



# Isopogon & Petrophile *Study Group*

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## *Anything but inconspicuous!*

These gorgeous little pink and white dainties belong to *Isopogon inconspicuus*.

In cultivation in our NSW garden, June 2023.

See our profile on this species in this issue.

Back 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](mailto:isopetstudygroup@gmail.com)).
2. Once availability is confirmed, purchase a prepaid **EXPRESS POST** satchel from Australia Post (Small \$12.95 or Medium \$17), 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. palustris, spathulatus, ‘Stuckey’s Hybrid’, trilobus  
**Petrophile** – acicularis, clavata, diversifolia, glauca, linearis, pedunculata, 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.*

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Dear members

The tap upstairs turned off in May this year and we are now experiencing some of the driest conditions we have ever seen here on the NSW South Coast. Our isopogons and petrophiles, both grafted and ungrafted, seem to be coping reasonably well unlike many of our established eastern banksias. We had a good winter and spring flowering with many newish grafts flowering for the first time. A recent highlight has been *Petrophile linearis* which had 36 flower heads this year. After several years of challenging conditions, it’s a case of lots of small and exciting plants rather than large displays.

We visited the Barossa, South Australia in August to spread the word on isopogons and petrophiles as the light relief during a full day meeting of the SA APS. The next day local Hans Griesser kindly accompanied us to the proteaceae wonderland that is Pangarinda Botanic Garden near Wellington. Although it was still technically winter, there was plenty in flower with *P. drummondii*, *Isopogon* ‘Stuckey’s Hybrid’, *I. axillaris* and *P. biloba* as highlights. A couple of months later, Karen Vajda updated us on what was flowering then. This included huge plants of *Petrophile brevifolia*. What a thrill to see them at their absolute peak. See Karen’s photo in the Members’ section.

In September we landed in Western Australia for a couple of weeks of fieldwork. Local study group members Don & Joy Williams, Lyn Alcock, Kevin & Kathy Collins and Margaret Pieroni plus temporary migrant Peter Olde showed us some wonderful specimens. See our article for some of the highlights.



Left, Catriona & Phil hard at work at Pangarinda.  
Photo: Hans Griesser.

We also caught the Ravensthorpe Wildflower Show where the isopogon and petrophile display (pictured below) included a particularly impressive display of local petrophiles which were then at their peak. The display also included different leaf forms of *Petrophile squamata* and *Petrophile glauca*. Ravensthorpe Shire is home to 13 isopogon and 15 petrophile taxa.



We only have a few species yet to find in the wild. It has taken many weeks to process all the photos and vegetative material and write up our

observations from WA. There are also plenty of taxonomic puzzles to ponder which will keep us busy for some time. Phil is very optimistic about his propagation efforts this time and hopefully will have plenty to report in the next newsletter.

We still managed to fit in a visit to the Pomonal Native Flower Show in Victoria which showcases hundreds of named native flower species (including many WA species), all picked from local gardens. There was a small but notable section of isopogons. On our travels we also found time to visit a few native nurseries and were surprised to find a good array of isopogons and petrophiles on offer (we discuss this further in the Prunings section).

This issue of the newsletter has wildlife as well as some gardening and propagation challenges. There is plenty of news from members who report on a range of isopogon and petrophile related happenings from sightings, acquisitions and availability to pollinators and garden performance.

Darren Allen is one of the members taking advantage of our cuttings program. For most of us it is trial and error as well as learning from each other, and Darren deserves a gold star for perseverance and effort. You might learn something from his experimentation as outlined in his propagation notes over the last six months. Member Alan Lacey, a retired industrial chemist, has a warning about nitrogen toxicity from some slow-release fertilisers. We also discuss whether alkalinity is a problem for isopogons and petrophiles, and why some people seem to be able to strike *Isopogon* 'Coaldale Cracker' easily while others have no success at all.

You'll find plenty of news snippets in our Prunings section. There is also some new information about the role of eastern petrophiles in the diet of the endangered Gang-gang cockatoo, and we investigate whether western isopogons and petrophiles could be part of the diet of the oh-so-cute but shy honey possum.

Our profiles are two WA species which have a lot in common, *Isopogon inconspicuus* and *Petrophile chrysantha*. Both were first described by Carl Meisner in 1855 from specimens collected by James Drummond; both are small plants with short, divided terete leaves and tiny but numerous cones; and both grow north of Perth in the Eneabba area. For 140 years they were both petrophiles until Don Foreman moved the former from petrophile to isopogon in 1995. Both are little-known and little-grown but really deserve a place in gardens. To find out the differences, you'll have to read the profiles!

Catriona and Phil

## From our members

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### Ian Cox, Kenthurst NSW

[Your newsletter is] certainly very inspirational and informative! Congratulations! Thank you! You've done a massive amount of research on the articles about seeds, etc.

### Liesbeth Uijtewaal, The Netherlands

Wow Phil and Catriona, this sure is a bumper issue! All this info combined, well done. So interesting! By the way, one of the lighter treated seeds of *P. linearis* of a second batch (3 weeks ago, 11 seeds each) germinated, none of the non-treated seeds suggesting that at least the heater treatment doesn't kill the fruits. My oldish *P. fastigiata*, again, won't flower this year with leaves growing from the buds whereas a small cutting grown plant has well developing flower heads, one on each of its four shoots! I still haven't figured out why the flowers tend to abort on my older plant.

**July-August:** [Re] the low growing *I. latifolius* ('Lollypop'), four seeds germinated and all four seedlings are happy. Both my *P. shirleyae* seedlings (first pic, below) are still OK albeit slow growing but I'd rather not try and speed them up too much. Some other seedlings in the tray with *latifolius* (below, right) are *P. linearis* (seed from my own plants)... *I. fletcheri* dropped dead a while ago. It never really looked happy even though it did flower.



**October:** As Kevin might have told you I'm currently in WA! We already saw beautiful flowers/trees and a bit of wildlife. It's so disappointing to see so much cleared and even the road verges are at times totally cleared with piles of dead trees ready to be burned. Absolutely devastating. Of course we spotted some I's and P's, they mostly finished flowering but yesterday there was this glorious *I. trilobus* in full flower next to masses of *Lambertia inermis* in red orange and gold. Stunning. ... We found a few I's and P's, like *P. teretifolia*, *I. trilobus* and *P. [sp.]* which was lovely. The latter's leaves looked a lot like *P. fastigiata* in my opinion, the plant was quite attractive. ... *I. trilobus* seems to be the most dominant species over here with, at times, huge and old plants! Stunning.

### Paul Maurice, NZ

What an amazing newsletter, packed with interesting information! Thank you....I was on a camping trip in the Pilbara last month. I know that there are no Petrophiles or Isopogons up there, but I was hoping to see some on my drive back down to Perth. In the end I just saw two species, please see the links to my observations on iNaturalist below. I think it might have been a rather late spring in the south-west, although the *Isopogon dubius* was looking glorious in

Wireless Hill Park - I couldn't resist taking several photos!

<https://www.inaturalist.org/observations/183798033>

<https://www.inaturalist.org/observations/183797380>

### Jodie Ratcliffe, Halfway Creek NSW

I have Isopogon drumsticks they grow wild here. I was very excited to learn that I may be able to graft them. I ordered other varieties and hope in time I'll have a go and let's say it's successful. Thanks for connecting with me. That spark of enthusiasm was re-ignited 🙏

### Verna Aslin, Cobargo NSW

I have a few I &Ps growing here at Cobargo, with mixed success. Some are very slow growing. Still a nice surprise when they flower.

### Karen Vajda, Brinkworth SA

My first intro to I&Ps was the article in the Australian Plants magazine. Then attending a meeting this year at Barossa Valley SAAPS (South Australian Plant Society) as a member of the Brinkworth APS group I had the fortunate experience of hearing Phil and Catriona speak. After the meeting who should we bump into at the Barossa Valley nursery but Phil and Catriona trying to put in lots of I&P's into their already full car (wonder how those plants are doing). This began my first purchase of I&P's. I purchased 4 Isos and 1 petro (Candy Cones, Pixie Mops, Pink Sparkler, Sunshine and Pink Bouquet). All doing ok so far. Did put all in ground except iso candy cones which is in a pot. Have just had another visit to this nursery, so more I&P's waiting to be planted. Really enjoying reading all of your newsletters.



On our annual Brinkworth APS camp we headed to Naracoorte. On our way we stopped at Pangarinda Botanic Gardens at Wellington. What an amazing display of I&P's they have. Right, *P. brevifolia*.



### Darren Allen, Pokolbin NSW

I went along to the Newcastle group plant sale and was able to pick up I Dawsonii, also what looks like a slightly different form of I Anemonifolius than the two you sent last time, and an I Formosus x Dubius hybrid. I was also able to find Petrophile Ericifolia at the sale. ... I tracked down a plant of I Coaldale Cracker. It's not really big enough yet to start raiding for cuttings as it is just sitting there in our dry winter.

The species I now have in the garden are I Sunshine, I Pink Drumsticks which generally dies soon after flowering so I just keep re-propagating it, and I Candy Cones which I now have a few backups of. I Sunshine and I Candy Cones have budded up and are about to flower. The I Candy Cones is growing under a north facing eave next to a deck. It's been there a year.

At my previous address on the southern side of Cessnock, I was able to grow the local I Anethifolius, I Cuneatus (until the fire), and I had some success with I Buxifolius, I Dubius and I Formosus. I Dawsonii grew well and re-generated after the fire in 2002 with hundreds of seedlings. One of the seedlings I potted up grew to about 3 metres tall and was still growing in my mother's garden when she moved into aged care a few years ago.

On the Petrophile front I have *P. Biloba* and *P. Serruriae* growing in a raised bed of freer draining soil. *P. Pulchella* and *P. Linearis* succumbed in the wet last year in the built up but heavier clay.

### Keith Alcock UK

Keith drew our attention to the dearth of isopogon and petrophile species in major native plant sales in WA: 'Maybe you should get on to the FKP folk (Friends of Kings Park sale) and get them to correct their ways. There was only *Petrophile biloba* and six isopogons at the last sale – *divergens*, *dubius*, *formosus*, *latifolius*, *nutans* and *trilobus*. ...I [also] have to report the Eastern Hills propagators for their scant coverage of isopogons and petrophiles .....no petrophiles and only two isopogons!!!' (Eastern Hills Branch, Wildflower Society of WA Native Plant Sale).

### Marjorie Apthorpe, Currowan NSW

For the first time, the feral European honeybees are taking a great interest in our *Isopogon formosus*. Grown on its own roots, this 7-year old plant has flowered wonderfully well this year. One flowerhead looks very odd. The only "pollinator" spotted this year on our *I. anethifolius* is a ladybug. Right, fasciation in Marjorie's *I. formosus*.

### Kevin Collins Mt Barker WA

Popped down to Mutton Bird Is. [to see *I. uncinatus* in flower] & just in time as peak flowering. I took heaps of shots so you can adjudicate. Strange little fluffy flowers which look more like a form of *Conospermum*. The plants seem to be enjoying [some] extra sunlight and just hope it has encouraged some pollination (pictured below, left).



Went to Margaret's site [west of Albany] looking for *I. axillaris* but couldn't find them. Saw plenty of *I. formosus*. Some with small flowers right up the stem like the plants on Redhen Rd. Lots of tall spindly *P. squamatas* and a sole lovely bush of *P. rigida* on the railway line (pictured, right).



### Margaret Pieroni, Denmark WA

On our day out in the Stirlings we found *P. divaricata* and *P. serruriae* flowering and also what I took to be a hybrid of the two. The photo (overleaf) shows *divaricata* opposite the car, the hybrid(?) in the middle and *serruriae* right in the front - I almost didn't get it in the frame. Oddly enough the leaves on this plant were much bigger than the other two.



### John Knight, Batemans Bay NSW

I thought it worth noting the effects of the current dry spell, which might reflect the results of other members. Currently, I only have 7 species of *Isopogon* and 1 *Petrophile*. I know, that's not good enough, but I will try to add to that soonish. My report is simply around the time plants produced flowers.

- I. 'Coaldale Cracker'** (thanks Phil) is a strong grower which flowered prolifically through September and early October, so one of the best performers for around 7 weeks, but now finished.
- I. anemonifolius** low form flowered for 4 weeks, but is now not looking happy. Growth is minimal.
- I. anethifolius** didn't flower, only a young plant but cutting grown.
- I. cuneatus x buxifolius** produced the best results, flowering heavily through August and September, with flowers all along the branches. Good value plant, although the flowers are a bit wishy washy pink, but with strongly coloured styles.
- I. formosus** (from Norm Hulands) flowered for only 2 weeks before fading. It is in a dry well drained spot with plenty of sun, but too young to flower strongly, although the new growth is prolific.
- I. formosus x latifolius** 'Candy Cones' aborted its flowers all together, although the plant is happy, not 1 flower opened.

The saving grace is **I. prostratus**, a young plant propagated from the 12 year old plant in the front garden. The plant is small, at around 60cm across, and flat on the ground, but each branch terminal has a bright flower which looks like they will last well into November. This tough little plant was originally collected from high elevation in the Deua NP growing in association with *Allocasuarina nana*, on sandstone. The older plant I have is being overgrown by *Lomandra* but continues to put out a couple of branches. I need to get propagating to ensure the clone is not lost.

My sole *Petrophile*, **P. biloba** decided that flowers are not necessary, but put out a lot of new growth, which is very soft, and unlikely to tolerate a hot dry spell, so pruning is on the cards. A few cuttings as well.

I lie, as Phil treated me to **P. filifolia**. This is in a container with the *P. biloba*, and is growing happily if slowly, with long grass-like leaves. It will need some time to determine its long term success, but I am confident Phil has a winner with this.

# Prunings

## Pixie power

Did you spot the petrophile mentioned in the 20 October 2023 episode of *Gardening Australia*? Under the heading 'Pixie power', *Petrophile linearis* was suggested for planting in arid areas in the 'Jobs for the weekend' segment: 'Rock-loving Petrophile species, Pixie Mops, can be planted in a dry sunny environment to provide habitat and food'. This species does not come from arid areas but the suggestion may reflect this species' need for perfect drainage and lack of tolerance for summer rain. In temperate Australia, it grows well in a pot or in a garden that is not summer-wet.

## Getting the priorities right

What a surprise to find a WA isopogon featuring in a Saturday *Sydney Morning Herald* article (21 January 2023)! Writer Jo Stubbings was discussing her Airbnb experiences but what is far more interesting is that she was touring WA with her partner (dubbed Flowerman) on a spring wildflower tour. Breaking a wine glass at a Mandurah Airbnb was a disaster ...but not finding *Isopogon crithmifolius* in Yalgorup National Park was worse! We should award Flowerman honorary membership of the Isopogon & Petrophile Study Group.

## Perfect spring flowers

WA gardening personality Sabrina Hahn calls isopogons and petrophiles perfect spring flowers. Find out why she likes them here [Sabrina Hahn: Why wildflowers such as coneflowers or isopogons and petrophiles are perfect spring flowers | The West Australian](#). Sabrina Hahn is a very knowledgeable and entertaining gardening expert. If you have ever heard her on the radio (she is sometimes a guest on national programs) you will know her bubbly personality. She is a hoot!

In the article she talks about the plants you might be able to find in nurseries. She is right on the money when she points out that while there might be some isopogons available, there are rarely any petrophiles: 'It is a shame so few species of petrophile are cultivated for sale in nurseries as they have interesting flowers and foliage, look great in a vase and of course are incredibly drought and heat resistant.' It's worth noting Sabrina's care advice: 'Always lightly prune after flowering finishes to promote denser growth and encourage more flowering. Isopogons and petrophiles must be fertilised with low phosphorus fertiliser and the best time is in late winter.'

## Nectar-producing (NOT!)

Have you ever noticed commercial plant labels on isopogons or petrophiles for sale in a nursery which claim the plants are bird attracting and rich in nectar? This of course is completely untrue – isopogons and petrophiles have no nectar. However, it is a common misconception that all native plants (or all proteaceae) produce nectar.

Some current labels are still misleading. Even Sabrina Hahn was misled although she did correctly note that smaller birds love prickly species for protection from predators. *Gardening Australia* also made the same error recently.



## New cultivar – 'Dazzler'

A new cultivar from Plants Management Australia now available in nurseries promises dazzling displays. It is a compact form of *Isopogon latifolius*. There is a similar cultivar called 'Lollypop' so it will be interesting to see if the two cultivars are noticeably different. 'Dazzler' seems to have broader leaves. The two cultivars are pictured together, left.

*Isopogon latifolius* has the largest flower heads of all isopogon or petrophile species and so is of course an impressive plant in flower. The blurb promises fireworks of prolific mauve-pink



flowers in the garden from late winter through spring, with stunning flowers so large you won't be able to look away! If you give this one a go, let us know how it goes and what its attributes in the garden really are.

### Are nurseries and producers lifting their game?

We always complain about a scarcity of isopogons and petrophiles for sale in nurseries. The only place you will sometimes find them is a handful of specialist native nurseries. However, this spring we have noticed a welcome increase in the number of plants as well as the number of species available in those nurseries. There are even sizeable displays of these genera, in some cases in a prominent spot right by the entrance. The plants are from only three suppliers, Plants Management Australia, Native Plant Wholesalers and Boutique Natives.

The isopogon species for sale are: 'Dazzler'/'Lollypop' (*I. latifolius*), 'Pink Bouquet' (*I. cuneatus*), 'Candy Cones' (*I. formosus* x *I. latifolius*), 'Pink Sparkler'/*I. formosus*/*I. formosus* grey, *I. divergens*, *I. sphaerocephalus*, and 'Sunshine' (*I. anemonifolius*). There are even some petrophiles available: *P. biloba*, *P. ericifolia*, *P. serruriae* and 'Pixie Mops' *Petrophile linearis*.

Make sure you take advantage of this situation – if sales are good they might supply even more species in future, and then maybe generalist nurseries will even follow suit.

### Seeds available in Victoria

The APS Victoria annual seed list for 2023 includes several isopogons and petrophiles. Current Victorian members are entitled to seed from this seed bank, listed in the *Growing Australian* bulletin. Available species include: *Isopogons anethifolius*, *cuneatus*, *dubius* and *Petrophiles fastigiata*, *linearis*, *serruriae*, *squamata*.

### Phylogenomics of Isopogon and Petrophile project

Francis Nge (University of Adelaide; Institute of Research for Development, France) is revisiting the phylogenetic relationships of these genera to look at species-level phylogenies by densely sampling phylogenies of *Isopogon* and *Petrophile*. The aim is to better understand phylogenetic relationships of species within these two species-rich Australian genera, but also advance our understanding on the evolution and biogeography of the Australian flora more broadly.

Sequencing has been completed. Analyses looking into the biogeographic history and evolution of these genera are ongoing. Francis is also collecting leaf traits relating to phosphorus use and acquisition to look at how these traits evolve across deep timescales, and looking at fire-adaptive traits, namely resprouters vs reseeders.

Francis Nge, Phylogenomics of two Australian plant genera: *Isopogon* and *Petrophile* (*Proteaceae*), *Newsletter of the Australasian Systematic Botany Society* No. 193–194, March 2023.

## A propagation diary

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### Darren Allen

**18 April:** Thank you for the cuttings, I have processed all of the material, including a few interstock grafts of *I. formosus*, a technique I haven't tried before. I've tried some with cocopeat pods and others with a free draining mix. Is fungicide necessary, and if so, which one do you suggest? [\[Not required\]](#)

I've documented everything, and I'm looking forward to reporting some success. I guess my main questions at this point are around care after grafting. I have them all under shadecloth, in a cold frame inside the hothouse, currently not exposed to the mist, just randomly giving them a spritz. I guess you'd call that triple insulated? I'm a bit wary of the mist after the failures with a lot (well, all of them) of the grevilleas and banksias I've tried as cutting grafts with known compatible stocks. I'm sure fluctuating temps in the hothouse over Spring and Summer got a lot of them as well. I have no problems with mist and cuttings, just the cutting grafts. The successes with *Eremophilas* as cutting grafts mostly come from pots individually covered with plastic bottles kept out of the mist in the shady part of the hothouse. Guessing the key has been that the *Myoporum* puts on roots in a couple of weeks so makes the cutting graft more viable for them?

**21 July:** It's 3 months now since I processed the cutting material you sent me in April. This was my first attempt with the cocopeat plugs and I agree with your comments about the challenges with keeping them somewhere between too dry and too wet. As an insurance I tried some of the material with a mix of seed and cutting mix with added perlite and river sand as cuttings only, as I figured this was closest to my tried and true method with other genera. Most of the cuttings in the mix are still looking healthy and putting on growth but no roots out of the bottom of the pots as yet. Species in this category are *I Formosus*, *I Cuneatus*, *I Spathulatus*, *I Anemonifolius*, *I Stuckeys Hybrid* and *I Panduratus ssp Palustris*. If I can get some of these potted up I'll have access to material for more grafting experiments even if they won't grow in the garden on their own roots.

The results so far with the plugs are mixed. I completed 28 grafts in total and the survival rate for those has been low. Of the 3 *I. Axillaris* grafts on Coaldale Cracker one looks good and one has died back to the rootstock, and one failed. The 3 grafts of *I. Panduratus ssp Palustris*, 2 look good and one has died back to the rootstock. Of the 3 *I. Spathulatus* grafts, one looks good and one has died back to the rootstock. One failed. My first crack at *I Formosus* as an interstock graft, of the 3, one still looks ok. All grafts of *I. Divergens* (8), *I. Cuneatus* (3), *I. Dubius* (4) and *I. Stuckeys Hybrid* (3) failed early on. I'm blaming too wet/mist, or crude handiwork on my part. Others I tried in the plugs as cuttings only, as I'd used all of the rootstock material, *I. Panduratus ssp Palustris*, *I. Divergens* and *I. Stuckey Hybrid* are looking ok.

I think I can attribute most of the failures to cocopeat plugs being too wet very early on before I took your advice and turned off the mist, and probably my still improving skills with the knife. My conclusions so far are that I'm leaning back to my own mix rather than plugs, and keeping the grafts out of the mist, cuttings are clearly more tolerant of it than the cutting grafts. Also in my mind, I think I may have better success striking the rootstock cuttings and grafting later. Looking forward to getting the surviving grafts and cuttings through to spring when I'm hoping they will get going.

I agree that once you have rooted stock plants to graft onto you will have better success, and stronger plants. Given that a lot of your grafts failed early on, dying back to the rootstock, try widening the Parafilm strips to around 20mm. If you have been using thin strips, say around 10mm, the tape isn't strong enough to tape the scion firmly enough onto the rootstock. The taping needs to be very firm. This should solve the problem of scions dying early. I agree that you should use a cutting medium that best suits your setup. If you can get good results with your cutting medium go with that.

**7 Aug:** I've dispatched a satchel to you today so that I can have another try with some grafts and cuttings with the warmer months coming. As I said, a few of the cutting grafts I did in Autumn are still looking ok, and cuttings of a number of species are showing some growth. Maybe *I Dawsonii* is a potential rootstock for the conditions here if I can strike it? The original plant I had in the 90's was very difficult to grow from cuttings. I'm still hopeful Coaldale Cracker will do well here and be the solution.

**24 Aug:** I will try the wider strips of nescofilm and hopefully better success with the grafts will follow. I think turning off the mist in the hothouse has helped in some respects, but the warmer months will present challenges with keeping everything cool. I'm leaning towards a more open mix than the one I currently put together in case I need to revert back to using more regular mist later in the year. Does this make sense? At the moment, I'm monitoring and just watering briefly when the mix or plugs are starting to dry out. Having not used the cocopeat plugs before, it was a learning curve with those that are still going from April, as they are a challenge to keep moisture levels constant, but when I finally assess the results, maybe some species favour the plugs, too early to tell.

**16 Sep:** I have a few questions about the attached pics of the grafts and cuttings that I did last month. I've switched the auto mist off and just watering when they appear to be drying out (most days) with the occasional mist from the hose on hot days. I've added more perlite to the mix which is about half coarse sand, 25% Osmocote cutting and seedling mix (I'm starting to think I might replace this with more sand/perlite), and 25% perlite or thereabouts. The cuttings and grafts are in the shadiest, coolest part of the hothouse. I've added shade cloth on the northern side of the roof so there is no direct sun.



I read one of your articles where you talked about conditions required for different leaf types. The question is about the browning on the ends of the leaves of the *I. Dubius* cuttings and the Coaldale Cracker rootstocks. You can see from the photos that cuttings of *I. Axillaris* that I did with left over material still look good as do cuttings of Stuckeys hybrid and *I. latifolius* that I took from a plant I bought recently. So do you think this is a result of not enough water, too much heat in the house or something else? Also, of the grafts and cuttings I did in April that are still looking healthy, there are no roots on anything, not even Coaldale cracker? During that time I have struck cuttings of some *Eremophilas*, *Grevilleas*, *Adenanthos* and some others. The only out of the ordinary thing I've done is water everything in the hothouse with a very weak solution of Gogo juice a couple of weeks ago? Just noticing from the photo, looks like the scion of *I. Formosus* on the interstock graft is on its way out....

It's difficult to know what is going wrong, but I would just water once a day in the morning. Misting has the potential to introduce fungal problems. Also I agree that you need to tinker with your soil mix. Before plugs I used to use a 4 parts perlite to 1 part coco peat. Maybe your mix holds too much moisture. Losing Coaldale Crackers indicates to me that the mix is either too wet or has dried out. It's just a matter of trialling different mixes to see what performs best in your conditions. Sorry I can't give any immediate solution but things can go wrong really quickly. A couple of years ago I couldn't put roots on anything when I was using misting and the perlite coco peat mix. That led me back to the plugs.

**23 Oct:** there are still some lessons to be learnt about my new setup. The strangest one is not one of the grafts or cuttings of *I. Coaldale Cracker* have put on roots, they are just sitting there. I've had success with cuttings of *I. Cuneatus*, Stuckey's Hybrid and *I. Formosus* that you sent in April. *I. Axillaris* and *I. Panduratus ssp Palustris* and a single cutting of *I. Divergens* are hanging in but with no visible roots. I've recently replaced the mist system with some fog nozzles, and added shade over the hothouse now the warm weather is here. Temperatures were getting into the high 30's in the hothouse, but in an effort to lower the temperature, the mist was making everything too wet. The smaller droplets with the fog setup look encouraging. One interesting observation is the success of a lot of Candy Cones cuttings in individual pots with a jar over them to keep the mist off but still get the benefit of the cooling. The one remaining cutting of *I. Divergens* is also under a jar. I'm going to try this with the grafts as soon as I solve the problem of no roots on the rootstocks

## Nitrogen toxicity: avoid slow-release fertilisers with high urea

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As propagators we all get frustrated when our isopogons and petrophiles die or damp off at the growing on stage. We are probably all aware of the danger of too much phosphorous in fertilisers, but another problem might be too much readily available nitrogen.

SG member Alan Lacey (a former industrial chemist) recently alerted us to the problem of nitrogen toxicity in proteaceae resulting from nitrogen in fertilisers being mainly sourced from urea. He learned the hard way when he lost over a hundred plants in 300 mm pots after using an 'all-purpose including natives' slow-release fertiliser. He found the likely cause was nitrogen toxicity when he checked the chemical content of the fertiliser. Alan notes that urea is the cheapest source of nitrogen and most likely to be used, especially in cheaper products. Biuret is a common impurity in synthetic urea that is detrimental to plant growth.

Alan's advice is don't trust the blurb on the packaging of slow-release fertilisers – even if they claim to be suitable for natives. Check the 'Analysis' panel. Sure, the phosphorus might be low, but what is the main source of the nitrogen? For example, a typical analysis might list the total nitrogen as 21%, with 1% coming from ammonium nitrogen, 0.5% from organic nitrogen, and 19.5% from urea. This means that 93% was from urea, which is readily available to the plants but alas, too quickly. This product is likely to be more harmful to your isopogons and petrophiles than other products which are not suggested for natives but have lower levels of urea nitrogen. A release period of 8-9 months is much better than a release period of only three months. Take care using slow-release fertilisers in small pots and avoid them when propagating.

Alan notes that his observations about nitrogen toxicity have been published in various journals and newsletters but have not been taken seriously. Phosphorous toxicity is keenly noted for all native species, but nitrogen toxicity for proteaceae genera has been ignored.

# Can you grow isopogons & petrophiles in alkaline soils?

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In South Australia recently, native plant growers asked whether isopogons and petrophiles tolerate alkalinity, explaining that many areas in South Australia have alkaline soils. Soil pH is a measure of the acidity or alkalinity of the soil. The scale for soil pH goes from 0 (very acid) to 14 (very alkaline). It is a 'reverse' scale in that a very acid soil has a low pH. Most soils have pH values between 3.5 and 10. A value of 6.5 to 7.5 is neutral, over 7.5 is alkaline and less than 6.5 is acidic. Soils with pH less than 5.5 are considered strongly acidic.

Australia has a mix of soils depending on the type of underlying bedrock, rainfall, and agricultural usage. Natural soil pH depends on the rock from which the soil was formed (parent material) and the weathering processes that acted on it—for example climate, vegetation, topography and time. These processes tend to cause a lowering of pH (increase in acidity) over time.

In higher rainfall areas the natural pH of soils typically ranges from 5 to 7, while in drier areas the range is 6.5 to 9. Generally, dry areas are more alkaline as elements in the soil are more stable. Tasmania's east coast is dominated by dolerite clays that forms neutral to acidic pH soils. Two-thirds of Queensland's soils are acidic due to high rainfall. Fifty per cent of our agricultural lands have high acidity due to practices like using ammonia-heavy fertilisers.

Western Australia, where the majority of isopogon and petrophile species occur in the southwestern corner, has soils ranging in pH between 4 and 8.5. Most of its coastal regions tend towards alkaline soil due to limestone underlying coastal sands. The presence of limestone could also be responsible for alkaline soils in South Australia. Soils further inland in WA, and most agricultural areas, are naturally acidic. This applies to other areas of Perth and in the wheatbelt. In agricultural regions and home gardens soils which were not very acid when cleared have become increasingly so through the continuous application of fertiliser.

Australian native plants are usually considered to prefer neutral to slightly acidic soils. While there is much information about the pH requirements of exotic species, little is available about native plants. The following pH ranges are recommended: Acacia 5.5-7.0, Boronia 5.5-6.5, Bottlebrush 7.0-8.0, Geraldton Wax 5.5-6.5, and Tea Tree 5.5-7.0. In relation to proteaceae, a range of 4.5-7.5 is recommended for grevilleas and 5.0-6.5 for waratahs. According to horticulturalist Aileen Reid, while WA native plants are adapted to a wide range of soil types and pH, usually on the acid side, some, such as *Banksia ashbyi*, do well in more alkaline soils.

Several petrophiles occur in limestone areas or can grow in such locations. These species may be more tolerant of alkalinity than others. For example, *Petrophile axillaris*, *P. brevifolia*, *P. macrostachya*, *P. pilostyla*, *P. prostrata*, *P. seminuda*, and *P. serruriae*. The fact that no isopogons are recorded as occurring in limestone areas could mean isopogons are generally more sensitive to alkalinity. While the petrophile genus was originally so-named because it seemed to grow in rocky locations (rock-loving), species are found in a range of soils from sandy to rocky, the rocky soils including laterite and granite as well as limestone. At Hi Vallee, for example, *P. macrostachya* grows in sand near laterite outcrops.

Where alkalinity is a problem alkaline soils can cause yellowing of young plant growth from iron chlorosis. In these cases, a high pH prevents the plant from taking up iron. Plants deficient in iron as a result of high pH are also often deficient in copper, manganese and zinc because their uptake is also impaired under those conditions.

The problem of alkalinity can be addressed with iron chelate as a foliar spray, but Aileen Reid suggests a better option is to decrease the soil pH by using sulphur or iron sulphate. This is because many plants won't respond well to foliar iron and will simply burn if the yellowing is too bad. A trace element mix as a foliar spray may also help. As Aileen points out, the pH scale is logarithmic (like the Richter scale used to measure earthquakes) which means that a pH of 6 is ten times more acidic than a pH of 7. This is part of the reason why it can be so hard to move from a pH of 8 say, down to 6 – there is a factor of 100 involved! Adding mulch and perhaps some compost to soils will help acidify soils in the longer term. Note that the water you give garden plants also needs to be pH neutral or slightly acidic (and low in salts).

Although many proteaceous species tolerate acid soils, pH should not be too low (acid) as acidity can also kill plant roots. Aileen Reid says it is not uncommon to get a soil pH as low as 4, especially at depth (15-30 cm) which is where

a lot of plant roots are. In many cases this is the result of years of fertilising. Iron deficiency is also common in acid loving plants.

See Aileen Reid: <https://wahorticulture.wordpress.com/2011/03/26/soil-ph-with-a-smattering-of-plant-nutrition/>

There is so far no direct information suggesting sensitivity to alkaline soils in isopogons and petrophiles. The problem of yellowing new growth has not been reported by members. This probably reflects the fact that most study group members live in areas with neutral or slightly acid soils. Also, recent extreme weather makes it difficult to identify the relative contribution of different likely causes of plant problems.

Marilyn Sprague reports her soil in Bendigo Vic is 5.5 (acid). Our garden on the NSW south coast is mostly quite neutral. However, some isopogons have struggled in a bed which proved to be slightly alkaline – however there are other possible explanations for this, including a low bed persistently wet from heavy rain. Waterlogged soils can become acidic. Saturated soils like these might have had the nutrients leached out over time or the plants might be suffering from oxygen deficiency and carbon dioxide toxicity. Root growth and plant respiration slow down while root permeability to water and nutrient uptake decreases.

Darren Allen reports slight alkalinity in Pokolbin NSW. His testing indicates fairly neutral pH in the first 100 mm or so then pH 8+ in the clay below. He notes: 'the results were interesting and probably explain some of the issues I've been having mostly with Grevilleas and Banksias where they go great for the first year or two and then start to suffer with yellow leaves etc.' Darren's pH readings and associated plant health were as follows (taken adjacent to the plants).

- Propagating mix pH 6.
- I Coaldale Cracker pH 8. Local soil, mostly heavy clay below 100mm with some compost dug in at planting. The plant is healthy but early days.
- I Dawsonii, I Sunshine and another small form of I Anemonifolius as above. I Sunshine is struggling a bit with the full sun in the afternoon I think. P Linearis and P Pulchella didn't thrive in pH 8 but I think the wet weather contributed to their demise some time ago.
- I Candy Cones pH 7.5-8 In disturbed local soil (excavated for a cellar) with some compost added. With Ag pipe enclosed in large aggregate about 2.5 metres down at the base of the cellar. So drainage is pretty good...the plant is growing quickly and flowered well recently. It has survived one summer so fingers crossed.
- P Biloba pH 7 Built up (300-400mm) bed of garden mix from the local landscaping supply and washed river sand 50/50. The garden mix had a small amount of cow manure in it which doesn't appear detrimental. Others in this bed are P Ericifolia and P Serruriae, I Formosus, I Formosus X Dubius and another I Candy Cones. All on their own roots. Also in this bed are some Western banksias that have survived 2 summers and came through the wet year ok, but still early days.

**POSTSCRIPT:** The easiest way to measure the pH value of your soil is with inexpensive and easy-to-use field kits available from garden centres. These include a colour chart to interpret the results. However, note that they provide only an approximate soil pH value, and different brands may produce different results. Laboratory testing is required to obtain an accurate pH value.

The experts suggest you test your pH when the soil is relatively dry and free of excessive organic material. When sampling, consider these suggestions.

- Do not mix different soil types, and sample into clean containers.
- Do not sample after heavy rain or after watering.
- If you have applied fertiliser, wait three to four weeks for the soil to adjust.
- Take the soil from the top 20 cm with a trowel, spade or auger and avoid weeds and plant roots in the sample.
- Select at least five random spots in the area to be tested, and mix the soil to get an average reading. Then take about a cupful as a sub-sample.

## Striking *Isopogon* 'Coaldale Cracker': Phil's method

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Some members have found it difficult to produce cutting grown plants of *I.* 'Coaldale Cracker' from cuttings. This is not only surprising, but it is an important issue to address as *I.* 'Coaldale Cracker' is usually easy to strike and is our recommended rootstock for grafting all WA isopogons including the spectacular pinks. It is tough and highly compatible with the WA species.

Given that I find it easy to strike trays of these plants with close to 100% success rate, it is worth describing how I do it so that we can compare methods and find where the differences are to perhaps resolve these problems.

To strike cuttings of *I.* 'Coaldale Cracker':

- Take cuttings from soft or very young material. Even soft, tippy material that you might normally avoid strikes beautifully with Coaldale Cracker. All my cuttings are now taken off the tips of young plants used for grafting. Cuttings from thicker and more hardened material from mature plants will be much more difficult to strike so avoid these.
- Make sure your cutting is snipped below a couple of leaf nodes at the base of the cutting. This where the roots will appear.
- Remove the bottom leaves, nick around the stem where the leaves were removed, dip in Clonex Purple and place in plugs or cutting mix. The cutting mix I use is 5 parts perlite to 1 part Coco-peat.



Above, left: the tip cutting (cut below a couple of leaf nodes); right, the trimmed tip cutting.  
Note the red new growth of the leaves indicating it is soft/very young.

I place the cuttings in plugs in my hothouse without bottom heat and water them once a day, but I don't think this is significant and your usual treatment for cuttings should be fine.

All the above steps are standard, apart from the use of very young material. So, try using younger material and let us know how you go. We really need all our propagators to be able to produce this great, hardy rootstock easily and reliably.



One I did earlier: a tip cutting which has successfully grown roots.

## Grafting tip: Phil's latest trick

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My latest batch of grafts has produced the best results in many years. After lots of experiments over the last year to correct less than acceptable success rates, I have finally solved the puzzle.

Having recently exhausted my supplies of Nescofilm, I have had to move onto Parafilm as my grafting tape. This move has coincided with a dip in my graft success rates. I had noticed that the tape was splitting at the graft union, often within a month, resulting in the graft union separating. The penny finally dropped that Parafilm did not have the strength of Nescofilm and that adjustments were needed.

My first adjustment was to cut wider pieces of Parafilm to strengthen the graft union. This produced excellent results but was not that suitable on smaller material. To overcome this issue I still cut wider pieces of Parafilm but then double it over to provide even greater strength. And the results have been fantastic!

So give this a try with your grafting. As a guide I cut pieces of Parafilm around 5 cm by 2.5 cm, and then double it over, resulting in a strong piece 5 cm by 1.25 cm, which is then wound around the graft union as tight as possible.

## *Isopogon inconspicuus* (C. Meisner) Foreman (1995)



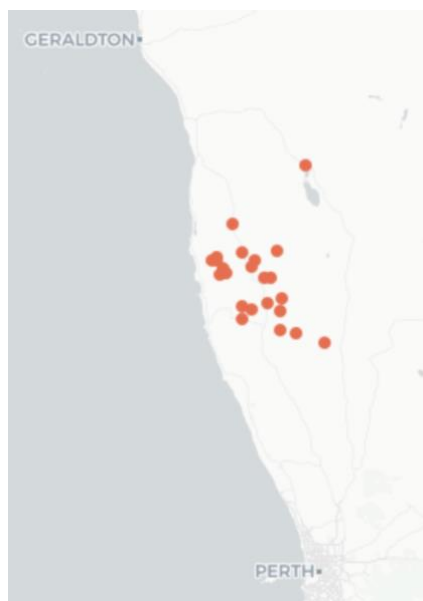
*Isopogon inconspicuus* was first described as *Petrophila inconspicua* by Carl Meisner in 1855 in Hooker's *Journal of Botany and Kew Garden Miscellany* using material collected by James Drummond between the Moore and Murchison Rivers in Western Australia. The species name is Latin meaning not conspicuous, referring to its pale flowers. The species was renamed as an isopogon by Foreman in his update of the *Isopogon* and *Petrophile* genera in *Flora of Australia* in 1995. It is an underrated species as it has usually finished flowering by spring, when the drooping, dirty grey, spent flowers which persist are mistaken for actual flowers.

**Description** – *Isopogon inconspicuus* is a low shrub to 80 cm tall, without a lignotuber. The branchlets are pale burgundy/brown and covered with a sparse indumentum of short, grey hairs. The short, spreading, pinnate leaves crowding along branchlets are bright green and slightly roughened, with a short petiole (to 2 mm) and a terete, grooved lamina (to 12 mm). The leaves have sparse white hairs. Those surrounding the inflorescence are recurved.

Globular inflorescences are sessile and axillary, clustered towards the end of branchlets, and mostly hidden by leaves. Both involucral bracts and cone scales are lanceolate and overlapping, pink



when fresh, and densely woolly. Pushing out beyond the leaves are long, slender flowers (to 25 mm) with erect, short, white/grey hairs. Described as pink to purple, they usually have a white/pale pink claw and a deep pink/purple limb. The tepals split only part way to reveal a somewhat unusual pollen presenter, swollen at the base then tapering to a slightly swollen stigmatic cap. It is covered with fine hairs and changes colour to orange/red over time. The cones are very small at only 5 mm in diameter and remain hidden in the foliage after flowering. The fruit is among the smallest of all isopogons at only 2 mm long.



**Distribution** – *Isopogon inconspicuus* is a relatively common species of the northern sandplains, from Dandaragan to Eneabba. It grows in sandy soils often with some gravel. Excellent spots to see this species are at Hi Vallee farm/Tootbardi Road, the nearby Alexander Morrison National Park and Tathra Nature Reserve.

**Confusing species** – *Isopogon inconspicuus* is most likely to be confused with *I. adenanthoides* or *I. asper*, which both grow alongside *I. inconspicuus* and have similar foliage. However, *I. inconspicuus* differs in having hairy flowers whereas the other two species have glabrous flowers. *I. adenanthoides* also differs in having terminal solitary bright pink inflorescences, and *I. asper* has flattened flower heads and prominent cone scales.



**Cultivation** – not previously in cultivation. However, *Isopogon inconspicuus* strikes readily from cuttings and can also be grown from seed. Like other WA species it is likely to require grafting in summer-wet climates. It has been successfully grafted onto *I. 'Coaldale Cracker'* though attempts to graft it onto *I. anemonifolius* have been



unsuccessful. Grafted plants have performed brilliantly, flowering profusely and showing no signs of disease after exposure to three record wet years in our south coast NSW garden. Its small size, winter flowering period and attractive, prominent flowers make it highly suited to modern gardens especially in rockeries or containers.

## *Petrophile chrysantha* C. Meisner (1855)



*Petrophile chrysantha* was first described by Carl Meisner in 1855 in *Hooker's Journal of Botany and Kew Garden Miscellany* using material collected by James Drummond between the Moore and Murchison Rivers in Western Australia. The species name derives from the Greek words *chryso-* golden, and *anthos-* flower, referring to the yellow/golden flowers.

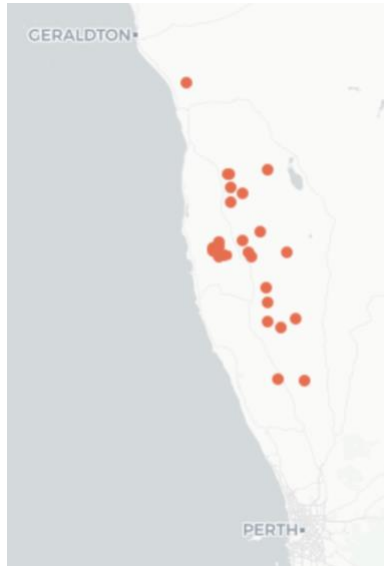
**Description** – *Petrophile chrysantha* is a small, spreading shrub to 1 m without a lignotuber. It has some of the smallest flower heads of all species. The crowded, short, pinnate leaves are 5-20 mm long and arch outwards. They are minutely scabrous with terete segments and pronounced pungent points. New growth is very hairy unlike the mature leaves. The terminal inflorescence no more than 1 cm wide is held high, clear of the leaves. Its broad yellow involucre bracts with a ciliate

margin cup the flowers. Cone scales tend to be smaller and hairier. It flowers in winter (from June) into spring but is mostly finished by September-October. The yellow erect flowers are densely hairy, to around 14 mm in length. At the bud stage, four appendages on the apex of each flower may be visible through the hairs. Tepals separate to the base revealing a fusiform (spindle-shaped) pollen presenter with a sparse covering of short, white hairs on the apical portion. Cones are globose to ovoid to 10 mm in diameter, while the flattened fruits are up to 4 mm long. Unusually, they have a narrow wing as well as a





long tuft or coma at the base and a beak at the tip formed by the base of the style.



**Distribution** – *Petrophile chrysantha* grows in sandy soils, often containing gravel, in shrubland and woodland. It occurs in Western Australia north of Perth from Regans Ford north to Eneabba and east to Marchagee. A great spot to find this species is in early September on Tootbardie Road, Badgingarra, where plants are very common on the roadside verges. Lesueur National Park, along the track to the base of Mount Lesueur is another great spot to see plants.

**Confusing species** – *P. chrysantha* is most commonly confused with *P. septemfida* because of similar short, terete pinnate leaves and overlapping distributions. However *P. chrysantha* differs in having more scabrous and less hairy leaves, glabrous involucral bracts and more densely hairy flowers, which are a bright yellow rather than cream/yellow colour.

**Cultivation** – Very little information is currently available on propagating and growing *Petrophile chrysantha*, surprising given what a stunning plant it is in flower. The Study Group is currently undertaking trials using all three propagation methods – seed, cuttings and grafting. Limited grafting trials have so far been unsuccessful using *P. pulchella* as a stock. Further trials including the use of *P. sessilis* as a stock are currently underway. In the summer-wet climates of eastern Australia, grafted plants will be required, as it is likely to be short-lived in ungrafted form. *Petrophile chrysantha* is not available at nurseries, probably reflecting the difficulty in producing plants in commercial quantities through cuttings or seed germination. Hopefully these propagation difficulties can be overcome with more research as the species has great horticultural potential with its showy bright yellow terminal flowers and interesting foliage in a small shrub naturally well-shaped and suitable for all gardens.



# The role of petrophiles in Gang-gang diet

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As we have previously documented, in eastern Australia petrophiles are a source of food for the Gang-gang Cockatoo (*Callocephalon fimbriatum*). This small cockatoo was listed as endangered in 2022, largely because of a perceived 69% decline in numbers from 1999-2019.

Because the diet of the Gang-gang is not well documented, a new study by Mulvany & Booksmythe investigated thousands of online images and written records to compile over four thousand feeding records. The sources included social media or citizen science platforms such as NatureMapr, iNaturalist or eBird, Facebook, Flickr, Instagram and Twitter as well as records from birdwatching clubs and literature.<sup>1</sup> Over 90% of the records were collected in the period 2012-2022 but some go back as far as 1910.

The results indicate that Gang-gangs consume a wide range of foods (native and exotic). Foraging is mainly arboreal, occurring in the canopy of woodland assemblages (particularly within eucalypts) and less often within the understory. Their diet is broad and flexible reflecting not only what food items are available at a particular time, but also an element of food selection or preference.

Although 275 different food items were found in feeding records the bulk of Gang-gang feeding is focused on only twelve main species. This handful of food items varies according to availability through the year and also by region. Gang-gangs are found in forests, woodlands and urban areas in cool-temperate south-eastern Australia and the records covered an area from around Sydney south into Victoria. In the Blue Mountains area of NSW, ten species were the focus of Gang-gang feeding with *Petrophile pulchella* as the fourth most commonly consumed. The top three foods in the Blue Mountains were walnuts, liquidambar and *Eucalyptus piperita*.

It is unsurprising that this petrophile does not make the overall list of most commonly consumed foods in this study given it does not grow in Greater Melbourne or the ACT where most records came from. Still, *Petrophile pulchella* represents an important part of one of the key food groups for Gang-gangs. This is the food group classified as soft pods (mainly *Liquidambar styraciflua* and *Petrophile pulchella*). The seven main food groups are, in order of frequency: eucalypt nuts and flowers, berries with relatively large seeds but a small pulp mass; green cones (pine or cypress); green wattle pods; **soft pods**; nuts; and invertebrates (mainly sawfly larvae and lerps).

Gang-gangs were much more likely to be observed feeding on cones (pine or cypress) and pods (liquidambar and petrophile) in the Blue Mountains than in the other areas, particularly in Melbourne. In particular, pod feeding was much more common in the Blue Mountains (17%) than the ACT (6%), Melbourne (2%) or overall (7.5%). In fact, Alan and Dianne Page did not even have to leave their Blue Mountains house – they photographed a pair of Gang-gangs feeding on *Petrophile pulchella* through their bedroom window (see overleaf). As liquidambar was one of the most common food items right across the Gang-gangs' range, the higher proportion of pod feeding recorded in the Blue Mountains presumably reflects the presence of *Petrophile pulchella*.

From the study, Gang-gang pod eating included bits of the pod (i.e the petrophile cone), the fruit and seeds inside, and insect larvae inside. Images of Gang-gangs biting bark or with bark in their beaks were not considered to constitute a feeding record as Gang-gangs bite beak-sized chunks of bark to line the base of tree hollows in which they are nesting. Sightings reported to the study group were of Gang-gangs chewing young or green cones although one male was chewing mature cones on a dead plant. In the study, pod eating was most common in the months February to June (particularly May). This corresponds to the ripening period for liquidambar as well as *Petrophile pulchella*. This petrophile flowers from October right up to as late as March.

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<sup>1</sup> The study acknowledges that this is a biased sample, as images tend to be from locations where Gang-gangs are most readily encountered (urban and peri-urban) and are less likely to include records from remote areas or from tall trees where birds are difficult to see and photograph. The images may also over-represent males, as their bright red head makes them more visible and photogenic.



Photo: Alan & Dianne Page

Gang-gangs feed in small groups of up to 25 individuals with large flocks of feeding Gang-gangs (15 or more birds) only rarely reported (3% of total sightings). Large feeding flocks can occur at any time of year but reach a peak in May and more generally in the late autumn – early winter period. Larger flocks recorded tended to be feeding on particular food species/ species groupings at particular times of the year. The Gang-gang flock feeding on petrophiles in autumn 2022 reported to this study group is an example, Peter Olde passing on the observation from Justin and Phoenix Greener that they were actively engaged in chewing the young cones and were not attending any other plants growing in the area, which is within the boundary of Nattai National Park.

With regard to Gang-gang habitat restoration efforts, a more strategic approach informed by this diet information is suggested. Rather than just planting or allowing the regeneration of local native trees, shrubs and ground layer plants, (especially acacias and eucalypts), particular species should be selected based on the type of food they provide and the time of year. In addition, restoration should include food from all the main food groups including those that have berries with large seeds, plus Cypress Pine *Callitris* sp. and/or *Petrophile* for its cones or soft pods.

The study notes that there is an introduced population of Gang-gangs on Kangaroo Island, South Australia. They were recorded eating white cedar there in September-October. It would be interesting to see if this population finds the cones or 'pods' of *Petrophile multisecta* which occurs only on Kangaroo Island. This species would provide a source of food in the autumn-winter months. However, as this species only reaches a height of 60 cm or so, and Gang-gangs are predominantly canopy feeders only occasionally feeding on low shrubs, *Petrophile multisecta* may not be selected by Gang-gangs.

Mulvaney, M. & Booksmythe, I. (2023) Gang-gang Cockatoo diet as assessed by camera images and written records, *Corella*, 2023, 47: 8-15. [https://absa.asn.au/wp-content/uploads/2023/04/4\\_V47\\_Pg8-15\\_GangGangCockatoo\\_V2.pdf](https://absa.asn.au/wp-content/uploads/2023/04/4_V47_Pg8-15_GangGangCockatoo_V2.pdf)

# Honey possums: do they eat isopogon/petrophile pollen?

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There were a few honey possum sightings reported while we in doing our fieldwork in WA in September. These were on banksias and honey possums are known to prefer proteaceae, especially banksias and dryandras. This led us to wonder whether honey possums use isopogons and petrophiles as a food source. As their name implies, honey possums feed on nectar. As isopogons and petrophiles secrete no nectar and offer pollen as their only reward, we might expect that honey possums would not use these genera as a food source. However, isopogons and petrophiles are a rich source of pollen.

Pollen in the honey possum diet is crucial to compensate for the lack of nutrients in nectar. Pollen provides proteins, lipids, vitamins, co-enzymes and other essential nutrients. A honey possum needs 0.7-1 gram of pollen each day to satisfy its dietary needs. They have no other source of nutrients and are the only mammals in the world that live entirely on pollen and nectar. Some other marsupials (e.g. pygmy possums, sugar gliders) also eat insects fruits, sap, gum, lerp and manna. The semi-solid faeces of honey possums comprise nothing but the empty shells of pollen grains whose contents have been digested. Pollen grains have incredibly hard external shells perforated with holes through which digestive juices can percolate to digest the inner cell contents of the grains.

As the harvesting of nectar uses up less energy than it provides, the surplus energy can subsidise the time-consuming and, energetically, more expensive collection of pollen. Pollen collection is so important that captive honey possums given a fresh blossom will often go around the flower licking off most of its pollen before probing its base for nectar. It is estimated that honey possums need to lick 2,500-5,000 fresh banksia flowers per day to meet their pollen needs.

Honey possums prefer banksias because they are a particularly good source of energy i.e. nectar. Banksias also have large pollen grains so feeding on banksias provides both energy and nutrients. The common food plants for honey possums also includes beaufortia, corymbia, adenanthos, callistemon, lambertia and dryandra.



Honey possums have a smorgasbord of flowers to choose from in WA kwongan habitats. Researchers speculate that honey possums only turn to the flowers of other plants when banksias are unavailable. For example, *Dryandra plumosa* flowers for much of the year and is visited by honey possums throughout the year. It contains little nectar and honey possums probably visit it mainly to harvest pollen.

Left, honey possum on calothamnus at Hi Vallee. Photo by Philip Stenzel Switzerland, courtesy Don & Joy Williams.

Honey possums are also likely to forage on co-blooming plants offering pollen alone. Bees often practice polylectic foraging across plant species with nectar and those with pollen alone. This increases the diversity of pollen they eat as well as fuelling the work of foraging. The shape and size as well as nutritional value of pollen grains varies widely. Most banksias have elongated, crescent-shaped pollen grains with two germination pores while isopogons (and hakeas) have triangular grains with three germination pores.

There are several factors which suggest that honey possums could forage on isopogons and petrophiles. While these plants might sometimes be included in the diet of honey possums, they are clearly not among their main food plants. Nor are honey possums likely to be pollinators of isopogons and petrophiles.

## Distribution

A wide range of species of Isopogons and petrophiles are found in the areas where honey possums occur in the

south-western corner of Australia. Even though the distribution of the honey possum is contracting it is still found in banksia woodlands and heathlands rich in nectar-producing plants, particularly areas richest in proteaceae.

### **Ability to collect isopogon and petrophile pollen**

These animals are so tiny that their heads are barely larger than your fingernail and tip. Incredibly agile, a long tail can wrap around stems for stability, hind legs are built for jumping, and forelimbs can cling to stems or manipulate blossoms. They have hands with fingers, not claws, meaning they may be able to grasp the pollen presenter and even to manipulate flower buds to open them.

The long (18 mm) tongue of a honey possum is covered by brush-like bristles with which they can very efficiently scrape pollen off a pollen presenter. On the roof of the mouth are transverse ridges with spines that comb the pollen from the surface of the tongue both as it is retracted and as it is protruded again. A tongue can be flicked in and out of the mouth about 2-3 times per second. It is stiffened and a keel underneath the tongue runs in a groove on the floor of the mouth, being guided by the forward-pointing incisors.

The act of licking pollen off a pollen presenter on an isopogon or petrophile means the honey possum is not likely to collect pollen on the rest of its body while feeding. There is little opportunity for pollen to be spread to other flowers or plants and therefore for pollination of isopogons and petrophiles. If any pollen was to land on any other part of a honey possum's body, it would be promptly removed by repeated grooming.

### **Quantity and accessibility of pollen**

Isopogons and petrophiles carry large pollen loads and offer pollen out at the edges of the flower head, usually pointing downwards towards the ground. Like many other proteaceae, they have a huge number of inflorescences on each bush and provide a continual supply as new flowers open from the bottom upwards. This pollen is so easy for honey possums to scrape off that it would make collecting it just as fast as collecting nectar.

### **Attributes favoured by small mammals**

The position of flower heads in many species of isopogons and petrophile is highly suitable for small mammals which are thought to favour flowers near the ground (although they can climb much higher), inside the foliage, and concealed. Odour has also been suggested as a factor – although this is mostly associated with nectar, some petrophile species do have a scent. The colour of the flowers may also be relevant. Small mammals are thought to favour drab flowers and many species of isopogon and petrophile have pale flowers in shades of white, cream or pale yellow.

There are many species which have a low habit, low and/or hidden flowers and a pale colour which might be attractive to honey possums e.g. *Isopogon uncinatus*, *Isopogon attenuatus*, *Isopogon polycephalus*, *Isopogon alcicornis*, *Petrophile prostrata*, *Petrophile filifolia*, *Petrophile longifolia*, and *Petrophile aspera*. All these species have long leaves with flower heads at the base of the leaves. The rarest species in the genera, *Isopogon uncinatus*, puts its flowers down low in large clumps right on the ground. *Petrophile aspera* has the additional attribute of scent which might make it attractive to a honey possum. In areas where there is a good population of honey possums (where nectar availability is high) many other isopogon and petrophile species could be sampled by honey possums.

There is only limited scientific evidence of honey possums actually visiting isopogons or petrophiles. Weins et. al. (1979) found three grains of pollen from *Petrophile longifolia* (probably *P. filifolia*) on one honey possum in the Albany area. As noted already, these plants are not among the major food plants for honey possums. Studies tend to focus on banksias only or the main food plants. A standard technique is analysis of pollen loads taken from the heads of honey possums. These pollen loads are likely underestimated because these mammals are live-trapped and may have preened themselves prior to sampling for pollen. In addition, the time of year the study is conducted will influence the likelihood of isopogon or petrophile pollen turning up. The 1979 study was conducted over three days in December and it is likely that *Petrophile filifolia* was the only I&P species in flower at that time.

Now there's a challenge for the study group – how to get a photo of the shy honey possum foraging on an isopogon or petrophile!

Ron and Sue Wooller (2013), *Sugar and Sand: The world of the honey possum*, Swanbrae Press.

Weins, D., Refree, M. & Wooller, R.O. (1979), Pollen loads of honey possums (*Tarsipes spenserae*) and nonflying mammals in southwestern Australia, *Ann. Missouri Bot. Gard.* 66: 839–838.

## A great WA wildflower season

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There were dire stories that this year's wildflower season in the west would be a flop. In fact, although the fields of daisies didn't eventuate this year, there were many parts of southwestern WA that were looking great. It is always difficult for us to time our trip so that we find the isopogons and petrophiles in peak flowering, but this time we saw displays that were the best we have ever seen. Here are some of the highlights of our two and a half weeks in September.



Our trip started north of Perth at **Lesueur National Park** and it looked a picture. Our main objective was to find *I. sphaerocephalus* subsp. *lesueurensis* (about a metre tall and with hairy leaves, pictured left) and we were thrilled to find plants in flower, looking very healthy including a couple of recently burnt plants resprouting nicely from lignotuber. *Petrophile chrysantha* was also in flower along with acres of *P. seminuda* by the path to the base of Mt Lesueur.

If you have been fortunate enough to visit **Hi Vallee** farm, you will understand why every one of our field trips to WA automatically includes a visit there. Hi Vallee is located on Tootbardi Road in the locality of Warradarge, about 240km north of Perth. Don & Joy Williams are the most welcoming owners of a magnificent remnant patch of bushland that is just packed with 528 plant species, many rare and endangered.

Hi Vallee's claim to fame is the nine banksias and nineteen dryandras on the property, but its isopogon/petrophile diversity is almost as impressive. There are seven isopogons and thirteen petrophiles, so it is the number one location in WA for us to do research on I & Ps. It is the only place to see *Petrophile nivea*. Despite extensive searching, this species has not been found elsewhere. Our visit this time was too late for the winter flowering *Petrophile nivea*, but it was still great to see its distinctive short, crowded leaves which completely obscure the branchlets.

Floral highlights of this visit were *P. megalostegia* (photo, below left) which has distinctive broad, papery involucre bracts, *P. pilostyla* subsp. *austrina* in peak flower, the stunning pink flowers of *P. linearis* (Pixie Mops), and the deep pink of *I. linearis* (photo, below right). Plants of the latter were in the best condition we have ever seen.



**Tootbardie Road** is perhaps the best flora road verge in WA. While so many previously excellent road verges have deteriorated in recent years due to drought, unnecessary clearing and weeds from adjacent crop farms, Tootbardie Rd is still in remarkably good condition. This road provided a real highpoint with a spectacular mass flowering of *Petrophile chrysantha* (photo below). We cannot recall seeing these flowering on previous trip along this road, so we were very lucky indeed to strike them at their peak. There were also some great flowering specimens of *P. biternata* and *P. seminuda* along this road.



Our visit to **Dryandra Woodland** was also perfectly timed. Lyn Alcock took us up some new roads and we found acres of *P. heterophylla* (photo below left), plus a couple of stunning patches of *I. crithmifolius* (photo below right), some *P. serruriae* and *P. imbricata*, all at their peak.! It was the first time we had seen *I. crithmifolius* in flower at the same time as the similar species *I. dubius* in the park and we were able to compare them directly. Sadly, we saw no numbats.







In **Stirling Range National Park** we managed to catch one of our favourite isopogons, *I. baxteri* (right) still in flower. *I. formosus* was looking great but many other species were still in bud and yet to reach their peak. For example, we found lots of plants of *P. anceps* showing bright lime green buds. One species in full flower was *P. divaricata*, lovely compact plants which have probably benefited from recent fires in the park (pictured above).

Another highlight was a day trip to **Cheyne Beach headland** with Kevin and Kathy Collins. A four-wheel drive is needed to navigate the rocky and deep sand conditions of the headland drive, so we are very grateful that Kevin and Kathy offered to take us there for the day. Cheyne Beach is a botanical wonderland, famous for prostrate/dwarfing forms of many iconic species such as a prostrate *Eucalyptus preissiana* and a prostrate *Hakea cucullata*. Species like this have evolved as low forms due to the elevated, exposed, windswept headland. The headland is also a great spot for banksias, including *B. coccinea*, *B. baxteri*, *B. dryandroides*, *B. sphaerocarpa* subsp. *sphaerocarpa*. All except *B. coccinea* have evolved into dwarfing forms.

We really timed our visit to Cheyne Beach well, with the headland a mass of flowering plants. The I & P species in flower included *Isopogon formosus* (dwarf form as low as 30 cm), and *Petrophile squamata* (two different forms, one around 20 cm high). *Isopogon cuneatus* (dwarf form to 50 cm) had finished flowering, hardly surprising given it flowers in winter. *Isopogon longifolius* (low form) was still some way off flowering.

The *Petrophile squamata* complex is regarded by the WA Herbarium as needing work to establish how many species/subspecies/varieties exist among the number of different forms. Cheyne Beach throws the most unusual form of this complex into the mix. It differs from other forms in having leaves which divide three times rather than the typical two of other forms. It's a spectacular plant, growing to around 15-20cm in height, and covered in masses of bright yellow flowers. We initially thought that this form was just another variation which had evolved under the exposed conditions of Cheyne Beach headland. However, just a hundred metres further up the hill from this population we found a population of the typical twice divided form. And then to further complicate the issue, a further 200 m up the headland was another population of the three times divided form. These were slightly higher

than the other population, growing to around 30 cm in height. So are these two different forms of *P. squamata* different species? We suspect they may be, given that they co-exist on the headland with no sign of any intermediate forms. Below, *P. squamata* with twice divided leaves. Right, *P. squamata* with three times divided leaves.



Further up the headland we found the most floriferous section. Here there were very low forms of *I. formosus* and *P. longifolia* flowering beautifully, both barely higher than 15-20 cm. Very low forms of *I. longifolius* were also in profusion at this site, although not in flower. This appeared to be a suckering form, spreading over 3 metres.



Above, the heathland at Cheynes with Phil and Kathy & Kevin Collins.

From this high point of the headland, we then drove back away from the coast through deep sand through the most amazing patch of hundreds of *B. coccinea* in peak flower, before exiting the headland drive. If you haven't ever been to Cheyne Beach headland, this is one of the great spots to visit in WA. Just make sure you have access to a 4-wheel drive to make the most of this botanical wonderland.



Cheyne Beach highlights: above top, *I. formosus* dwarf; above bottom, *P. longifolia*.

**Between Albany and Denmark** we also managed to catch both *I. axillaris* (far right) and an increasingly rare species *I. buxifolius* subsp. *buxifolius* (right) in flower. This form of *I. axillaris* is tall and graceful, a particularly attractive form.

On the **South Coast Highway** there is a wildflower hotspot where we found *I. cuneatus* (below) still in flower – these specimens have enormous flower heads at least 5 cm across with huge leaves and deep pink flowers.



Near **Hyden** we found great examples of flowering *I. nutans* as well as *P. merrallii*, *P. cyathiforma* and *I. divergens*. At **Tarin Rock**, *I. teretifolius* pink form was flowering beautifully, with *I. gardneri* just coming into flower. We ventured as far east as **Southern Cross** looking for *P. arcuata* (right) which we found along with plenty of *I. scabriusculus* in flower.

Finally, near **Esperance** we found wonderful examples of *I. alcicornis* (below). They occur under trees and are concentrated in certain areas, so you have to find the exact spot! The long upright leaves are a bit untidy (the plants look like they are having a bad hair day) but the flower heads are large and very impressive.



## Financial Report

Total 10/04/2023	\$1,981.56
Bank balance	\$1,878.12
Cash on hand	\$103.44
Donations/income	\$447.50
Darren Allen	\$20.00
Australian Plant sales	\$17.50
SA APS	\$410.00
Total 31/10/2023	\$2,429.06
Bank balance	\$2,325.62
Cash on hand	\$103.44

*Donations are welcome*

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