollinated by a single species of wasp in that habitat and this typically will occur on warm sunny days when wasps are most active[2]. The images featured on this page feature a variety of orchids that are pollinated through means of sexual deception either by appearance and/or pheromone production.





Images from left: Lyn Alcock – *Calochilus stramenicola*, Jeremy Storey - *Calochilus stramenicola* and Ian Puddey - *Drakaea livida*

Pollination by Floral Mimicry and Food Deception

Some orchid flowers attract pollinators purely by being large and bright in colour, possibly with a fragrance and give the illusion of offering food rewards but not actually delivering on the offer[2]. *Diuris* and *Thelymitra* species in particular utilize this method of pollination. Last year we were treated to a presentation by Daniella Scaccabarozzi on her paper on floral mimicry in *Diuris brumalis* which resembles local native pea plants in appearance and thus misleads insects into pollinating the orchid[9]. Diuris species provide neither scent or nectar as rewards to bees but have bright colours that attract them nonetheless. Many of the vibrant blue coloured sun orchids flower in habitats where other species of blue to purple coloured native wildflowers grow and if you look closely at the centre of the column, the yellow apex resembles pollen to attract insects much like nearby growing native lilies[10].

Gaskett et al[11] explored the reasons why insects are attracted to colourful orchids by measuring spectral reflectance and modelling pollinator perceptions of colour and patterns. It was felt that high contrast against the background and target patterns may be a reason for why orchids without scent or food rewards are successful in attracting pollinators rather than just visual mimicry alone.



Images by Rachel Halls – *Caladenia latifolia, Caladenia flava* and *Thelymitra macrophylla*

Mark Brundrett – *Pterostylis mutica* pollination by fungus gnats

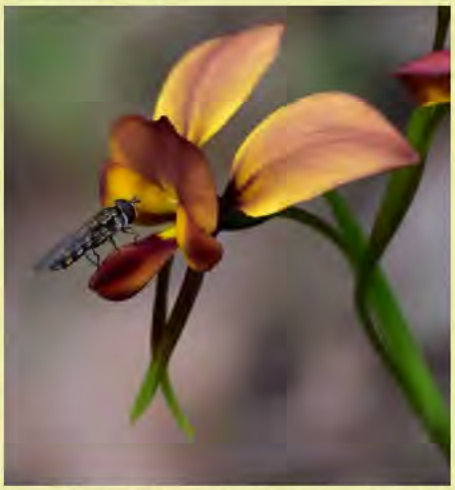



Image centre by Lisa Wilson – *Thelymitra anteniferra* & Right by Robin Parsons - *Diuris sp.*

Pollination by Fungal Gnat Deception

Orchids that flower in late autumn and winter such as Greenhoods and Helmet species rely on fungal mimicry to attract pollinators in the form of fungus gnats. This has been found to be another form of sexual deceit as the fungus gnats are sexually attracted to several *Pterostylis* species[12]. The fungus gnats are thought to be attracted to the dank odours of these species of orchids as well as their duller colouring. Gnats have additionally been witnessed feeding off nectar at the pollination site[12].

"Pollination by Insects" continued...

Pollination by Food Rewards

Many of the native orchid taxa in Australia do not produce food rewards in return for pollination and as such have relied on the previously mentioned methods of deception. *Prasophyllum* and *Microtis* species are known to produce nectar offerings which is often why they are seen with a plethora of insects exploring the flowers[1]. These species may be pollinated by a number of different insect species. Below are several members photos of a variety of insects on these food rewarding orchid species.

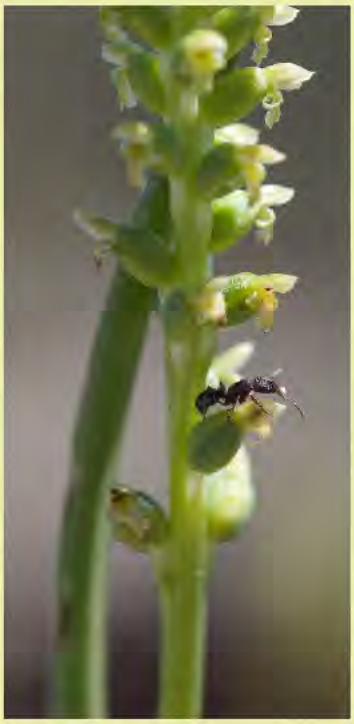


Image by Jeremy Storey – *Prasophyllum brownii* with Red Spotted Jezebel Butterfly

Image centre by Mick Hurdus – *Microtis sp.*

Image top right by Nathan Piesse – *Prasophyllum giganteum*

Image bottom right by Brian Trainer – *Prasophyllum sp.*

Thanks to Andrew Brown for providing me with several journal articles to read through on this topic to help piece together some simplified information to share with the membership. Native orchid pollination is a massive topic to cover within a short bulletin article and there are many more fascinating details yet to be uncovered about the interaction between insects and orchids. Keep watching for insects as you explore this season as you never know what interactions you may witness and keep taking these amazing images to share with members.

References:

1. Orchids of South-west Australia, N. Hoffman, A. Brown and J. Brown. Fourth Edition. 2019.
2. Stoutamire W. Wasp-pollinated Species of Caladenia in South-western Australia. Australian Journal of Botany. 1983, 31.
3. Phillips RD, Scaccabarozzi D, Retter BA, Hayes C, Brown GR, Dixon K and Peakall R. Caught in the act: pollination of sexually deceptive trap-flowers by fungus gnats in Pterostylis (Orchidaceae). Annals of Botany 2013.
4. Kuiter R, Findlater-Smith MJ. Overview of Pterostylis Pollination (Orchidaceae) in Victoria. Aquatic Photographics. July 2017.
5. Bower C. Pollination of the Small Duck Orchid, Paracaleana minor: Flower Structure and Function. The Orchadian, Volume 17 Number 11.
6. Xu H, Bohman B, Wong D, Phillips R, Pichersky E and Peakall R. Complex Sexual Deception in an Orchid Is Achieved by Co-opting Two Independent Biosynthetic Pathways for Pollinator Attraction. Current Biology 27, 1–11, 2017.
7. Bohman B, Phillips R, Menz M, Berntsson B, Flematti G, Dixon K and Peakall R. Discovery of pyrazines as pollinator sex pheromones and orchid semiochemicals: implications for the evolution of sexual deception. New Phytologist 203, 2014.
8. Phillips R, Bohman B, Anthony J, Krauss S, Dixon K and Peakall R. Mismatch in the distribution of floral ecotypes and pollinators: insights into the evolution of sexually deceptive orchid. Jan 2015.
9. Scaccabarozzi D, Cozzolino S, Guzzetti L, Galimberti A, Milne L, Dixon K and Phillips R. Masquerading as pea plants: behavioural and morphological evidence for mimicry of multiple models in an Australian orchid. Annals of Botany. 1-13, 2018.
10. Brown A, Western Australian Orchids – masters of deceit.
11. Gaskett A, Endler J and Phillips R. Convergent evolution of sexual deception via chromatic and achromatic contrast rather than colour mimicry. Evolution Ecology. September 2016.
12. Reiter N, Freestone M, Brown G and Peakall R. Pollinator by sexual deception of fungus gnats in two clades of *Pterostylis*. Botanical Journal of the Linnean Society, 2019, 190.

Question Time!

This section is for any burning questions members may have in regards to Western Australia's native orchids. Questions can be simple or complex, there is no minimum standard and the authors are kept anonymous. I'm eagerly awaiting submissions from members again this year and will do my best to provide as accurate answers as possible with help from the experts as required. Answers will be published in the next edition of the bulletin.

Last month's question:

Why don't *Pterostylis* species generally flower prolifically after a summer burn?

Thanks to Andrew Brown for assisting with this answer.

Bush fires have not been found to stimulate flowering in the *Pterostylis* genus. However, for many species, it also does no harm, meaning that they will still flower regardless of the fire. For other species of *Pterostylis*, fire can be detrimental as these species typically have their tuber in the shallow litter layer and a fire can kill them if it is hot enough to burn through the layer. The same applies to other Genera that have taxa with tubers in the litter layer, i.e. some Corybas, Cyrtostylis etc. Fortunately, the majority of these taxa are clonal and you only need a few to survive for a colony to quickly re-establish.

This month's question:

What is the average lifespan of an orchid in standard conditions without human interference?

Please send any questions / responses to wanoscg.newsletter@gmail.com. Looking forward to your contributions!

Image left by Annie Bowerman - *Caladenia excelsa,* Image top centre by John Ewing - *Caladenia erythronema,* Image bottom centre by Brian Trainer – *Cyrtostylis huegelii* and Image right by Krystyna Rees – *Diuris pulchella*.

Bulletin Articles

Please send Bulletin contributions to the Editor – Rachel Halls at wanoscg.newsletter@gmail.com