



Isopogon & Petrophile *Study Group*

Newsletter No. 35

October 2024

ISSN 1445-9493

Website https://anpsa.org.au/study_group/isopogon-and-petrophile-study-group/

STUDY GROUP LEADERS

Catriona Bate & Phil Trickett

Email: isopetstudygroup@gmail.com



He's the King of the Castle! *Isopogon anemonifolius*, October 2024. Photo: Karlo Taliana.

Karlo notes: 'This photo was taken on the long weekend at Picnic Point within the Georges River National Park in south-western Sydney. This species is very common in this area along with *Petrophile sessilis* and *Petrophile pulchella*. It also just so happens to be the floral emblem of my local APS Group – Harbour Georges River. The skink was perched on the highest flowerhead of one shrub about 2 metres above the ground ...so it was a long climb to the top although I'm unsure why it was resting there. Regardless, it had a great vista and kindly allowed me to take some snaps.'

Issues of the *Isopogon & Petrophile Study Group Newsletter* are available at
<https://anpsa.org.au/newsletter/isopogon-and-petrophile-study-group/>

Exchanging cuttings & seed

This is a way to share propagation material between study group members. All States apart from Western Australia allow material to be mailed from NSW. If you would like to be sent cuttings/seed (may vary for seed-only requests):

1. Email us to check that material is currently available. NB: cuttings are more plentiful than seed. (isopetstudygroup@gmail.com).
2. Once availability is confirmed, purchase a prepaid **EXPRESS POST** satchel from Australia Post, self-address it, put in an envelope and send to:
Isopogon & Petrophile Study Group
PO Box 291
ULLADULLA NSW 2539
3. We will then package up your cuttings/seed and send it back to you **Express Post**.
4. An email will be sent to you on the day the package is mailed so that you can be ready to propagate as soon as the parcel arrives!

Species currently available are:

Isopogon – anethifolius, anemonifolius (1.5m or 0.3m size), axillaris, ‘Coaldale Cracker’, cuneatus (shrub or dwarf coastal form), dawsonii, divergens, dubius, formosus, latifolius, linearis, mnoraifolius, nutans, panduratus ssp. panduratus, panduratus ssp. palustris, spathulatus, ‘Stuckeys Hybrid’, trilobus

Petrophile – acicularis, clavata, diversifolia, ericifolia, glauca, linearis, pedunculata, recurva, sessilis, shirleyae, teretifolia

We need to expand the available species list to include all species growing in members' gardens. If you can provide material from other species, please let us know so we can add them to the list.

IN THIS ISSUE

Editorial

[From our members](#)

[Prunings](#)

[The fabulous Frankland formosus](#)

[Extreme dry hits WA](#)

[Growing *Isopogon* and *Petrophile* on heavy clay](#) – John Knight
[Coaldale Cracker: cracking the cuttings code](#)

PROFILE – [Isopogon spathulatus](#)

PROFILE – [Petrophile cyathiforma](#)

[On show this spring at Little Forest](#)

[Native bees in the pollen](#) – Phil Watson

[WA field trip report: a different story north and south](#)

Financial report

Dear members,

What an amazing shot of Karlo's on our cover! That little skink must have thought he'd found the perfect spot to bask in the sun, goodness knows how he got up there! Perhaps he thought by curling himself around the flowers that he would be hidden from predators overhead – let's hope there were no raptors or the like around that day. Karlo and his little friend aren't the only ones noticing *I. anemonifolius* at the moment. Our newsletter has several other wonderful specimens to admire.

On the subject of critters, did you know that the native bees responsible for pollinating isopogons and petrophiles are pollination superstars? In this issue Phil Watson gives us a rundown on the unique abilities and adaptations our native bees have developed to meet the challenges associated with pollination of Australia's unique native flora. These pollen and nectar addicts do an amazing job, and some have evolved specialised abilities such as the capability to scrape the pollen from the style ends of isopogons and petrophiles.

Extreme weather continues to be a challenge for growing isopogons and petrophiles around the country. Here on the NSW south coast the endless rain seems to have come to an end for now at least, relatively dry conditions being relished by the natives in our garden. It's a different story in Victoria and South Australia where members are reporting dry conditions never seen before. What is so dire about this situation is that these regions are now moving from what should be their rainy season into their dry season, meaning that plants that are struggling now will find it even more difficult to survive the hot summer conditions ahead. In southwest Western Australia,

the unprecedented dry and hot summer was followed by very late winter rains. This gave some respite although many plants in the bush didn't make it and the implications for the future are a real concern. See our article on the situation in WA in this issue.

As usual, we have been out and about spreading the word on I&Ps as well as doing research. In April we were in Melbourne to give a talk to APS Melton & Bacchus Marsh group. They had an amazing raffle – somehow they had sourced a lot of wonderful isopogons from local nurseries as prizes for the lucky winners. Unfortunately we were not among them! In early August we had a captive audience in the desert off the Tanami Track at Desert Discovery. In the Botany team we dealt with an entirely different range of plants during the day, but one night we were able to teach the wider group of fauna, bird, insect and desert experts something new. They even seemed to find isopogons and petrophiles pretty interesting! In late August we headed off for our usual I&P fieldwork in WA. See Phil's article in this newsletter for a taste of the wonderful plants we found there this year, a welcome antidote to some depressing sights following the big heat and dry. One of the discoveries is exciting enough to merit its own article – see our article on the Frankland Formosus to find out what all the fuss is about.

The range of isopogons and petrophiles in our garden here on the NSW South Coast has been growing steadily thanks to Phil's progress on grafting, plus some valuable additions thanks to fellow I&P grafter Tony Henderson. We have lost some larger and older specimens but the new additions cover a range of really exciting species which have been putting on a small scale but impressive display. These plants have thrived despite total neglect from us for months this year as well as extreme winds, marauding wombats and inquisitive bandicoots. In this issue, Phil has picked out some highlights for you. Despite the current sorry state of the rest of our garden, SG members are always welcome to come see the I&Ps. John Knight has also been working on expanding his range of isopogons and petrophiles on a steep hillside of heavy clay at Batemans Bay. Take advantage of his horticultural experience by noting the tricks he has tried in his article in this issue.

Speaking of tricks, we seem to be collectively sorting out the trick for propagating cuttings of *Isopogon* 'Coaldale Cracker'. This is the attractive natural hybrid that is a beaut, tough plant in the garden as well as an excellent stock for grafting WA isopogons. Read the update from members in this issue.

Our profiles this issue include an isopogon and a petrophile that are opposites in some ways. *Isopogon spathulatus* is a fairly common isopogon with flat leaves and pink flowers. *Petrophile cyathiforma* is less common with cylindrical leaves and yellow flowers. *I. spathulatus* is a species with much variation and a range of forms; *P. cyathiforma* is much more circumscribed but part of a wider set of petrophiles with similar attributes. Both reach a height of about a metre and occur in Western Australia.

Catriona and Phil

From our members

Graeme Downe, Endeavour Hills VIC

Have had a long interest & involvement with Australian natives, especially Proteaceae, with *Telopea* my particular focus. Being so closely related & spectacular, have always loved isopogons with only a peripheral touch on *Petrophile*. Was an original member of Isopogon Study Group but got "lost" for a while & pleased to be back. Have grown, enjoyed & lost a large number of Isopogon over the years; still have 3 Eastern state varieties plus *latifolius*, *baxteri*, *formosus*, Stuckeys hybrid. Would like to graft a few plants for better longevity. Check out Newsletter 18 for a step-by-step guide to grafting (it's basically the same process using cuttings or seedlings as the stock). Newsletter no. 34 summarises known stock/scion combinations.

Alan Lacey, Melbourne VIC

Disappointment & frustration has prevented any earlier correspondence! I have completed many failed ISO/PETS--- so confession can now follow:--I have failed miserably in all attempts to propagate from material you kindly sent late last year. In review: I killed with "kindness" - much too wet. I have since successfully used your suggestions about propagating mediums (Perlite/Peat). I hate being defeated---so will try again! [Sorry to](#)

hear about your propagation disappointments Alan. I have had wipeouts as well. We can send you more material whenever you are ready to try again. Certainly, too wet cutting mix is to be avoided. The use of perlite reduces the risk of this happening. I know top nurserymen who use a 7 perlite to 1 cocopeat mix.

Tom Gleeson, Orange NSW

Hello from Orange NSW. I took a photo (right) of this beautiful *Isopogon anemonifolius* recently in the Blue Mountains. I was walking along the track to Lockley's Pylon, overlooking the Grose Valley. *Isopogons* were flowering nicely.



Susan Ehrenberg, Bullengarook VIC

I live in Bullengarook Victoria and I haven't had much success growing the ones available in nurseries. After hearing your talk at Melton, I would like to try the hardier ones like *I. anemonifolius*, *I. Coaldale Cracker*, *I. anethifolius* and *I. cuneatus*, *P. pulchella*, and *I. dawsonii* with the view of grafting others in the future. I did enjoy your talk and hopefully it will be possible to get some cutting material from the study group.

Kevin Collins, Mount Barker WA

May 2024: [South of] Collie we found an *Isopogon* in an extensive area around the southern & eastern side of a water catchment dam. (Mungallup Dam). Although it is a little further south than its normal range, it looks like it is *Isopogon pallidus* (previously *I. sp. Darling Range*). This species (pictured below left) is rarely photographed and only recently named, so great detective work Kevin!



October 2024: At the conference we visited Chris Larkins' garden in Melbourne, [saw] *I. anemonifolius* and *I. anethifolius*, (pictured right). Also saw *I. ceratophyllus* in bloom at Anglesea on our field trip.



Pete Bredell ACT

I recently grafted a batch of *Isopogons* (*formosus*, *dubius*, *cuneatus*) onto the rootstock you brought me, and while it is still too early to gauge final success, it looks like almost all will take.

Miriam Ford, Hurstbridge VIC

Another extraordinary issue. I look forward to reading it properly on my travels to different DGs in the state over the next few months. I have several species growing well in pots now propagated from cuttings you have sent (including *Coaldale Cracker* - I will look out for it in the shops as well) and I hope to report on those sometime later in the future, once the conference is over.

David Lightfoot, Surrey Hills VIC

Germination excitement in Surrey Hills! The first *Petrophile helicophylla* seeds have begun to germinate with a tap root appearing on two seeds using the wet paper towel method. The *Isopogon alcicornis* in the same method are swelling and fingers crossed for roots soon. The other two methods were jiffy preforma plugs in the shade house and direct seeding into seed raising pots. Nothing obvious from them, but even if they are at the same stage as those above I wouldn't see anything yet. Now the difficult balance of too much vs not enough water!!! I'll keep you updated how things go. Thanks again for the seed.

Keith Finlayson, Armidale NSW

As a new member of the *Isopogon* & *Petrophile* study group my knowledge of growing I & P is very limited. In our

garden we have *I anemonifolius*, *I anethifolius*, *I Coaldale Cracker* and two forms of *I formosus* all growing on their own roots. They all have plenty of flower buds this year. I have been interested in propagating and learning to graft plants for a fair few years now. In May 2023 I grafted three *I cuneatus* onto *I Coaldale Cracker* cuttings. They were very slow to root. It took about 160 days for the roots to emerge out of the bottom of the pots. Maybe summer time is better for grafting in Armidale. They didn't put on much growth until the weather warmed up around Xmas time. One died a few months later but the other two are about ready to be planted in the garden as soon as the worst of the frosts have finished. I am now trying my hand at propagating some seed. I have *I mnoraifolius* and *P canescens* seed germinating. The next step is to try and pot them on. I look forward to growing more of these beautiful *Isopogons* and also adding some *Petrophiles* to our garden. A group of Armidale APS members were fortunate to watch Phil demonstrate his grafting skills when he came to Armidale in April. A big thanks to Phil and Catriona both for all the work they put into the great newsletters.



Darren Allen, Pokolbin NSW

I can finally report some success with the *Isopogon* cutting grafts using *I dawsonii* as a rootstock. I've attached a couple of pics.

Left, *I. axillaris*, right, *I. panduratus* ssp *panduratus* (both grafted on *I. dawsonii*).

Last September I took about 10 cuttings of *I Candy Cones* and whilst all are still surviving in the pots, some with foliage growth, there are no roots on any as yet. I did the same exercise in April this year and the majority are now



growing well with good root systems. Probably very little science in this but

just an observation. I've attached a photo of a September 2023 cutting (right) vs an April 2024 cutting. What a difference! Some people only propagate at certain times of year as they feel this is when their results are best. This varies according to location. If there were no other differences in treatment, it is possible that summer conditions in your area slowed root formation in the Sept 2023 cuttings.



I have attached a photo of a plant I found at the APS sale in Newcastle maybe 2022. It was labelled *Petrophile biloba* (see left). It flowered recently but with a small cream coloured flower in the leaf axils, which doesn't look like any of the *P. biloba* flowers I've seen. Could you ID please? This is *Petrophile squamata*. The leaves are similar to *P. biloba* which is probably where the confusion has arisen. We have also noticed this erroneous identification which seems to have crept into the nursery trade recently. Both species seem to be relatively difficult to propagate so let us know how you go with this plant.

Now that I have grafts that appear to have taken, is there any special care tips and how soon can they go in the garden? With cutting grafts it is important to provide conditions to allow a good strong root system to develop. I would grow them on in pots until they produce a well-developed root system. Also ensure they are not exposed to any extreme weather over the next couple of months while the stock is developing this stronger root system. And don't overwater while this process is occurring.

Tony Henderson, Engadine NSW

Over the last couple of months I've been busy grafting various varieties of *Petrophiles*. As usual I ran out of root stock. Nevertheless, I managed to graft for the first time *P. globifera*, *P. helicophylla*, and *P. juncifolia* using seedling scions. The other species I've grafted include *P. carduacea*, *P. juncifolia*, *P. merrallii*, and *P.*

scabriuscula. I've also grafted *P. anceps* and *P. brevifolia* subspecies *rosea*, which I had to interstock. I've just grafted the material Phil collected on his last trip to WA, so in another two weeks I should know whether he wasted his time on my behalf. Also, the seeds he collected on that trip are germinating, so I'll get another chance to graft if the current ones fail. [Next issue I will provide an update on Tony and my grafts from the recent WA trip, as well as a further update on Tony's great results above.](#)

Right: Peter Olde sent this photo of one of Tony's grafts, *Petrophile linearis*, flowering in his garden right now.



Prunings

Attracting attention: *Isopogon anemonifolius*

The exotic anemones this species is named for are lovely flowering plants, but the name refers to a resemblance in the leaves. The flowers are very different but no less appealing. This year, they are putting in a special appearance in gardens. In ours, we have several different forms and all are looking especially good at the moment. Our favourites are the low forms which are more rounded and dense in terms of foliage, with prominent and well-spaced flower heads. Denise and Graham Krake at Brogo NSW have another lovely form which is a bit larger than ours. It is growing happily in part shade.



Above: *Isopogon anemonifolius* in the Krake garden at Brogo NSW, October 2024.

Right: *Isopogon* 'Sunshine' at its best! Caption and photo: Native Plant Wholesalers.

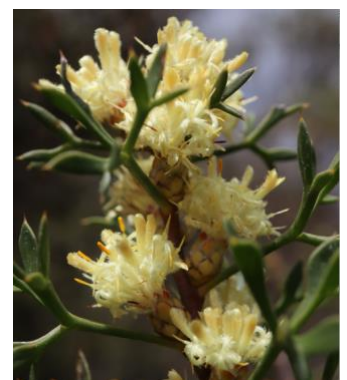


Native Plant Wholesalers sell a cultivar called 'Sunshine'. Their plant is looking so good they couldn't resist boasting about it online recently. This cultivar has mostly undivided leaves and is a bit more fussy than other forms, but as you can see, well worth the effort.



Biloba or squamata?

Take note of Darren Allen's report on the mislabelling around in the nursery trade at the moment. It's causing confusion for people wanting to grow the beautiful *Petrophile biloba* (left). Plants of *P. squamata* (right) are being erroneously sold as *P. biloba*. The species both have propeller-like leaves. If like us you have bought one of these, don't despair – *P. squamata* is a lovely species and so hard to get that you have struck gold. Unfortunately, it does not have the pink colouring of *P. biloba* so valued by the nursery trade.



The Don and Joy Williams Nature Reserve

It is hard to believe, but Don and Joy Williams have finally hung up their hats at Hi Vallee Farm near Badgingarra WA. We have often featured Hi Vallee in this newsletter – it has a record 7 species of isopogon and 13 species of petrophile among an amazing array of kwongan species preserved by Don and Joy for many decades (see our article in NL20). The new owners have named the untouched bush block "The Don and Joy Williams Nature Reserve". It was officially opened and a sign unveiled at the property on 21 September. Our understanding is that you will still be able to visit the reserve, which will be protected and used for research.

An unexpected bonus at the Banksia Farm

Some people think the banksias are the best plants at the Banksia Farm in Mount Barker WA. Others prefer the dryandras. What they don't expect to find there are isopogons and petrophiles! But we are worming our way in via the good offices of study group members Kevin and Kathy Collins. Not only do they have a good collection of young isopogons and petrophiles at the Banksia Farm, but there are even more coming on in the propagation area. Hopefully they will do well enough to graduate to the garden to join the I&P plants already flourishing there. At the Open Day plant sale in late



August, there were even some I&Ps for sale at the Banksia Farm. The handful of species, propagated by Kevin Collins and Erica Shedley, will not be found on sale anywhere else in Australia. What a find for the lucky buyers. The plants on sale included different forms of *I. spathulatus*, a form of *I. longifolius*, *I. attenuatus*, an unusual form of *I. cuneatus*, and *P. filifolia*.

'Pixie Mops are so hot right now'

Pixie Mops (*Petrophile linearis*) is the most loved and best known petrophile, and it's not just because of the cute common name. Every year about now when flowering hits its peak, there are new converts on social media, blown away by their beauty and asking what they are. Fans rave on about how this is their favourite plant: 'This has to be one of the most gorgeous flowers out there'. It's the photographer's favourite and there are some stunning photos appearing online.

'As the temperature rises, out come the pixie mops – like fuzzy pink QTips!!'



When you realise that I&Ps rarely appear on social media and are little known, this little rush of interest (a handful or so sightings) is significant. Every year this species elicits the same passion. It is the celebrity of the I&P world, and, like most celebrities, the fame lasts for just the few weeks in late spring they appear. Once a year, they make I&Ps almost as glamorous as banksias, grevilleas, eremophilas, waratahs, orchids, fields of daisies, wreath leschenaultia....

Left: Specimens in the WA bush right now. Photos: Ed Bourne, Facebook

This year seems to be a particularly good one, with more online posts than usual. Here in the east, we are used to having trouble sourcing and growing this spectacular species. But even the WA locals are having difficulty. One frustrated person asked Kings Park and was told that they have tried everything to propagate them but no luck. Others are asking where to buy it and best advice given is that some WA nurseries (Zanthorrea, Muchea or Bunnings) occasionally have it. The failure of nurseries to stock I&Ps is our perennial gripe, but this is one species it's worth putting in the effort to source and grow yourself.

This is definitely a fussy plant but as John Knight says, having a favourite but fussy plant survive for a few years is worth the effort. As the Facebook posters know, the prize is the knockout, numerous flowerheads. Out of flowering season, it tends to blend into the background. It needs excellent drainage; avoid watering it in summer. It would be best in a container. If you are trying grafting, it's worth having a go at this one – even though there's the extra step of an interstock, the potential rewards are fabulous. It can be propagated – it grows well from cuttings, and grafts well on *P. pulchella* using an interstock of *P. teretifolia*.

Expectations fulfilled

Last newsletter we showed you the extraordinary number of buds on one of our *I. cuneatus* plants. It didn't disappoint – the only disappointing thing was that we weren't home enough to appreciate the pink explosion beside our deck. Here is the plant (right) still flowering four months later. That's after several flushes and non-stop flowering all the way through winter. This plant has already been pruned right back to less than half the size to ensure another bountiful season next year. There were so many stems I tried to cut some right out to allow for more air circulation given that some of the leaves are now showing signs of spotting and disease. We will see how it goes next year.



The fabulous Frankland formosus

This magnificent isopogon caused much excitement among our group of proteaceae lovers in WA recently. Margaret Pieroni, who often finds isopogon and petrophile specimens alongside the dryandras she studies, took Neil Marriott over to the Frankland area near Mount Barker where there are excellent specimens of *Dryandra subinnatifida* var. *imberbis*. This isopogon grows nearby and Neil was so impressed with it that he took many photos (see overleaf) and he was quick to show them to us when we ran into him soon afterwards. We were all amazed by the size and intense colour of these flower heads. There were so many on each bush it made for maximum impact.

Margaret Pieroni has long told us about a wonderful isopogon she found near Frankland, which is on the other side of the Albany Highway west of Stirling Range National Park. She first sent photos in 2015. It was a bit of a mystery as it had mostly undivided leaves and pink flowers like *Isopogon divergens*, which however, occurs further north (from Kalbarri over to Lake Grace).

The identity of this mystery isopogon was clarified in a paper published by Rye & Hislop in 2017. The isopogon was in fact *Isopogon heterophyllus*, a species first described by Meisner in 1845. Similar to *Isopogon formosus*, it had less divided leaves, sometimes simple and sometimes divided only towards the apex but not divided as extensively as in *I. formosus*. It appeared to mostly occur in the Stirling Range and adjacent areas. Similarities between *I. heterophyllus* and *I. formosus* had long caused confusion between the two and taxonomists Rye & Hislop found that there appears to be a complete intergradation in terms of leaf morphology as well as an overlap in distribution. Based on this, they concluded that *Isopogon heterophyllus* should be reduced to a

synonym of *I. formosus* subsp. *formosus*. Therefore, Margaret's isopogon could be now accurately identified as a form of *I. formosus* with mostly undivided leaves (previously *I. heterophyllus*).

This form is only one of an array of different forms of *I. formosus*, a species with much variation. Only one is formally recognised as a subspecies (*I. formosus* ssp. *dasylepis*). Leaves vary considerably: thick or slender, stiff and sharp or soft, dense or open foliage, rounded or more linear foliage. Flower heads can be large or small, deep pink or pale pink, terminal or axillary. There are also low or dwarf forms, as well as several cultivars including a hybrid. It grows in the south of Western Australia, in a near-coastal belt from Walpole north-east to Hopetoun and from Dalyup east to Cape Arid National Park, with subsp. *dasylepis* found from the Busselton area east to Noggerup and south to the Scott River.

When Margaret took us to see the Frankland formosus for ourselves, we also found another population nearby. It was pouring rain, reminding us of the ability of *I. formosus* to withstand winter soaking, even temporary drowning. The foliage is soft, divided and undivided leaves occurring on the same stem. The tallest specimens were



around 1.5 m. Terminal flowers appear to be produced at a very early stage – even the youngest plants were flowering, with older plants displaying flowers on even the lowest stems. Later, in Stirling Range National Park, we found similar specimens on Red Gum Pass Rd. The flowers were the same and foliage similarly soft but with more divisions in the leaves.

The Frankland Formosus is so attractive we urgently need to get it into cultivation. It seems to be a fast grower and was doing well in disturbed soil at the edge of the road. Trials are needed to establish whether it is like the typical form in cultivation which is regarded as probably the toughest and most adaptable of the WA isopogons to cultivation, hardy given good drainage, and easy to strike from cuttings. Grafting is successful but requires an interstock of *I. cuneatus*. However, other forms from the wild are much more difficult to cultivate from cuttings. Hopefully the Frankland Formosus will be in the former category and then we can all look forward to growing it.

Extreme dry hits Western Australia

Last newsletter we reported on extreme heatwaves over the 2023-24 summer, WA's hottest on record. Around 90% of all isopogon and petrophile species occur in the southwest of Western Australia. They are tough plants well suited to their location, but all plants have thermal limits, and intense heat events slow growth and increase mortality.

On top of a record-breaking hot summer, there was an unprecedented dry spell in southwest WA. In fact, Perth recorded its driest ever six-month stretch between October and March. In April, the usual winter rains (which

last until August) did not eventuate. This followed four years of increasingly dry winters. Scientists reported that trees and other smaller plants had got so dry they died. As stressed plants ran out of water, several areas had swathes of dry and dying flora. This raised concern about the potential long-term effects on biodiversity should this lead to forest collapse. A forest collapse event is like coral bleaching but on land, and just like in the ocean, such an event can have serious implications for the wider ecosystem.

Rain was recorded in Perth on 25 May, but the rainy season did not start in earnest until June/July. On 1 May, Kevin Collins reported a few sprinkles of patchy rain around Collie, the first for many months: 'The forest is very stressed particularly on shallow soils. Ironically the bush blocks that were burnt in 2023 look lush despite the bare ground. Fascinating, must be the nutrient rich ash and the loss of obligate seeders decreasing the need for under-ground water.' The winter rains eventually came in late with a bang, Don & Joy Williams up at Badgingarra reporting that after eight long months without rain, they got a year's worth of rain in two months.

This late rain saved the day for local farmers – but what about the native flora? What are the effects of the prolonged dry, and what are the long-term impacts?

From the frontline, WA's beekeepers report disturbing developments. They say the heath (kwongan) hasn't flowered like normal this year. Plants are flowering later and have fewer flowers or none at all. Even plants that flower are showing signs of stress, with dry flowering without pollen or nectar. Bees are struggling, an ominous sign for species codependent on certain native bee species like isopogons and petrophiles. Even more worrying, if honeybees are an indicator of habitat health, everything will be under similar stress. Margaret Pieroni, who has observed WA wildflowers for decades, reports a delay in flowering near the south coast, assessing it at about three weeks.

In late August beekeepers raised Ravensthorpe as an area where flowers are not as good as they should be. In late September, the Moore Catchment Council (representatives from shires directly associated with the Moore River catchment and drainage system stretching from Perenjori in the northeast to Gingin in the south) reported widespread flora deaths north of Perth. In a Facebook post they commented: '...not a flower to be seen and dead vegetation throughout. Right now the Midwest Kwongan heathland should be ALIVE and a riot of colour with ... Banksias, Hakeas, Grevilleas, Petrophile, Calothamnus, Balgas, and Verticordias galore. I've driven past thousands of hectares looking exactly the same. Should we be worried? Damn right we should be! It's ecological collapse, which will directly affect us in so many ways.'



Browned off: dead vegetation in the Moore River catchment area north of Perth.
Photo: Moore Catchment Area, Facebook, 26 September 2024.

Unfortunately, we can confirm plant mortality in the Moore River area. On our recent field trip, we were shocked to observe the poor condition of plants in the Koodjee Nature Reserve near Gillingarra with perhaps 80% dead, the worst we have ever seen this reserve. *Petrophile plumosa*, a Priority Three species, had some plants in bud but many were dead. *Petrophile biternata* (also Priority Three) plants were mostly dead. An

unusual form of *Petrophile brevifolia*, tall with thick stems and leaves plus a one-sided pollen presenter, had some buds but many plants were dead. This species was dropping a lot of seed, bad news for the chances of future germination with the hot and dry summer not far away. The only I&P species to survive in reasonable condition was *Petrophile heterophylla* which was putting on a good display.

Sadly, another area where we observed significant plant mortality was much further to the north beyond Geraldton, in Kalbarri National Park. Ironically, the recent rains there had been so extensive that water was still lying over the main road which bisects the park. Here, the extent of the damage was worst in certain parts with some areas of total collapse, particularly towards the eastern part of the park. In the vicinity of the Hawks Head Road turnoff we found *P. pilostyla* ssp. *pilostyla* (pictured right), *P. foremanii* and *P. conifera* ssp. *conifera* mostly dead, *P. semifurcata* all dead and *I. divergens* in very poor condition. Further west (towards the Loop Road) we saw some good patches of *P. foremanii* and *P. conifera* ssp. *conifera*. Only one plant of the latter species was in flower, and it was no surprise that this plant was on the edge of the road almost on top of a rain puddle. In better news, a section near the Loop Road pay station was recently burned and the rains had arrived in perfect time to help plants of *P. shuttleworthiana* bounce back spectacularly from lignotuber.



In between these two areas around Badgingarra and Eneabba, the effects of the long heat and dry were mixed. While many species were doing well, we did find dead or stressed plants not previously observed on trips over many years. *Petrophile axillaris* grows in ones and twos and the few we saw this trip were mostly dead. In one population of *I. panduratus* ssp. *palustris* in swampy habitat near Jurien Bay, the largest plants furthest south were dead or in poor condition. On Tootbardie Road, a large patch of massed *P. biternata* (Priority Three) was 90% dead and dropping all its seed. This seed dispersal timing just before summer is the opposite to normal and there is little prospect of any surviving long enough to reproduce the population. Further along, in some patches of massed *P. chrysantha* up to 50% were dead while elsewhere others were flowering impressively. On Garibaldi-Willis Rd, plants of a low form of *P. brevifolia* were not flowering at all this year, with flowers mostly aborted and remnant flowerheads rotting. On the Hi Vallee property most plants were thriving except for one patch where most of the *I. adenanthoides* were dead and another where *P. chrysantha* plants were struggling, although this species was doing very well elsewhere on the property. A little further north, on the corner of Hydraulic Road where *P. globifera* is usually found, the flora was in very poor condition and only a single dead *P. globifera* could be found. Passinto Rd (Wilson Nature Reserve), usually an I&P highlight in spring, had no I&P species in flower. Closer to Eneabba we managed to find *I. tridens* (right), but the plants were stressed and in poor condition or dead. In one location we counted about 8 dead specimens and only two live ones.



Happily, the condition of the flora was generally better the further south we travelled. The only exception was very old plants of *I. trilobus* dead on Lake Magenta Rd off the South Coast Highway, which could have simply been due to old age. We did not travel as far as Ravensthorpe – perhaps others can comment further. Our observations were sobering, and we are hoping that there will be some years of respite from climatic extremes to give plants and habitats a chance to regroup – to what extent that is possible is anyone's guess, and something we will be monitoring.

Growing *Isopogon* and *Petrophile* on heavy clay soil

John Knight

Following disappointing attempts to grow I&P's in our naturally heavy shale based soil, I have over the past 2 years experimented with various soil mixes to overcome drainage issues.

Due to the steep slope of our block, with a south-east aspect, raising the soil profile to improve drainage has proved impractical. So I have turned to open ended plastic pipe containers, varying between 250mm and 500mm deep, and trialled a few soil mix variations before settling on my currently preferred mix.

- our garden soil with its bits of broken rock included (2 parts),
- coarse sand/10mm metal (1 part in a ratio of 3:1),
- and coarse woody potting mix e.g. Osmocote Premium(1 part), or even recycled mix
- with a couple of handfuls of Gypsum and a sprinkling of activated charcoal to each wheelbarrow load.

As our block does not have ready access to the garden, all material has to be physically carried to site. Age and weary bones dictate that the materials are ferried down in 30 litre plant pots, and my builder's barrow can easily accommodate 4 of these filled pots with plenty of room to mix the components with a long-handled spade. In another life, and much younger, it was common to use large terra cotta pipes, with diameters up to 1m., and cut into lengths from 150mm to 2m., whilst the pipe was still green (that is before the clay had hardened with curing). These proved very successful and many APS members in Victoria still have some of these treasures in their gardens. No doubt concrete pipes would also serve my purpose, but are much too heavy to get onto site in the garden.

In preparing the site where the containers are to be placed, the ground is simply levelled and the soil loosened but not removed. As the containers are open-ended, water can drain into the sub-soil over time and ensure that the mix in the container is not water-logged.

The soil mix is firmed in the containers and watered heavily, then left for a week before planting. This ensures that the soil settles and remains at the desired level. Then, plant, top the soil with pea gravel for aesthetics, and to prevent soil/leaf contact, water in with Seasol or similar and be astounded by the results. As the mix contains 50% soil, I prefer not to fertilise until I see what progress the plants make, and in some cases it is too vigorous. So far the containers have required watering only every 2 – 3 weeks in cooler weather and not at all in the depths of winter, and never more than weekly even in the hottest months. This is a distinct advantage over plants growing in 100% potting mix.

Although only 2 years have elapsed since the first plants were added, most of these difficult to keep alive plants, (in my natural soil) have survived. Here's hoping that the future remains bright. Happy plants include *Isopogon formosus*, *I. formosus x latifolius* ('Candy Cones'), *I. cuneatus x buxifolius* ('Stuckeys hybrid'), and *Petrophile filifolia*, propagated by Phil in May 2021 and donated to my experiment. As the photo (right) shows, this plant is very happy and growing vigorously in a 300mm deep container. *I. dubius* grew too well and blew out of its container in a freak wind event.



Not all isopogons need to be in containers, and *I. 'Coaldale Cracker'* is just that, now 1.5m high and flowering prolifically, and forms of *I. anethifolius* and *I. anemonifolius* are quite content with natural soil conditions. And my favourite, *I. prostratus* collected from the high country west of Batemans Bay has performed reliably. One plant is over 10 years old and a more recent planting, 3 years ago is flowering brightly in a sunny front garden.

If one wishes to consider using above ground containers, recycling some 30 or 45 litre pots, removing the base to provide access to the soil below is a viable proposition, although I am unsure how many years they might last. (Older pots have thicker walls than the more recent productions, and these are worth seeking out. The local recycling centre might be worth a try.)

But surely having a favourite, but fussy plant survive for 3 -5 years is worth the effort. I prefer not to use 100% potting mix as it will break down over time, and require replacement, which action might be detrimental to the health of the plant you are striving to grow successfully. I am sure others might like to try making a suitable mix using soil from the garden, and let Phil and Catriona know of successes. But don't use the soil from the veggie patch, which may have too many nutrients for our diverse flora.

Coaldale Cracker: cracking the cuttings code

In NL33 I provided some tips on how to reliably strike *I. 'Coaldale Cracker'* from cuttings, following some feedback from members who found the process difficult. The most important tip I provided was to use young, even soft tippy material, not thicker, older material. I was very pleased to hear much improved results from a couple of our members.

Darren Allen: I took your advice on propagation of *I. Coaldale Cracker* and I'm now able to strike it from the growing shoots, but it is still a bit hit and miss for me. In your article it sounded like you propagate in communal pots? with the perlite mix whereas I'm still using individual tubes or one cutting per cell for propagation, so maybe that is a consideration? [I use 20 mm peat plugs just like Pete Bredell below. These are very convenient and avoid any transplant shock if you use cutting mix. But you should still expect very high success rates using cutting mix – well over 50%!](#)

Pete Bredell: Phil, just wanting to say thanks for the tips on how to propagate *Isopogon 'Coaldale Cracker'*, both your verbal advice and the Study Group newsletter with the detailed info. I was obviously using material which was much too thick and old, because doing it with the very thin fresh material you suggested, in Jiffy plugs, has yielded c.100% success, as opposed to the dismal lack of success I was having. I see now why you were so incredulous about me saying I was struggling with it!

Isopogon spathulatus R. Brown (1830)

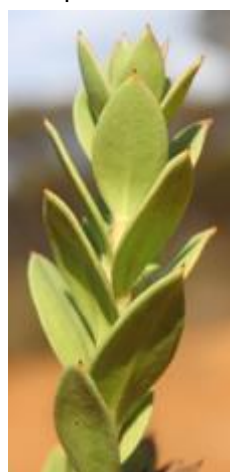
The species name is from the Latin meaning spathulate or spoon-shaped in reference to the leaves. The type specimen was collected by William Baxter, an English gardener, in 1829 on a collecting expedition east from Albany along the south coast of Western Australia.



Description – *Isopogon spathulatus* is an extremely variable species, growing up to 1.5 m high and 1.5 m wide, but generally much smaller. It does not have a lignotuber. It has abundant leaves, usually arranged in a regular, symmetrical fashion. The leaves are flat, entire and glabrous between 10-70 mm. Leaf colour ranges from lime green to olive-green to grey-green. Leaf width and shape varies considerably, from narrow (linear), to widest at the middle (elliptic) or end (obovate). The thick, smooth leaves are not prickly but have a defined point. Young leaves may be pink or have a red/pink margin and a pink point. They are often very crowded, particularly around flower heads, and even on flower heads. The relatively

large, dark pink or yellow involucral bracts are thus largely hidden when in flower, as are the large floral bracts. Flower heads are numerous, mostly terminal but in some cases axillary along the upper portion of the stem. Some plants have several flower heads grouped together while others have solitary flower heads. Delicate long flowers up to 20 mm long, poke out from among the leaves. They are usually pale pink with a darker pink limb and distinctive tuft at the top. Each tepal peels back only a short way into a reverse S shape, and collectively the open tepals form an elegant, symmetrical arrangement made prominent by the deep contrasting colour of the open anthers (white with a dark burgundy background). The small cones are ovoid to globose, between 6-11 mm diameter, with the fruit around 3 mm in length. The woody core remaining after seed dispersal is very small, only a small dome or bump remaining in the centre of the old bracts and surrounding leaves.

Recent analysis has helped to clarify taxonomy, resulting in three subspecies. **Subsp. *spathulatus*** (right) has the shortest and narrowest leaves (usually less than 25 mm long). Stems can be thick and ridged. The smaller the leaves, the more densely crowded they are. Leaves crowd around the flower head and often several inflorescences group together into a conflorescence. In this case the spent flowers tend to persist, their shrivelled, white and fluffy parts simulating actual flowers. Pollen presenter is short with a somewhat truncate or squared off base.



Subsp. *obovatus* (left) has wide and short leaves with a clear centre rib, to around 30 mm in length, widest at the middle or end. Can grow tall and spindly in thick mallee woodland understory.

Subsp. *elongatus* (right) has the longest leaves, hence the name *elongatus* meaning lengthened (elongate). The leaves are relatively narrow and always widest towards the tip, tapering to the base. They are very variable in length, ranging from 25 to 70 mm long. Its pollen presenter is also longer, usually with a distinctive constriction. This subspecies is also the most common.



Right: Varying leaf sizes in *subsp. elongatus* on Fitzgerald Rd, WA.

A dwarf form of *subsp. elongatus* occurs in the Fitzgerald River National Park. It has short, wide grey-green leaves up to 25 mm long with a prominent point, new growth characteristically pale pink later turning green with a pink margin and point.



Confusing species - *Isopogon spathulatus* is easily confused with *Isopogon buxifolius*. For 145 years, it was classified as *I. buxifolius* and taxonomic differences between the two species were not fully resolved until 2024. *I. spathulatus ssp. spathulatus* usually has longer, narrowly obovate (wider at the end, spoon-shaped) or linear leaves which are densely crowded whereas *I. buxifolius* has egg-shaped short leaves, usually broadest around the base or middle. *Isopogon spathulatus ssp. obovatus* can be very similar to *I. buxifolius* in terms of leaf shape (short and rounded, sometimes elliptic), but *ssp. obovatus* has longer leaves and a longer pollen presenter, and can also be taller. *Isopogon spathulatus ssp. elongatus* is broadly similar to *I. pruinosus*, however that species' leaves are wider with a distinctive pale bloom, and it occurs further north. *Isopogon panduratus* has similarly larger leaves but occurs much further north (north of Perth), lacks a tuft on the tip of the flower and also has a pale bloom on its leaves.

Distribution – *Isopogon spathulatus* is generally common in southwest Western Australia, extending from the southeast edge of Perth down to Busselton and eastwards to around Esperance. It grows in mallee woodland or heath in dry habitats; the typical subspecies is also found in winter-wet locations. The typical subspecies occurs in the northern and western parts of this range, *subsp. obovatus* in the centre and *subsp. elongatus* to

the east. Only *subsp. obovatus* is uncommon, recorded only in a restricted area around the Cape Riche area with scattered records from the south and east of the Stirling Range.



Distributions of *I. spathulatus* ssp. *spathulatus* (left), *I. spathulatus* ssp. *obovatus* (middle), and *I. spathulatus* ssp. *elongatus* (right).

Flowering period - Peak flowering occurs through the autumn/winter period but some flowers may be produced throughout the year.

Cultivation - Uncommon in cultivation. All subspecies can be grown from seed, cuttings or via grafts. Like other WA species it is likely to require grafting in summer-wet eastern climates. All subspecies have been successfully grafted onto both *I. anemonifolius* and *I. 'Coaldale Cracker'*. This species has plenty of potential to become a valuable garden plant. It is mid-size, very floriferous and it bursts into flower during the winter months to brighten up the garden. Very attractive in flower, only the best forms should be selected for cultivation. Those with deeper pink flowers and/or clustered flowerheads with many flowers on each have greatest impact. The dwarf form of subsp. *elongatus* is particularly attractive and well suited to small gardens.



Above, *I. spathulatus* ssp. *spathulatus* in cultivation at Little Forest NSW.

Petrophile cyathiforma Foreman (1995)



Petrophile cyathiforma wasn't named until 1995 in Foreman's revision of the genus published in *Flora of Australia*. The type specimen was collected by M. Barrow at Hyden, Western Australia, in 1966. The species name is derived from the Latin *cyathus* - a goblet and *forma* form or shape, and refers to the cup-shaped structure formed by the involucre bracts, which persists through to the fruiting stage.

Description - *Petrophile cyathiforma* is a small/mid-size shrub up to 1 m x 0.75 m, much branched, with straight hairs on young stems and leaves. Leaves are undivided and rough to the touch due to tiny hard bumps visible as minute spots on their surface. The short leaves (10-15 mm) without hairs are well-spaced and spreading, with a well-defined point. Terminal flower heads are conspicuous. At the bud stage, they

are pointy, like small, shiny, burgundy-coloured onion domes. This is due to long, sticky involucral bracts which, at the mature floral stage, become hairy. These prominent involucral bracts are bronze/brown or brown at the narrowing tips, sometimes curving backwards at the tip. The hairy, bright yellow flowers which emerge from their tight embrace are held erect in a bunch of 15-20 flowers. They are unusual in that all the visible floral elements are the same colour. On each flower, each tepal has a relatively long (up to 2 mm) free tip, without hairs.



Flowers open along their full length, tepals coiling loosely at the base. This gives prominence to the style which droops down, its long, spindle-shaped, hairy pollen presenter bearing a relatively long bare tip and at the tip, a prominent stigmatic cup. The mature, dried cones are notable for their cup or hemispherical shape. It is formed by hardened, fused involucral bracts. This cone is 15-20 mm in length and is relatively wide in proportion to its height unlike typical petrophile cones which are generally taller than they are wide. Fruits are about 3 mm x 3 mm with a large basal tuft about double the size of the fruit.



Distribution – *Petrophile*

cyathiforma is found from near Corrigin, southeast through Hyden and Lake King to around Ravensthorpe, Western Australia. It grows in mallee and open dwarf scrub with low heath and sedges in white sand, in mallee heath in grey clay or white sand and on sandplain. An excellent spot to find this species is at the Corrigin end of the Corrigin Wildflower Drive.

Confusing species -

There are a number of similar species to *Petrophile cyathiforma*, all having short, cylindrical leaves which are undivided (or only divide into three short lobes near the leaf tip). This cluster of lookalikes includes petrophiles *ericifolia*, *arcuata*, *globifera*, *foremanii*, *imbricata*, *merrallii*, *misturata*, *phylicoides*, *recurva*, *trifurcata* and *wonganensis*. All these species have involucral bracts which create a cup shape, but only *P. cyathiforma* has bracts which fuse together to form an actual cup which persists long after flowering. While all have glabrous, free tepal tips atop a hairy perianth (except for the glabrous *P. phylicoides*), *P. cyathiforma* has the most prominent free tepal tips. Two of these species (*P. foremanii* and *P. recurva*) also have narrow, hairy and sticky involucral bracts like *P. cyathiforma* but they occur much further north (north of Perth) and have shorter leaves and recurved leaves respectively. The most distinctive identifying features of *P. cyathiforma* during flowering are its shiny, burgundy-coloured pointed buds like onion domes, and its prominent brown/bronze, shiny, involucral bracts beneath bright yellow flowers. After flowering, its hemispherical cones are very distinctive.



Flowering period - late August through to December.



Cultivation -

Rarely cultivated. Like other WA species *P. cyathiforma* requires grafting in summer-wet climates. It can be grown from seed with good germination results reported using fresh seed in a vermiculite/perlite mix. Propagation by cuttings have proven difficult so far, but study group trials are continuing. Grafting trials are ongoing with success so far on *P. sessilis*. *Petrophile cyathiforma* is an ornamental small shrub worthy of cultivation. Its prominent flowers are held up above the foliage. The large number of flower heads ensures a knockout floral display in spring, the bronze bracts an eye-catching contrast to the bright flowers. It has good potential for small gardens and is particularly suited to containers.

On show this spring at Little Forest

Our isopogons and petrophiles have had a bumper season. This spring the weather gods have smiled upon us, with lots of sunshine and warmth, and just enough rain, resulting in some spectacular flowerings. Here is a selection of the most impressive, including a few unusual, rarely grown species.



Isopogon formosus (grafted onto *I. 'Coaldale Cracker'* with an interstock of *I. cuneatus*)

One of the most adaptable of the western isopogons, this species needs grafting in our rich, moist volcanic soils. We now have two fully mature plants planted next to each other which flower brilliantly each year. This year saw probably the most impressive flowering yet with masses of brilliant pink inflorescences. These plants are the tall form most commonly found in nurseries. It can be struck very easily from cuttings so please let us know if you would like some material.

Isopogon 'Candy Cones' (grafted onto *I. 'Coaldale Cracker'* with an interstock of *I. cuneatus*)

This very touchy plant (right) probably requires grafting even in summer-dry gardens unless drainage is perfect. It's widely available in nurseries, due to its ease of propagation by cuttings, but we suspect very few plants last many seasons. One well-known nurseryman calls it the 'ultimate drop-dead plant'! As such, we recommend ungrafted plants be planted in pots where drainage and moisture can be controlled. Our grafted plant is now around 1 m high and is covered in stunning pink flowers each year. It's easy to see why it sells so well.





Isopogon linearis (grafted onto *I.* 'Coaldale Cracker')

Our plant (left) has the typical low, compact habit of this species (around 50 cm high). The combination of bright pink flowers and attractive grey/green foliage in such a compact package makes us wonder why this species is rarely seen in cultivation.

Isopogon mnoraifolius

This NSW species is definitely one of the hardiest plants in our garden. We have a number of plants scattered around, all ungrafted. All flower profusely each year, and we can't recall ever having one die. They



don't seem to mind how dry or how wet the ground is. Again, this is very rarely seen in cultivation, despite its compact form and reliable mass flowering. We have lots of cutting material available so contact us if you would like to try some.



Petrophile linearis (grafted onto *P. pulchella* with a *P. teretifolia* interstock)

It's not surprising that this one is in cultivation under the common name 'Pixie Mops', and what a stunner it is. The pale pink fluffy flowers with grey tips are eye-catching in any garden setting. This year we had our best flowering with some 20 huge blooms on our one plant (left).

Petrophile megalostegia (grafted onto *P. pulchella*)

Another species never seen in cultivation, the brilliant gold/yellow flowers are a standout. Our young plant (right) put on a great display this spring. Pruning is highly recommended to produce a bushier plant, as it tends to want to reach for the stars as quickly as possible. This form has flat leaves instead of the typical cylindrical leaves. Well worth a spot in any garden!



Petrophile acicularis (grafted onto *P. pulchella*)

This species (pictured right) is never seen in cultivation but has lots of appeal with its curly fine leaves, and unusual bunches of terminal flowers. It's worth getting up close to the flower heads for an eye-popping, colourful spectacle. Sometimes it looks like it's having a 'bad hair day' but we reckon that only adds to its charms.



Petrophile diversifolia (grafted onto *P. pulchella*)

This species (pictured left) is generally overlooked because of its tall spindly habit and short life in the wild. However, our plant has benefited from hard pruning to produce a sturdier, more bushy plant. The flowers are quite stunning.

Native bees in the pollen

Phil Watson



This is an edited version of an article which appeared in *Australian Plants*, Spring 2021 Vol 31 No 248 pp. 121-130. Photos have been substituted with isopogon/petrophile-related examples.

Editor's note: Isopogons and petrophiles have no nectar, relying instead on the offer of copious amounts of pollen to attract pollinators. Pollinators visit both nectar-laden and nectar-absent plants during foraging, the nectar providing the energy needed to collect protein-rich pollen. The main pollinators of isopogons and petrophiles are native bees.

Left: *Leioproctus* bee on *Petrophile chrysantha*, Hi Vallee WA.

Across the vast spectrum of plant pollinators be it an insect, bird or small marsupial, native bees emerge proudly as the most efficient of all pollinators. The reasons are simple! Native bees

are born as pollen and nectar addicts, with the females genetically driven to collect pollen and often nectar, not only for sustaining herself but more importantly for provisioning her brood cells. This is achieved during the flowering season by visiting hundreds of flowers often of the same species on each individual foray. By visiting a single species this markedly increases the likelihood of cross pollination.

From a native bee's perspective, it is easy to understand why they are inextricably linked to pollen and nectar. The oldest fossils of bees have been in amber being around 100 million years old. Fascinatingly this coincided with the rise of flowering plants (angiosperms) enabling bees to gain floral rewards for pollination services necessary for the ancestral angiosperms to flourish.

Of the world's 2,500 native bee species, Australia's native bee fauna is notably large and distinctive from other continental bee fauna, consisting of up to 2,000 species (1,600 named) that occupy almost all terrestrial habitats but mostly in semi-arid regions.

Correcting native bee myths

Stings or no stings? Two mythical features commonly come to mind when native bees are mentioned, namely that they mostly live gregariously in hives just like honeybees (*Apis mellifera*) where they store a honey and secondly, they do not sting. Both these features are surprisingly very rare amongst our native bee fauna. Of all the native bee species there are only a couple of small groups of bees that do not sting. Stings are exclusive to females. As opposed to wasps, (from which native bees evolved) which sting to paralyse prey, female native bees only sting for defence and can do so repeatedly, never leaving the sting in the victim. Their hollow sting shaft (evolved from ovipositors) secretes venom with pain levels proportional to the size of the bee.

Social or solitary? The other myth about their gregarious nature only applies to just 11 species commonly referred to as 'sugarbag bees' (*Austroplebeia* sp., & *Tetragonula* sp.). These species actually store honey differently to the honeybee. They construct and fill 100's of small pot-like vessels (size of grapes) with regurgitated nectar and pollen before capping with propolis, which is a mix of wax from their wax glands and plant resins. Their fairly runny honey is sharp and tangy with infused floral flavours derived from the propolis, distinguishing it very clearly from the sweet more concentrated honey we happily consume!

The immense majority are solitary native bees which nest by themselves and collect primarily pollen which they mix with nectar to provision their brood. Their brood (eggs and larva) develop in individual closed cells located in narrow tubular holes dug or drilled by mum into the ground or pithy wood etc. As these solitary mums need to work hard to collect enough floral pollen and nectar to feed their young, they do not have time to store it nor allow their rather watery supplies of honey and nectar to ferment and go bad.

Ways to win the mating game battle!

Although male native bees' noble objective is to guarantee females are fertilized, they could otherwise be considered as lazy! Males do not construct nests, collect pollen to provision the brood nor care for the brood until adults! Males are constantly competing against other males to attract females. Once mated the female stores their sperm in readiness to fertilize eggs laid on a porridge of pollen and nectar in each cell. The female determines the sex of the egg in each cell by simply either fertilizing the egg (females) or not (males).

Simple techniques The simplest techniques involve patrolling over preferred flowers or perching on fresh unopened flowers preferred by young females, days before they arrive. Others patrol over long-term nesting sites particularly where there are clusters of nests awaiting young virgins to emerge. There is a marked range in the male sizes resulting in larger males monopolising nesting burrow holes by vigorously defending their burrow holes from rival males. This forces the smaller males to patrol forage flowers or stay on freshly opened flowers likely to be visited.

Specialised techniques including brute force, floral oils, and pheromones Individual bee species have evolved various techniques to gain advantages such as the blue banksia bees which perch on banksia flowers and fan their wings to disperse pheromones, often engaging in violent skirmishes with rival males. Another captivating example is the orchid bee which busily collects strongly scented oils from local flowers and

accumulates the scented oils on specialised hairs located on their legs. Since each male bee has a different collection of scented oils, they emit their own individual concoction of floral perfumed pheromones. They then perch at the edge of the rainforest and fan their legs with their wings to spread the scent towards where the young ladies emerge from their nests in the hope that their unique scent is the one that at least one lady prefers! Additionally, some of the bees that rely heavily on pheromone attraction have longer antennae with expanded tips to enhance both the dispersion of pheromones as well as warning of rival males.

Solitary males struggle for survival Male brood cells tend to be smaller and closest to the entrance of their mother's brood nesting hole, ensuring males emerge early in the flight season ahead of any females. Once males have left their nests, they do not return, preferring to roost in dead twigs or leaves as well as inside flowers that close up at night akin to sleeping bags. These flowers include native blue bells, native pigface, and noon-flowers (*Wahlenbergia* sp., *Carprobotus rossi* and *Lampranthus glauca*) returning to the same roost each night. Some males do not like sleeping outdoors, instead sheltering in old nest holes or short burrows in soil. Observant bush walkers may have noticed the largest solitary male aggregations (1,000's) as a black mass clinging to the fronds of one single grass tree (*Xanthorrhoea* sp.) dispersing during the day (unless bad weather) before returning at night.

Curious ways to gain floral rewards

All bees visit flowers primarily for pollen to collect precious proteins and fats for their brood. The pollen is gathered on specialised hairy legs or hairy abdomens. Nectar on the other hand is sucked up with their proboscis and stored in their crop or 'honey stomach'. As this nectar is initially just a watery solution of sugars it is converted into honey using evaporation. This is achieved by repeatedly regurgitating for a few seconds nectar drops onto their tongue, to allow for evaporation and then re-swallowing.

The largest and most noticed native bees are the sparsely hairy short tongued species that have evolved in parallel with the prolific nectar producers with easily accessible nectaries such as the *Myrtaceae* family. Unfortunately for the native bees, these also attract strong insect competition for pollen and nectar.

To survive this cutthroat world, short tongued native bees have evolved coping strategies. These include foraging very early or in the case of the geebung, *Persoonia*, which have four rigid, fleshy tepals they prise open their flower buds. *Persoonia* bees, *Leioproctus* (*Cladocerapis*), are specialist pollinators of the *Persoonia* or geebung flower. These bees have shiny smooth faces that help them reach deep into the flowers' nectary and are aided by dense bristles on their forelegs used to rake out the pollen from special grooves in the flowers. Others nibble at flower buds to gain access to pollen on their stamens. Intriguingly, some of the more robust bees, such as the blue banded bees, even lever off the cap of gum flowers to get to the highly prized pollen.

As pollen ranges in size, some bees specialise in fine grained pollen whilst others have adapted the hairs on their legs (setae) to be wider apart and more robust to collect and carry the coarse-grained pollen. For example, the hibiscus family *Malvaceae* has very coarse-grained pollen.

Many native bees inadvertently gather pollen of peas (*Fabaceae*) and milkwort (*Polygalaceae* sp.) by being lured by colourful bee guides to their nectaries. The bees land onto the keeled petals. The weight of a small native bee is sufficient to press down on the keel releasing stamen which are cocked up between the two petals allowing pollen to be trapped on the belly of nectar seeking bees.

A conspicuous challenge comes when the nectaries are deeply located at the base of tubular flowers such as the native heaths (*Epacridaceae*). Evolution has enabled some bees to be small enough to scramble inside the corolla whilst other bees have evolved long tongues for the task. For example, many of the net bushes,



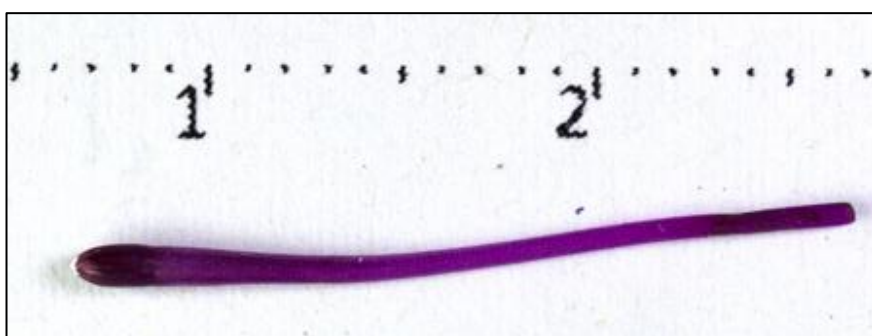
Above: *Leioproctus* sp. bee using its mandibles to work open the limb of an *Isopogon anemonifolius* flower to take the pollen inside.
Photo: Tessa Barratt.

Calothamnus, and emu bushes, Eremophilas, have a tight constriction near the base of their tubular corollas. Although long tongued bees can access the nectary it stymies short tongue bees, except for few highly adapted emubush specialist bees. A good example is the male banksia bee which possess elongated mouth parts (technically known as labial palpi) which are additional to their short tongues (proboscis) which enable the sucking up of the nectar. As an aside, this male banksia bee also has a curious way of attracting females. He perches on top of flower heads that are likely to be visited by females where he vigorously fans out his pheromones made of floral oils. Unfortunately, he must struggle to hold his advantageous position often resulting in territorial combats with other competing males.

Sophisticated ways of gathering pollen

Buzz pollination favours bees when the flowers have specialised characteristics such as no nectaries, fine grained pollen and flowers that have large, exposed anthers with terminal pores or slits that open to expose the pollen. Unfortunately, the technical word called 'sonification' needs to be applied to the simple name 'buzz pollination' to fully comprehend the process. This is purely a native bee thing, where the native bees such as the blue banded bee, the carpenter bee and many members of the large, short tongued megachilids group, hunch over the tips of the anthers and vibrate or shiver their flight muscles. This catapults the pollen from the pores or slits onto the bee's belly. Inadvertently this shivering also causes the bees folded wings to resonate and emit a noticeable buzzing sound. Hence the term sonification which describes this sound. There are also a very large number of native plants which possess what are known as vibratile anthers that enable them to be buzz pollinated. These include fringed lilies *thysanotus* sps., pink bells *tetratheca* sps., flax lilies *tiarella* sps., native primroses, *hibbertia* sps. and kurrajong family *Sterculiaceae* just to name just a few.

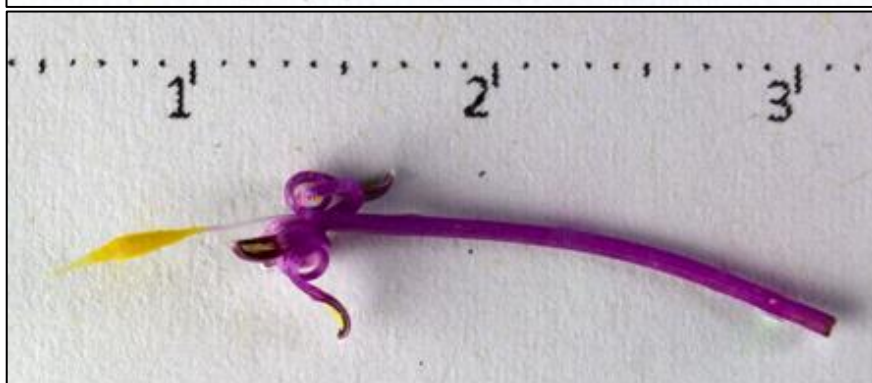
Style end presentation (proteaceae) Proteaceae not only attract birds and small marsupials but also cater for native bees using a unique form of pollen presentation known as style end presentation. Many native Proteaceae such as *Banksia* spp., *Grevillea* spp., needle bushes *Hakea* spp., geebung *Persoonias* spp, benefit from this technique where the anthers burst open whilst still in the flower bud as do kangaroo paws, *Anigozanthus* spp.



Left: An unopened isopogon flower bud.

At the end (left) is the limb, a swelling which conceals the anthers and pollen presenter underneath.

The anthers inside have likely already deposited their pollen on the pollen presenter.



Left: Pollen presenter revealed. The floral tube (perianth) has split into 4 tepals. The tepals, each with an anther still attached to the inner surface, have partly peeled back to reveal the pollen presenter at the end of the style; the style and pollen presenter do not move. Here, the pollen has already been taken.

Isopogon formosus flower. Photos: Mark Noake

As the style begins to unfurl in bud it collects pollen as it brushes past the open anthers and once fully unfurled the style grows longer presenting the pollen laden apex to bees. [In isopogons and petrophiles the style does not move; anthers are located directly next to the pollen presenter and by opening deposit pollen there directly.]

Several female native bees specialise in *Proteaceae* having evolved an ability to clean the pollen from the style ends.



Right: *Leioproctus* bee scraping pollen off *Petrophile linearis*.
Photo: Jean and Fred Hort.

Left, above: Pollen presenter with pollen, and left, after a bee has removed the pollen. *Petrophile drummondii*.



Secondary pollen presentation (native primroses)

Native primroses such as *Velleia* spp., *Lechenaultia* spp., *Scaevola* spp., *Goodenia* spp., and *Dampiera* spp. have fascinating and unique ways of presenting their pollen to native bees in exchange for their pollination services. In a similar way to the style end presentation of the *Proteaceae*, the native primroses release the pollen from their anthers whilst still in bud. However, this is scooped up by the cup-shaped end of the style known as an 'indusium'. When the flower finally opens the style-end bends down allowing it to dab pollen on the backs of nectar feeding bees. Curiously, native primrose specialist bees have evolved stiff, erect hairs with hooked ends on the backs of their heads that collect the pollen in readiness for the bee to groom it off once back at their nests. Other native bees such as a halictid species rake pollen from the indusium using their bristles on the lower sections of their back legs (tarsi).

Trigger plant method The trigger plant relies on the strangest of all pollination techniques. Anyone who has interest in native plants would know of the trigger plants' (*Stylidium* spp.) tricky way that the cocked column (fused male and female organs of the flower) located on one side of the flower snaps across and dongs pollen on the native bee when it alights on the open flower. Interestingly the column slowly resets several times, to allow it to revert to capturing pollen from backs of bees that were dinged by another trigger plant flower.

Conclusion

Native bees possess unique abilities and adaptations to meet the challenges associated with pollination of Australia's unique native flora. It is for this reason that they deserve to be recognised as the pollination superstars. A significant percentage of indigenous plants are totally reliant on the various pollination methods employed by our rich diversity of native bee. Hence Australia's flora would be decimated by any significant demise of our native bee population. The understanding of pollination ecology which focusses on the special relationships between pollinators and native flora is essential to safeguarding the health and wellbeing of our native bee population.

WA field trip report: a different story north and south

'Going south' often means things are getting worse. We were relieved to find that possible dire outcomes after record heat and dry in southwest Western Australia were only evident in certain areas. As we travelled south, things improved. We discovered something of a north-south divide, with the bush south of Perth much less affected by this year's unprecedented climatic conditions than the bush north of Perth.

We were somewhat apprehensive as we flew into WA in late August for our annual field trip. The timing was a little earlier than last year and we were hoping to find different species in flower. But reports of record heat and dry and possible 'forest collapse' had us worried about what we would see as we headed north to begin our fieldwork in Kalbarri National Park. This was our first trip to Kalbarri for a number of years. We were keen to find four of the northern petrophiles found in Kalbarri National Park: *P. conifera* subsp. *conifera*, *P. pilostyla* subsp. *pilostyla*, *P. semifurcata* and *P. foremanii*.

We were shocked to see mass deaths of plants in the park caused by the record extreme heat/dry of the previous summer/autumn. However,



despite seeing many dead examples of the above petrophiles, we did find some healthy specimens of each of the four petrophiles. Of these, only *P. foremanii* and *P. conifera* subsp. *conifera* (right) were flowering.



We also saw great specimens of *P. shuttleworthiana* (left). Having had the benefit of rain to resprout after fire, these plants were looking spectacular, with fresh, bright green leaves. This is a disjunct population, as it is mostly found south of Geraldton. These plants have three main leaf lobes rather than two, with a more rounded shape, and clear parallel veins. Typically, the leaf is more angular, with a reduced or vestigial middle leaf lobe, and commonly described as like a whale tail referring to the two main leaf lobes.

We then headed south down to one of our favourite spots in WA, Hi Vallee farm, home to a huge collection of I&Ps. We were pleasantly surprised that Hi Vallee was looking in remarkable condition given the savage weather conditions that had devastated parts of Kalbarri National Park. While we were too late for the winter-flowering *P. nivea*, *P. chrysantha* was in peak flowering with its masses of brilliant



yellow flowers producing a stunning spectacle (pictured left). This was the best flowering of *P. chrysantha* we had ever seen at Hi Vallee. Other highlights were *P. scabriuscula* at peak flowering, and great plants of *I. asper* (above). These were flowering late and had grown large because they had resprouted after the paddock was cleared, had full sun and space, and had been tip pruned by sheep.



The entrance to Hi Vallee is on Tootbardi Road which we think is the best roadside verge in WA. While so many of these verges have been decimated by encroachment of weeds from adjacent farms, much of Tootbardi Road remains in good condition. However, the road was showing the effects of the extreme dry in the first half of the year with lots of dead plants including many *P. biternata* and *I. dubius*. On the positive side there were lots of *P. chrysantha* flowering brilliantly along the road.

One of our regular stops north of Perth is Koodjee Nature Reserve which is home to an excellent population of *P. plumosa*, as well as *P. biternata* and unusual forms of *P. heterophylla* and *P. brevifolia*. But we were shocked by the condition of this reserve with mass casualties due to the dry, hot first half of the year. Most of the *P. biternata* and *P. brevifolia* plants were dead. Many *P. plumosa* plants were dead, but most of the *P. heterophylla* plants had survived and were flowering well (right). It will be interesting to see how this reserve responds to the good rains through this winter.

Next stop was nearby Wannamal where fire a couple of years ago killed a population of *P. biloba*. We saw no new plants germinating from the burnt patches but there were some plants that escaped the burns flowering nicely. It is a very spectacular petrophile which should be more available in the nursery trade.

Corrigin Nature Reserve is one of our favourite reserves in WA, being home to the hybrid *Isopogon* 'Silvertips' we discovered a few years ago. Its two parents, *I. gardneri* and *I. divergens*, and Silvertips, were just coming into flower. Much of the reserve had been burnt earlier in the year due to an arson incident, but the Silvertips area escaped the fire. Corrigin NR is also home to a lovely large-leaved form of *P. glauca* and we were thrilled to find some in flower.

Our first visit to Boyagin Nature Reserve was a highlight. It's a piece of Proteaceae heaven, with so many species of isopogon and petrophile mixed among huge stands of *Dryandra nobilis* subsp. *nobilis* and *Dryandra stuposa*. *Isopogon crithmifolius* flowers here have the reputation of having the deepest flower colour of all and mature plants were looking spectacular. *Petrophile imbricata* was also in peak flower, as was *P. divaricata* and *P. heterophylla* which was thriving on lateritic rises next to the dryandras. We only spent a couple of hours in the reserve, but we definitely need to go back and explore it more thoroughly.



From left, *Isopogon crithmifolius*, *Petrophile imbricata*, *Petrophile divaricata*, Boyagin Nature Reserve.

On our way east to Fitzgerald National Park, one of our regular must-stops is just off the South Coast Highway near Bluff Creek Road. This is an I&P hotspot and despite the challenging 2024 weather, it was in great condition. *Isopogon cuneatus* (with very large flower heads, below right), *I. formosus* (below left), *I. baxteri* and *P. divaricata* were flowering spectacularly, while the difficult-to-find *P. carduacea* was in bud. By this stage of



our trip, it had become obvious that the bush south of Perth had endured the torrid 2024 weather much better than the bush north of Perth, with most areas unaffected by the extreme weather.



Our few days

exploring Fitzgerald River National Park yielded plenty of good material. We based ourselves at Quaalup Homestead and concentrated on the western end of the park. It was in great condition and we found many I&Ps at peak flowering. All the way along the highway to Fitz we saw great specimens of *P. squamata* in full flower, and this species was a highlight of our visit to the park. At Point Ann, we found a dwarf form of *I. spathulatus* ssp. *elongatus* as well as the typical form.



Left: *P. squamata* typical form and entire leaf form.

Below left: *I. spathulatus* ssp *elongatus* dwarf. Below right: *P. prostrata*.

Fitzgerald River National Park.



On previous visits, we had rarely seen *P. prostrata*, but this time we found it literally underfoot and we had to be careful where we stepped. Appropriately, we were in the same area where the type specimen was collected. We saw heaps of plants in flower between Quaalup Homestead and Point Ann. *Isopogon trilobus* is a very common species in the park and around Bremer Bay and while we were too early to see them in flower, we were fascinated by the different leaf forms, some with shallowly divided leaves and others very deeply divided. Often these two forms are growing right next to each other. *Isopogon formosus* was another highlight for us here, in peak flowering throughout the park. What a stunning species this is!

Our final day was in the Stirling Range National Park. It's recovering slowly from the disastrous fires a few years ago, but in the unburnt parts we saw some spectacular I&Ps in flower. Highlights were low forms of *P. divaricata*, stunning flowers on *I. baxteri*, and an unusual find of *P. longifolia* in full flower. This species is now considered rare in the Stirlings. *I. formosus* was also at its peak, including a form with less divided leaves which used to be called *I. heterophyllus*. And we saw a stunning plant of *P. filifolia* ssp. *filifolia* in bud. It was interesting to contrast the two similar species, *P. longifolia* and *P. filifolia*, the latter a mounded shrub and not yet in flower, and the former almost (but not quite) prostrate and already in flower. We were hoping to find *P. anceps* in flower but it was a bit too early and it was still in bud.



Clockwise from top left: *I. baxteri*, *P. longifolia*, *P. filifolia* ssp. *filifolia* in bud, and *P. anceps* in bud, Stirling Range National Park.

Financial Report

Total 3/04/2024	\$2,624.06
Bank balance	\$2,520.62
Cash on hand	\$103.44
Donations/income	\$405.00
<i>Australian Plants</i> sales	\$45.00
APS Melton & Bacchus Marsh	\$300.00
SGAP NPQ	\$40.00
APS	\$20.00
Total 3/04/2024	\$3,029.06
Bank balance	\$2,925.62
Cash on hand	\$103.44

Donations are welcome

ANPSA Isopogon & Petrophile Study Gr
 Bendigo Bank BSB 633-000
 Acct 156858730