Newsletter

Australasian Systematic Botany Society

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Australasian Systematic Botany Society (ASBS)

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In this issue

From the President

Dan Murphy

Hopefully, by the time you are reading this Victoria will be coming out of, or at least looking in a more positive situation, after strict 'Stage 4' lockdown in Melbourne to reduce an alarming second wave of COVID-19 infections. I must admit the second lockdown in Victoria has certainly put a dampener on some of our work and plans, especially fieldwork, and the general mood has been more sombre this time, as compared to the first COVID-19 lockdowns earlier in the year. It is a very difficult time for all (globally), and in other Australian States and New Zealand I feel the empathy levels have increased as the seriousness of the Victorian outbreak became apparent. Overall, it has become clear just how vulnerable we all are to new outbreaks, and anyone, anywhere, may quickly find themselves in a similar situation. I think it has also highlighted just how challenging the next stage(s) of the pandemic will be to navigate. A lot of hope is currently placed on a vaccine, as this will probably be the only way global and more extensive local travel will become possible again in the shorter term, unless elimination becomes a viable strategy. It is complex situation, and I hope (if anyone is reading this in the future!), that the way governments and populations manage pandemics has become clearer.

As you will see elsewhere in this newsletter, Darren Crayn and colleagues provide an update on the recent activities of Genomics for Australian Plants (GAP). This very exciting initiative is beginning to bear much fruit in terms of data, collaborations and future research ideas, and most importantly involving a significant number of our ASBS community in a truly collaborative research network. If you want to get involved please feel free to contact me or any of the GAP members, who would all gladly point you in the right direction, as we all wish to emphasise that GAP is an open network of researchers and users of genomics data (at this stage with a focus on Angiosperms).

ASBS Conference

From this vantage an international conference looks a long way off, but, as we are discovering, things can change quickly. Since the previous ASBS newsletter, the Cairns conference organisers have wisely moved the planned face-to-face conference to July 2021, where I am VERY much looking forward to seeing ASBS members (and in fact *anyone*) who may attend, and having the opportunity of introducing our 2020 Nancy Burbidge Medallist to deliver the 2020 Nancy Burbidge Lecture (please see the exciting announcement elsewhere in the newsletter of this year's awardee).

Annual General Meeting

The postponement of the ASBS conference until 2021 means that it will not be possible to hold this year's Annual General Meeting with the conference. Moreover, because uncertainties surrounding interstate travel mean a face-to-face meeting could be susceptible to last-minute cancellation, Council will hold a virtual meeting on November 18. You should have received a notice about this from Hervé on June 21. The Society is able to do this only because the ACT Registrar-General amended section 70A of the Associations Incorporation Act allowing societies, like ASBS, whose Rules required members to attend meetings in person, to attend via methods of communication other than in person. Details on how to participate in the videoconference will be emailed to

you closer to the date. Council has resolved to work on changes to the rules to allow the Society to manage future situations like the one we are currently experiencing. John Clarkson has foreshadowed some of the changes Council is considering elsewhere in this issue.

Thanks to Editors

In what is an impressive follow up to their first newsletter, our new editors have put together another jam-packed edition, and many thanks Lizzy and Alex, and to everyone who has submitted news and reports (and just quietly, our diligent Vice-President, Heidi Meudt, who has been chasing up previous Eichler grant reports).

Nominations to Council Reminder

Finally, please note that the call for Council nominations has now been triggered, as these are due two months prior to the published date of our next AGM (18 November 2020); nominations close at 17:00 Sydney time on Friday 18 September.

Prof. Wendy Nelson is the 2020 Nancy Burbidge Medallist

ASBS Council

Professor Wendy Nelson

It is the ASBS Council's pleasure to announce that the 2020 Nancy Burbidge Medallist is Professor Wendy Nelson.

Our 2020 President, Dan Murphy, hopes to be able to present the Medal to Wendy at our next ASBS Conference in Cairns in 2021 and invite her to deliver a Burbidge Medallist Lecture. In the meantime, the ASBS Council outlines here just a few of Wendy's many achievements that were highlighted in her nomination for this award.

Wendy Nelson is an active researcher in marine phycology who has made sustained and invaluable contributions to systematics and conservation of marine algae in New Zealand for more than 35 years. She has an extensive publication record with over 150 refereed papers, 3 books, 11 book chapters and numerous technical reports and popular articles. Recognised nationally and internationally as a leading authority in her field, Wendy is a respected leader within her institutions. She is Programme Leader (Marine Biological Resources) in the Coasts & Oceans National Centre in the National Institute of Water and Atmospheric Research (NIWA), and also a Professor in the School of Biological Sciences at the University of Auckland. All of these involve active partnerships with other organisations. Prior to joining NIWA

she worked for 15 years at Te Papa (WELT) as Curator of Botany and continues to have a close association with that institution.

Significantly for ASBS, Wendy led the Royal Society Te Apārangi review of National Taxonomic Collections in New Zealand (https://www.royalsociety.org.nz/what-we-do/our-expert-advice/all-expert-advice-papers/national-taxonomic-collections-in-new-zealand/), which was published in 2015. Several years of discussions about writing a white paper on systematics in Australasia preceded and followed the publication of this document, but having this high-level publication for New Zealand highlighted the critical issues around taxonomic collections, training, and staff, especially to those not working in the sector. Importantly, this publication laid the foundation for the Decadal Plan for taxonomy and biosystematics in Australia and New Zealand (https://www.science.org.au/support/analysis/decadal-plans-science/discovering-biodiversity-decadal-plan-taxonomy). Wendy was a member of the executive steering committee for the Decadal Plan which has now given rise to Taxonomy Australia (https://www.taxonomyaustralia.org.au/) and Species Aotearoa (https://www.speciesaotearoa.nz/about-1). Wendy is a member of the steering committee of the latter, which aims to achieve the goals set out in the Decadal Plan.

Wendy has made, and continues to make, a huge contribution to Botany at Te Papa. During the course of her 15 years there she doubled the size of the algal herbarium, adding over 10,000 new collections made around the whole New Zealand coastline from the Kermadecs to the Southern Ocean. The entire collection is now well identified and almost completely databased, providing unrivalled knowledge of the distribution of New Zealand's algal flora. She has worked tirelessly to improve the understanding of New Zealand seaweeds and to train new phycologists, but she is still one of very few people employed in New Zealand with the detailed knowledge and ability to identify this distinctive and taxonomically difficult component of our marine biodiversity.

Wendy has been President of the International Phycological Society, the Systematics Association of New Zealand and the Australasian Society for Phycology and Aquatic Botany, a member of the Cawthron Institute Trust Board, a committee member of the Association for Women in Science, an Honorary Research Associate at Victoria University of Wellington and Te Papa, and a Fellow of the Royal Society of New Zealand. She is currently on the Editorial Boards of three international science journals and has previously served on three others. She has won a string of awards that testify to the quality of her science including the prestigious Zonta Science Award (1996), the George Papenfuss Systematics Award (2001), the New Zealand Marine Science Society Lifetime Achievement Award (2007), the Allan Mere Award (2011), the Provasoli Award (2012), the Hutton Medal (conferred by the Royal Society Te Aparangi) (2016), and in 2008 she became a Member of the New Zealand Order of Merit.

It is clear Wendy is an outstanding scientist in systematics and a well-deserved recipient of our Society's highest honour, the Nancy Burbidge Medal.

Recent ASBS Eichler Funding News

Heidi Meudt

ASBS Vice-President and Chair, *ex officio* of the ASBS Research Committee

The July 2020 round of the ASBS Marlies Eichler Postdoctoral Fellowship has just closed, and we are pleased to report that we have three applications now undergoing assessment by the ASBS Research Committee. It is very pleasing to see this number of high-quality early-career botanists applying for this competitive grant. We anticipate being able to announce the winner of the 2020 Marlies Eichler Postdoctoral Fellowship in the next ASBS newsletter.

Congratulations to the latest recipients of research grants from the March 2020 round of the ASBS Hansjörg Eichler Research Fund:

Luis Williamson, The University of Adelaide, for the PhD project, 'Evolution of Australian sundews–the genus *Drosera*'; supervisors: Michelle Waycott and Bob Hill.

Aiden Webb, The University of Melbourne, for the MSc project, 'Phylogenetic inference of *Caesia* and *Corynotheca* (Asphodelaceae) and taxonomic clarification of an Australian species complex, *Caesia parviflora*'; supervisors: Joanne Birch and Russell Barrett.

A full list of the winners of the Hansjörg Eichler Research Fund (1997–present) can be seen here: http://www.asbs.org.au/asbs/hesrfund/index.html. This page also has additional links to the resulting reports from most of the previous winners.

Writing a report on the highs and lows of the research that was undertaken using the Hansjörg or Marlies Eichler funds is one of the conditions of accepting either award. It is wonderful to see so many of these eventually published in the *ASBS Newsletter*. The reports allow readers of the newsletter a chance to appreciate the high-quality systematic research that our grants help support. They are not only of scientific interest, however. It is also great to find out who the people are behind the research, as many recipients include photos of themselves doing field, laboratory or herbarium work. And writing the reports is an opportunity for the recipients to hone their skills in science communication.

The deadline for the next round of the Hansjörg Eichler Research Fund is just around the corner: 14 September 2020! For those intending to apply, all the important information and the application form can be found on the webpage listed above. If you have any questions, please contact Heidi Meudt at vicepres.asbs@gmail.com.

Taxonomy Australia cost-benefit analysis completed

Kevin Thiele

The time since the last *ASBS Newsletter* has been a busy one for Taxonomy Australia, and it feels like many pieces of a giant jigsaw puzzle are beginning to come together.

Deloitte Access Economics have finalised their cost-benefit analysis of a mission to discover and document all remaining Australian species in a generation. The report is not yet released, and awaits final production and clearance from the Academy of Science to make it public, but I can summarise by saying that this preliminary cost-benefit analysis clearly shows that the benefits of discovering and documenting Australia's species and other taxa far exceed the costs. This will prove to be an invaluable document when we move into the advocacy phase. I thank the team at Deloitte Access Economics for their diligence, thoroughness, and the care with which they completed this work.

I have summarised the action items from the national meeting held in April and May and have distributed a copy of the report to all meeting participants for checking and comment. In all, the meeting can be summarised into 35 actions, ranging from ones that can be implemented immediately without needing to wait for funding, through ones that would need modest funding to achieve, to actions that cannot really be implemented without substantial new investments in our sector. In the next *ASBS Newsletter* I will report more fully on these actions.

Our next step once this work is done will be to develop an advocacy plan and to begin advocating our mission – and hence taxonomy – to governments, industry and the community. With the outcomes of the national meeting and the Deloitte report, we are now in a position to develop a detailed advocacy plan and to take the next steps. More on this next newsletter.

ASBS conference in Cairns rescheduled to July 2021

Katharina Nargar, Darren Crayn, Ashley Field, John Clarkson & Frank Zich

ASBS 2021 Organising Committee

The organising committee for the ASBS conference in Cairns discussed several options on how to proceed with the conference scheduled for November this year. It was concluded that a face-to-face meeting this November was not a viable option due to remaining restrictions around national and international travel. As many members expressed an interest in visiting Cairns to combine the conference attendance with other activities such as field or herbarium work, a face-to-face meeting was strongly favoured over a virtual conference.

Therefore, the organising committee has decided to reschedule the ASBS conference to 11–15 July 2021 in the expectation that travel restrictions may be eased by then. Should travel still be restricted, the conference is to be held either partly or completely virtually. Registrations are scheduled to open in early March 2021. Further updates will be provided in the next ASBS newsletter as well as on the ASBS 2020 conference website (https://systematics.ourplants.org/). Please feel free to contact the organising committee by email if you have any queries or comments: asbs2020Cairns@gmail.com.

Genomics for Australian Plants consortium update

Darren Crayn GAP Phylogenomics Lead – Australian Tropical Herbarium and James Cook University
Mabel Lum GAP Project Manager – Bioplatforms Australia
David Cantrill GAP Lead – Royal Botanic Gardens Victoria
Anna Syme GAP Reference Genomes Lead, Training Lead – Royal Botanic Gardens Victoria
Margaret Byrne GAP Conservation Genomics Lead – Department of Biodiversity, Conservation and Attractions, Western Australia
Lalita Simpson GAP Community Coordinator – Australian Tropical Herbarium and James Cook University

www.genomicsforaustralianplants.com @PlantsAus

The Genomics for Australian Plants (GAP) Framework Data Initiative aims to develop genomics resources to enhance our understanding of the evolution and support the conservation of the unique Australian flora. The project was initiated by Bioplatforms Australia as a consortium in partnership with the Australian State and National Herbaria and Botanic Gardens. GAP has three major project streams: reference genomes, phylogenomics, and conservation genomics. Here we present a brief update on progress across each of these three streams since the report in the last ASBS newsletter.

Update list

1. Reference genomes: pilot – *Acacia pycnantha* (golden wattle), *Telopea speciosissima* (waratah)
2. Reference genomes EoI
3. Phylogenomics: Australian Angiosperm Tree of Life (AAToL), and researcher directory
4. Conservation genomics
5. Training

Reference genomes pilot

Plant genomes are particularly challenging due to their large size and high repeat content, but methods utilising long sequencing reads have been particularly useful for re-constructing large contiguous genomic regions. The reference genome pilot projects were designed to identify the potential challenges and pitfalls working with Australian native plants.

Acacia pycnantha

Team leader Dan Murphy, Royal Botanic Gardens Victoria

The team continues to improve the draft assemblies of the nuclear, chloroplast and mitochondrial genomes of Australia's floral emblem. A transcriptome is now available through the generation of additional RNA-seq data which will allow polishing of the assembly and efficient progress on genome annotation. The consortium is preparing a media release for Wattle Day (1 September) that will not only report the genome sequencing of this iconic species, but promote the whole GAP framework data initiative. The team is formulating a plan for publications.

Telopea speciosissima

Team leader Jason Bragg, Royal Botanic Gardens Sydney

The living plant from which initial DNA samples were sourced was thought lost during the recent bushfires, but has now resprouted, Lazarus-like. This is great news and allows the team to pursue Hi-C sequencing to add to the existing Chromium 10x and Nanopore data. Furthermore, studies that build on the genome data, such as gene expression research, can potentially be undertaken on the same individual.

Reference Genomes EoI

With the pilots well underway and in the light of the many lessons so far learned, GAP re-

cently called for a round of proposals for genome sequencing. Twelve applications were received and are currently being assessed by the Steering Committee.

Phylogenomics

Australian Angiosperm Tree of Life (AAToL)

Sample selection and preparation by the six teams for stage 1 of the AAToL project continues in earnest. The Western Australian team are first to have submitted their samples for sequencing, and our five other teams are on track for submission over the next few months. Our estimate of the extent to which the samples committed by the AAToL teams and our partners from the Plant and Fungal Tree of Life (PAFTOL) project covers the Australian flora at genus-level, is 94%. This is a great outcome for this initial stage given our target of 95% for the project. It is expected that some samples will fail during processing, but the project will have opportunities to repeat and expand sampling in a bid to exceed our 95% target for AAToL stage 1.

AAToL researcher directory

In order to facilitate collaboration with other like-minded initiatives (e.g. PAFTOL - www.kew.org/science/our-science/projects/plant-and-fungal-trees-of-life) and more broadly, we have compiled a directory of AAToL researchers and published it on the GAP website - www.genomicsforaustralianplants.com/researcher-directory-phylogenomics/. We encourage all who would like to be listed on the directory to get in touch with Mabel (mlum@bioplatforms.com.au) or Darren (darren.crayn@jcu.edu.au).

Conservation Genomics

The Conservation Genomics component aims to provide genomic information to support conservation of the Australian flora. A call for expressions of interest to participate in the Conservation Genomics project closed on July 6 2020. Of the proposals received, 15 were approved to proceed and are listed below. Congratulations to the successful applicants. Development of the project workflow for sample preparation and submission is underway and we expect the projects to commence soon after this is made available to the teams.

Training

We continue to add content, links etc. to the genomics training page at https://plant-genomics.github.io/training/. As always, we welcome your contributions and suggestions. The genomics workshop which was to be presented at the cancelled 2020 ASBS meeting will benefit from extra time now available to develop an even better workshop for the 2021 meeting.

We gratefully acknowledge the support of the Ian Potter Foundation, the Royal Botanic Gardens Victoria Foundation, and the many institutions and researchers that have committed cash and in kind support to the GAP initiative.

Below: List of 15 Conservation Genomics projects approved for commencement

Species complex	**Team leader (Herbarium)**
Allocasuarina section *Cylindropitys*	Marlien van der Merwe (NSW)
Cassia species in Queensland	Laura Simmons (BRI)
Geleznowia verrucosa species complex	Kelly Shepherd (PERTH)
Gompholobium species in Queensland	Laura Simmons (BRI)
Isopogon buxifolius complex	Rachel Binks (PERTH)
Lepidosperma laterale	Jeremy Bruhl (UNE)
Lepidosperma fimbriatum	Russell Barrett (NSW)
Melichrus urceolatus / *M. erubescens* complex	Helen Kennedy (UNE)
Olearia ramulosa	Andre Messina (MEL)
Paracaleana gracilicordata / *P. granitica* complex	Katharina Nargar (CNS/CANB)
Samadera bidwillii	Laura Simmons (BRI)
Synaphea stenoloba complex	Rachel Binks (PERTH)
Thelymitra variegata	Katharina Nargar (CNS/CANB)
Wurmbea dioica subsp. *alba* complex	Rachel Binks (PERTH)
Zieria species	Mike Bayly (MELU)

ABRS National Taxonomy Research Grant Program winners and Flora news

Haylee Weaver ABRS abrs@environment.gov.au

Grants

We are pleased to announce the recipients of botany-related grants in the most recent round of the National Taxonomy Research Grant Program:

Chris Cargill
CSIRO
Phylogeny and taxonomy of Australian members of the liverwort genus *Riccia*

Aiden Webb
University of Melbourne
Phylogenetic inference of *Caesia* and *Corynotheca* (Asphodelaceae)

Timothy Hammer
University of Adelaide
Diversity of Dilleniaceae: a revisionary synthesis

Teresa Lebel
State Herbarium of South Australia
Investigating eastern Australian *Agaricus* (Agaricaceae) species diversity and evolution

James Clugston
National Herbarium of N.S.W.
Building the eFlora for the Fabaceae tribe Mirbelieae

Gintaras Kantvilas
Tasmanian Museum and Art Gallery
Flora accounts of Australian lichen genera

Rodney Seppelt
Illustrations of mosses of the Australian wet tropics

David Meagher
Taxonomic revision of the bryophyte family Pterobryaceae

A full list of recipients, both zoological and botanical, is available on the Federal Government's GrantConnect website: https://www.grants.gov.au/

Flora of Australia

The Flora of Australia Advisory Group met in June to discuss the strategic direction for the eFlora platform. The Flora of Australia Working Group will meet in September to discuss the priorities for development of the platform and how multiple floras can be included stand-alone (e.g. State-based floras) as part of a national platform.

Please contact the ABRS (address above) with any feedback about the FoA content and platform functionality, or if you would like to contribute new taxon profiles or update existing descriptions. This could include anything from adding complete treatments to adding profiles for taxa from your research papers. There is also much opportunity for updating and editing treatments loaded from the hard copy floras, reconciling the information with currently accepted taxonomic concepts.

Summary of ASBS Rule changes since 2003 and further changes in the offing

John Clarkson

The evolution of the Society's Rules between 1973, when the Society was formed, and 2002 were summarised in *ASBS Newsletter* by Bill Barker (Barker 2003). In that time, the Rules, or the Constitution as they were known until 1998, were amended five times. Since then, there have been three additional amendments. As Council is currently considering further changes, which will be outlined later, the changes made in 2006, 2011 and 2012 are summarised here.

The 2006 Amendments

The Society has traditionally held its Annual General Meeting (AGM) in association with the annual conference. Between incorporation in 1991 and 2005, all but three of these conferences were held in the second half of the calendar year for reasons pointed out by Brendan Lepschi when explaining the need for the Rule change (Lepschi 2004). The Associations Incorporation Act 1991 requires incorporated societies to hold their AGM within five months of the end of their financial year. At that time, the ASBS financial year ran from January 1 to December 31 meaning the AGM had to be held before the end of May. As a consequence, the Secretary had to write to the ACT Registrar-General most years to request an extension. Not surprisingly, the Registrar-General eventually got tired of this and made it quite clear that requests for further extensions were unlikely to be approved. The simple solution was to adopt a financial year that ran from July 1 to June 30 and amend the Rules accordingly. Putting the change into effect turned out to be far from simple.

Changing Rules should not be taken lightly. Votes to adopt changes should require more than a simple majority. However, the Rules in force in 1998 were worded in a way that required three quarters of the membership to participate in a vote to change the Rules. The relevant rule *30(5)(b)* read:

> A special resolution can only be carried in the affirmative at a general meeting of the Society provided it is approved by the vote of at least 75% of those members of the Society who are entitled to vote.

This wording appeared in the Rules for the first time in the May 1998 revision. In versions prior to that, an alteration required just 75% of valid votes, provided no fewer than 13 valid votes were received.

Despite almost unanimous support in favour of both proposals, the ballot held in 2005 fell about 50 votes short of the 75% of members required. With appropriate explanation and apology to members (Clarkson 2005), the proposal was put to the membership again. Councillors, with the help of Local Conveners, worked hard to ensure sufficient members voted. 216 eligible members voted and the resolution was carried with 212 votes in favour. Only two members voted against the proposal and two votes were declared informal.

The 2011 Amendments

Members were asked to vote on two amendments in 2011. The first was a proposal to change the name of the Society from Australian to Australasian Systematic Botany Society. The second was to resolve the problems caused by *Rule 30* governing the way the Society voted on special resolutions to bring it in line with the legislation under which ASBS is incorporated. Peter Weston explained the need for the changes in his President's report in the September-December Newsletter (Weston 2011). Once again it took an incredible effort by the Secretary, Gillian Brown, and Council member, Pina Milne, to ensure the required 75% of eligi-

ble members participated in the ballot. In the end 86% of eligible members voted and both resolutions were carried in the affirmative (Brown 2011).

The 2012 Amendments

In 2012 it fell to Peter Weston to once again ask members to vote on changes to the Rules (Weston 2012). This time the changes were triggered by correspondence from the Australian Taxation Office (ATO) instructing the Society to insert a clause in the Rules stating that the Society was a non-profit organisation. Failing to do so would have jeopardised the Society's Deductible Gift Recipient Status. The change was straight forward and appropriate wording was copied word-for-word from an example clause on the ATO web site.

While engaged in amending the Rules, Council took the opportunity to start taking the Society into the evolving digital world. Under the Rules in force at the time, to secure a quorum for any meeting, members had to be present in person. This even included Council meetings where four of the six Councillors had to be physically present at the same place to transact any business. The proposed change would allow Councillors to meet by electronic voice communication and thereby meet more frequently. At the time this meant by telephone but the definition was sufficiently broad to include video conferencing which, at the time, was in its infancy and other forms of communication yet to be invented. Other proposals were aimed at allowing members of Council to participate in General Meetings in this way. The quorum for a General Meeting is 13 members, four of whom must be Council members. Getting at least nine ordinary members together in the one place for a General Meeting was never a problem as long as the meeting was held in one of the southern capital cities but the requirement for four Council members to attend in person often meant spending Society funds to fly Councillors interstate. Although it was discussed, the technology available at the time precluded extending this to the membership at large. Because Council felt that that members should have the opportunity to interact with Councillors face-to-face at least once a year, the requirement for at least four incumbent members of Council or Council members elect to be present in person to establish a quorum at the AGM was retained. In another step into the digital world, several changes were proposed to clarify the way members cast their votes at General Meetings and in the determination of Special Resolutions. The 2002 changes had allowed the use of electronic mail as a means of communication for Society business (Barker 2003) but this proposal would allow electronic voting on some issues for the first time.

Over the years, a few typographical errors had accumulated in the Rules. Some of these were the result of simple mistyping but most were the result of changes to the Rules that had not taken into account all of the logical cross-referencing between rules. As Peter Weston pointed out, correcting such errors is a necessary exercise in constitutional housekeeping so, while the opportunity presented, Council addressed these. There were 12 such changes. Members voted in favour of all proposals and the new Rules took effect when they were lodged with the ACT Registrar-General in October 2012.

More changes are foreshadowed

The 2012 Rules have stood the Society in good stead for eight years but the impacts of the COVID-19 pandemic threatened to throw the cat amongst the pigeons had the ACT Registrar-General not intervened. Travel restrictions meant that many Societies could not hold their AGMs within the required time and, even if they could, rules around social distancing limited the numbers of people who could attend. The ACT Registrar-General responded by granting an extension to the time in which societies could hold their AGM. It also amended section *70A* of the Associations Incorporation Act to allow societies, like ASBS, whose Rules required members to attend meetings in person to attend via methods of communication other than in person. This exemption will remain in place for 12 months after the expiry of the Austra-

lian Capital Territory's COVID-19 Emergency Declaration allowing ASBS to hold this year's AGM electronically on November 18. Council has resolved to work on changes to the Rules to allow the Society to manage future situations like the one we are currently experiencing.

From time to time, since the expanded geographic focus of the Society was formally recognised in the name change adopted in 2011, there have been suggestions that perhaps it is time for a new logo. Adding weight to this is the fact that the Society will celebrate its 50th anniversary in 2023. Maybe the time is right for a fresh new image. This is something Council is currently considering. If the new logo does not include a *Xanthorrhoea* it may be necessary to amend the Rules. Opinion varies whether reference to the logo that appeared in the Rules for the first time in 2003 forms part of the Rules or is simply a preamble to the Rules. Either way, is it necessary to be so specific? This sort of issue can be dealt with in other ways.

In July last year the ACT Registrar-General drew the Society's attention to amendments to the Associations Incorporation Act. The amendments seek to provide greater clarity on governance matters and may require amendments to the Rules of associations incorporated in the ACT. Amendments that ASBS will need to consider include:

- a new provision to clarify process for resignation by a committee member;
- new requirements for dispute resolu tion;
- a new provision outlining the duties of officers;
- processes for managing access to in formation, including protections for privacy and improper use;
- matters related to the requirements for reviewing or auditing financial ac counts;
- matters related to the register of members; and
- issues related to the use of the common seal

Advice from the Access Canberra is that, at this stage, there is no pressure on societies to amend their Rules but this could change so it is wise to consider what the implications will be and plan accordingly. If these trigger changes to the Rules, then they would be best addressed at the same time as other matters. Rule changes are not for the faint-hearted. When required, it is something that needs to be done once and done well.

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Deceiving wasps and humans alike: hidden complexities of the Warty Hammer Orchid (*Drakaea livida*) revealed

Alyssa Weinstein

Australian National University

The south-west Australian Warty Hammer Orchid (*Drakaea livida*) attracts pollinators through a most bizarre strategy, that of sexual deception (Stoutamire, 1974). This means that the flowers mimic female insects, causing male insects to visit and attempt to mate with the flowers. As female wasps are wingless and rely on the males to carry them to food sources (Alcock & Gwynne, 1987), males attempt to fly off with the 'female wasp'. In this case the 'female' is the labellum (a modified petal) of the orchid. Hammer orchids manage to turn the momentum of the wasps against them: when wasps attempt to fly away with their 'mate', the orchid's unique hinge structure causes the wasp to flip over and get 'hammered' onto the flower's column. The column is where the pollen is housed - so every time the wasp is tricked, more pollen sticks to its thorax and is thereby transported between plants.

Like most sexually deceptive orchids, hammer orchids deceive wasps by producing floral chemicals in their labellum that mimic the sex pheromone of the wasp (Peakall, 1990, Bohman et al., 2014). Sex pheromones are highly specific. Typically each co-occurring insect species has its own unique blend of pheromone chemicals that is emitted by the female and recognised by the male. Therefore, each sexually deceptive orchid species typically mimics a specific sex pheromone, and attracts only one pollinator species (Ayasse *et al.*, 2011, Paulus & Gack, 1990). Consequently, sexually deceptive orchids have one of the most highly specific pollination systems in the world (Tremblay, 1992, Schiestl & Schlüter, 2009). However, the warty hammer orchid seemed to be a bit different as it is known to attract three different species of wasp across its broad geographic range (Phillips *et al.*, 2017). I set out to investigate this peculiarity as part of my PhD project.

My first question was, which pollinator species are being attracted at different locations across the distribution of the orchid? To answer this, I conducted pollinator observations at multiple locations within the orchid's geographic range in southwest Western Australia - from Perth to Albany (Figure 1). I found that each of the three species of wasps pollinated plants at different but neighbouring geographic regions: *Zaspilothynnus dilatatus* exclusively visited plants on the Swan Coastal Plain (red circles, Ecotype 3, Figure 1), an undescribed species of *Catocheilus* was attracted to plants growing in the inland Jarrah forests (blue circles, Ecotype 2, Figure

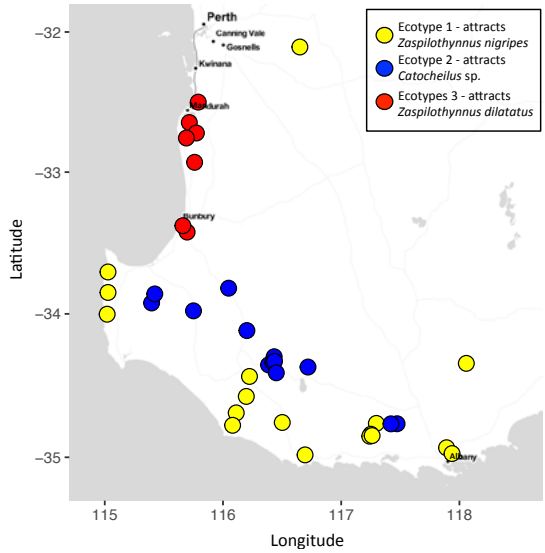

Figure 1: Distribution of *Drakaea livida* showing Ecotype 1 populations (yellow), Ecotype 2 populations (blue), and Ecotype 3 populations (red).

1), while *Z. nigripes* pollinated-plants had a broader, largely coastal distribution (yellow circles, Ecotype 1, Figure 1). Choice trials, where flowers are translocated between populations normally visited by different pollinators, confirmed that the pollinators only pollinated the local orchids and not the translocated orchids. In summary, there were three different groups of orchids, each attracting their own unique pollinator species, and occupying different geographic ranges. These groups of orchids are known as pollination ecotypes.

Interestingly, pollinator surveys revealed that *Zaspilothynnus nigripes* was present over the entire distribution of *Drakaea livida*, yet only visited some populations of the orchid. To investigate why different populations of orchids were attractive to different wasp species, I analysed the floral chemical composition of the orchids' labella using gas-chromatography mass-spectrometry. What I found was that each pollination ecotype had a different chemical composition: the presence of certain chemical compounds was associated with the attraction of a different species of pollinator wasp.

Previous studies on pollinator electrophysiology have been used to determine which compounds are perceived by the pollinator species *Zaspilothynnus nigripes* and *Catocheilus* sp. To identify these compounds, an antenna from the pollinator is connected to an electrode. Then, using a gas-chromatograph, floral extracts from the flowers they pollinate are passed over the antenna. When a compound perceived by the antenna passes over it, an electrical signal is recorded, demonstrating which compounds the pollinator can detect. These experiments found that *Z. nigripes* and *Catocheilus* sp. both respond to different pyrazine compounds found in *Drakaea livida* flowers (Bohman *et al.*, 2012a, Bohman *et al.*, 2012b). To test whether these pollinator-perceived pyrazine compounds were associated with the attraction of only a specific pollinator, I screened individual floral extracts from 338 flowers to see which compounds they contained. I found that only flowers from populations attracting *Z. nigripes* contained compounds that *Z. nigripes* responded to. Similarly, compounds known to attract *Catocheilus* sp. were not found in any populations of orchids attracting either *Z. nigripes* or *Z. dilatatus*.

To determine which compounds *Zaspilothynnus dilatatus* was could detect, I conducted some electrophysiology experiments of my own. I took antennae from *Z. dilatatus*, and ran floral extracts from Swan Coastal Plain *Drakaea livida* flowers (Ecotype 3) over them. By looking at the compounds that elicited an electrical response in the antennae, I discovered that plants from the Swan Coastal Plain do not produce any pyrazines. Instead, this ecotype appears to produce a different range of compounds. Rather than making nitrogen-containing pyrazines, these flowers produce sulphur-containing compounds, similar to what has previously been observed from sexually deceptive members of the distantly related genus *Caladenia* - the spider orchids (Bohman *et al.*, 2017a, Bohman *et al.*, 2017b).

The ecology of the *Drakaea livida* ecotypes is different: each ecotype attracts a different pollinator species, produces different floral chemicals, and has a different distribution. As separate ecological entities that could potentially be classed as distinct evolutionary significant units or even taxa, these different ecotypes should be conserved. Knowing how to effectively identify the ecotypes is the critical first step in their conservation management (Bickford *et al.*, 2007). So, how could we tell the three ecotypes apart?

Observing the species of pollinator visiting a flower is one way to determine its ecotype. However, this method is time intensive, and relies on sunny weather and the presence of wasps at a site. Perhaps the ecotypes could be differentiated based on morphological traits? To find out, I measured a variety of floral traits from orchids of each ecotype. Interestingly, I found that while flowers of the *Zaspilothynnus nigripes*-attracting ecotype were generally larger, the size ranges of the

traits of each ecotype all overlapped. As you can see in Figure 2, the floral morphology of the three different ecotypes does appear quite similar! The degree of trait size overlap means that none of the traits I used could be measured in the field to accurately determine the ecotype of a plant. However, a predictive model that uses data from all of the morphological traits at once was able to correctly identify the ecotypes 87 % of the time.

As another way of potentially identifying the ecotypes, I tested whether the floral chemistry of a flower could be used to predict its ecotype. I found that by using a subset of ecotype-specific compounds, the ecotype of a flower could be predicted for all of the 338 tested samples. This is a useful result, but unfortunately it is also destructive; removing the labellum of a flower for chemical analysis means that the plant will not be able to attract pollinators.

To develop a non-destructive chemical sampling technique, I investigated whether removing and sampling labella from plants that had already been pollinated would provide an alternate method of chemical identification. It could be expected that once plants were pollinated, they would stop producing chemicals to attract wasps, and therefore that labella from pollinated plants could not be used to chemically identify an ecotype. Alternatively, attractant chemicals may be stored in the labella, meaning that some ecotype-specific chemicals may still remain after pollination. It turned out that, even after pollination, enough chemicals were detectable in the labellum to be able to correctly predict the ecotype of a flower 96% of the time. By using this sampling method, I was able to identify the ecotype of many more flowers without affecting reproductive success, and thereby I managed to assign ecotypes to additional populations

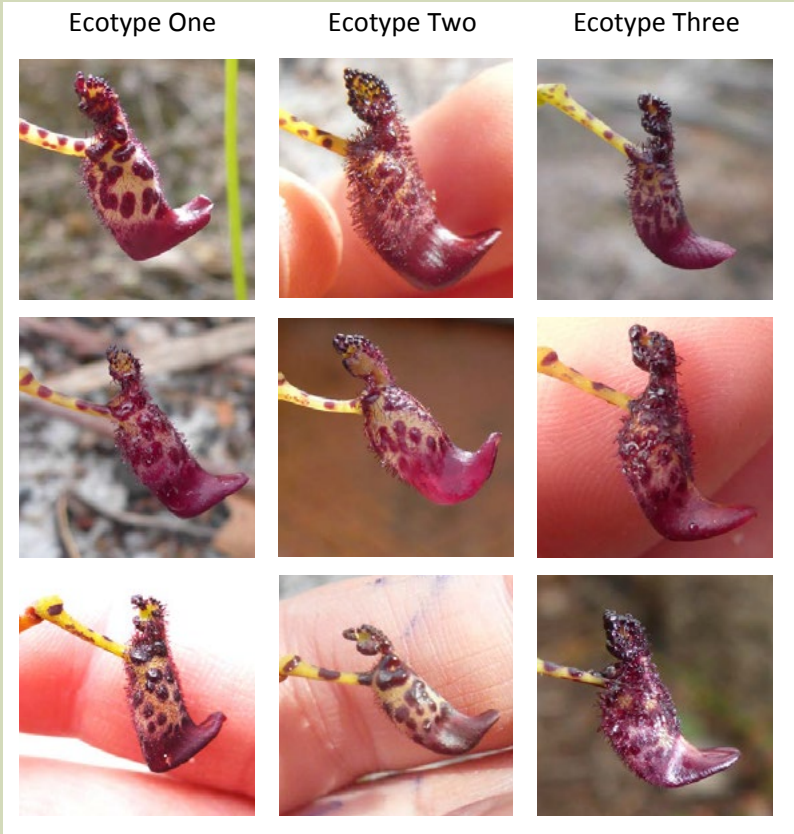

Figure 2: Three different flowers of each ecotype of *Drakaea livida*: Ecotype 1 (attracting *Zaspilothynnus nigripes*), Ecotype 2 (attracting *Catocheilus* sp.) and Ecotype 3 (attracting *Z. dilatatus*).

of *Drakaea livida*. These data helped to more accurately determine the geographic distribution of the ecotypes (Figure 1). From these data, it became clear that Ecotype 3, which occurs on the Swan Coastal Plain, has a very limited distribution (red circles, Figure 1). The distribution spans less than 200 km, within which extensive land clearing for agriculture has occurred, and in which only 10 populations are currently known. This ecotype can now be prioritised for conservation management.

Without the generous financial support from the Hänsjorg Eichler Scientific Research Fund, I would never have been able to discover the complexities of the warty hammer orchid, which was clearly deceiving not only male wasps, but scientists as well! This funding allowed me to discover the presence of distinct ecological entities within *D. livida* and develop methods to aid in their identification. Being able to accurately quantify our unique biodiversity is the critical first step in conserving it.

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Assessing morphological variation in the leaf cuticle between similar species of *Cycas* growing in Australia

James Clugston

National Herbarium of New South Wales, Royal Botanic Gardens & Domain Trust

Australia represents a biodiversity hotspot for cycads (Hill 1996) and is one of the world's key areas of floristic diversity (Sloan *et al*. 2014), with approximately 92% of vascular plant species being endemic (Chapman 2009). *Cycas* is the largest genus in the Cycadales, consisting of 117 extant species. There are 38 species of *Cycas* in Australia, and the country is considered to have some of the largest and most undisturbed populations in the world (Liddle 2009). *Cycas* populations within Australia's Northern Territory are relatively accessible and many species grow abundantly throughout their range (Dixon 2004). *Cycas armstrongii* Miq. and *C. maconochiei* subsp. *maconochiei* K.D.Hill (referred to as *C. maconochiei* from here on) are two of the most common species in the Northern Territory and their populations are relatively large (Liddle 2009; Watkinson & Powell 1997). *Cycas calcicola* is an iconic Australian cycad; although comparatively less common throughout its range than *C. armstrongii* and *C. maconochiei*, it remains in sizable populations (Liddle 2009). Although *C. armstrongii* and *C. maconochiei* are allopatric, their geographic ranges are in close proximity, which has led some to hypothesise that populations of *Cycas* with morphological characters reminiscent of both species may comprise interspecific hybrids (Liddle 2009).

From a morphological perspective, *C. calcicola* is distinctive due to the silvery hairs that cover the dark green leaflets and give them a glaucous appearance. This allows characters of the species to be easily differentiated from the other species (Hill 1996). But *C. armstrongii* and *C. maconochiei* are similar morphologically and are distinguished only by minor leaf characters and differences in the structure of the cataphylls (Hill 1996). However, leaves are not generally considered to be reliable in species identification in *Cycas* due to a high degree of morphological plasticity (Zhang *et al*. 2015). But micromorphological characters from the abaxial leaf cuticle and stomata are highly informative and have been used as a tool to aid in species differentiation (Vovides *et al*. 2018; Clugston *et al*. 2017; Whiting 2009; Mill & Stark Schilling 2009; Whang *et al*. 2001, 2004; Ickert-Bond 2000; Stockey & Ko 1988). This indicates that leaf cuticle micromorphology could be used to differentiate closely related species and may have the potential to differentiate between *C. calcicola*, *C. armstrongii* and *C. maconochiei*, and the interspecific hybrid *C. armstrongii* x *maconochiei*.

The aim of this research has been to address the variation among three species of *Cycas* endemic in the Northern Territory: *C. armstrongii*, *C. calcicola* and *C. maconochiei*, and an interspecific hybrid, *C. armstrongii* x *maconochiei*. To do this we assessed and measured a range of characters from the internal abaxial leaf cuticle using a scanning electron microscope (SEM), to determine micromorphological variation between species. Additionally, using principal component analysis (PCA), we aimed to determine if there are significant morphological and micromorphological differences among the study species.

Overall, the results and findings of this study resulted in imaging the leaf cuticle for 238 individuals: *C. armstrongii* (n=90), *C. calcicola* (n=60), *C. maconochiei* (n=78) and an interspecific hybrid *C. armstrongii* x *maconochiei* (n=10), using scanning electron microscopy (SEM). The SEM imaging was directly sup-

ported by an award from the Hansjörg Eichler Scientific Research Fund. Stomatal structures from images were measured, including area of stomatal apparatus, length of left guard cell, width of left guard cell and length of upper polar extensions. The initial measurements and preliminary results showed that *C. calcicola* has the smallest stomatal structures when compared to the other species but had the highest density of stomata (Figure 1), with *C. armstrongii* having the largest stomata. To visualise differences between the stomatal structures, we used a PCA, which showed good differentiation of stomatal characters in *C. calcicola* relative to the other species. However, there was very little differentiation in the PCA among *C. armstrongii*, *C. maconochiei* and the supposed hybrid population, which indicates intermediary between the stomatal characters of both *C. armstrongii* and *C. maconochiei*.

Once the character differences were visualised using a PCA, we checked for statistical differences between *C. armstrongii* and *C. maconochiei* to test the interspecific hybrid status using a pairwise T-test. The results from the T-test showed that, although there was little spatial differentiation between *C. armstrongii* and *C. maconochiei* in the PCA, there were significant differences in their stomatal micromorphology. This indicates that when *C. armstrongii* is compared to *C. maconochiei* there is a noticeable difference in the size of their stomata (*C. armstrongii* being larger), supporting validity of both species. These preliminary results indicate that *C. armstrongii* x *maconochiei* could either represent a morphological intermediate between *C. armstrongii* and *C. maconochiei* or indicate that the two species are actually a single continuous species. These micromorphological results will be combined with population genetic data also generated from my PhD project to fully understand the taxonomy and relationships of *C. armstrongii* and *C. maconochiei*, and help to determine the hybrid status of *C. armstrongii* x *macon-*

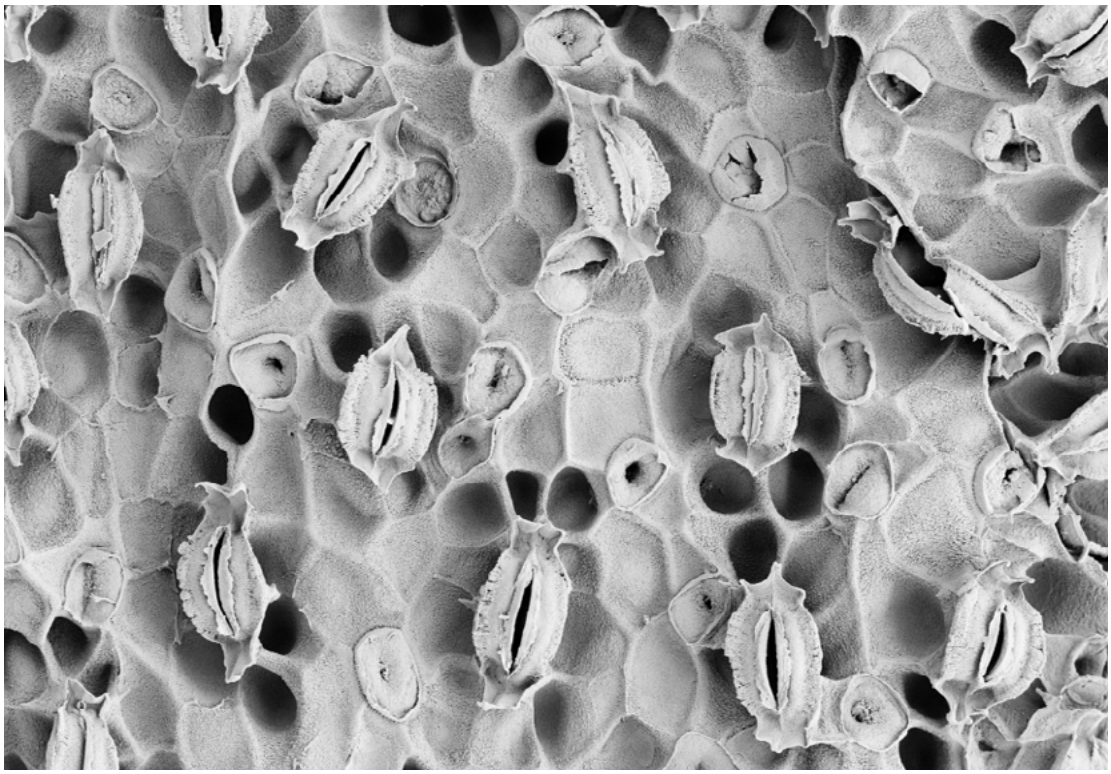

Figure 1: the internal leaf cuticle structure of *Cycas calcicola* captured using a scanning electron microscope (SEM).

ochiei.

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But *how* do we manage the lists of taxa and their names? An update and response to Thiele's proposed scheme

Editorial introduction

Lizzy Joyce

In the last issue of *ASBS Newsletter* (http://www.asbs.org.au/newsletter/pdf/20-march-june-182-3.pdf), Kevin Thiele put forward the case for changing the way we document biodiversity in our region, advocating for a system that allows for the tracking of taxonomic changes as well as nomenclatural changes. Following community feedback, Kevin submitted an update to his article for inclusion in this issue, where he revises the standard circumscriptional statements suggested for inclusion in taxonomic papers, and addresses some objections to his proposed scheme. After we received this update, we also received a response to Kevin's article led by Bill Barker. In this article, Bill and his co-authors argue that Kevin's proposed changes are unnecessary because taxa and names can be mapped with an extension to the existing, but often poorly applied, synonomy section of taxonomic papers. They also go on to express concerns relating to the practicality of some aspects of the proposed changes. Both Kevin's update, and the collective response led by Bill are published below; it is excellent to see such robust discussion about taxonomic practice in a time of great change for taxonomy and systematics.

Update to: Why we need to manage lists of taxa as well as lists of the names of taxa

Kevin Thiele

In the last *ASBS Newsletter* I provided a rationale for why we need to manage taxa as well as their names, and a draft suggested mechanism for doing so.

In brief, if one of our goals as taxonomists is to help document and manage information about taxa, and if names are not good surrogates for taxa, then we need a system that allows us to connect biodiversity information to taxa other than just through their names.

And names are not good surrogates for taxa, for the simple reason that (1) names frequently change while a taxon remains the same (as, for example, when we move a taxon from one genus to another, or find an earlier synonym), and names frequently remain the same despite a taxon changing (as, for example, when we split a taxon thereby creating a *sens. lat.* and *sens. str.* taxon, both of which share the same name).

Our key problem is that for as long as we persist in indexing biodiversity knowledge against the names of taxa rather than a better signifier of taxa, our indexing will often become ambiguous when our taxonomy changes.

I proposed a way out of this problem. If we make three relatively small changes in current practice, we can fix this, at least going forwards. The proposed changes are:

(1) Some small changes to APNI/APC to ensure that there is a way of tracking taxa as well as their names through taxonomic and

nomenclatural change

(2) A small change to taxonomic papers, by including an explicit list of changes to taxon circumscriptions at the end of every paper.

(3) A small change to determinavit slips (and other references to taxa) to ensure we reference a taxon rather than just the name of a taxon.

Following very useful discussions with several people since that article, and after more thought, I'm keen in this short article to slightly revise and tighten the original idea and to recommend the adoption by the Australian taxonomic community of the second and third of these. These are small changes to taxonomic practice that will bring about very great improvements in the way we manage biodiversity information.

It's been pointed out to me that there are two minor flaws with the system presented in the last article, both of which can be readily fixed. The fixes will make the system easier to implement, and more robust to error. They are as follows.

Statements of circumscriptions in taxonomic papers

While I have had strong support for the inclusion of the set of standardised circumscriptional statements in taxonomic papers, the schema I provided in the last article includes options that are unnecessarily loose. I proposed, for example, statements such as:

'*Hibbertia leptotheca* (J.R.Wheeler) K.R.Thiele *comb. et stat. nov.* in this paper has the same circumscription as *H. spicata* subsp. *leptotheca* as previously accepted at PERTH.'

However, the 'as previously accepted at PERTH' is unacceptably loose and essentially points to an indefinable taxon concept. Instead, a better standard, wherever possible, is to refer to a published taxon concept (a name instance) in the Australian Plant Name Index. The above statement would then become:

'*Hibbertia leptotheca* (J.R.Wheeler) K.R.Thiele *comb. et stat. nov.* in this paper has the same circumscription as *H. spicata* subsp. *leptotheca* J.R.Wheeler *sensu* Paczkowska & Chapman 2000.'

This unambiguously references the taxon as treated in the paper to a taxon concept in APNI, and hence tightens the statement.

Note, as an aside, that while the example given above appears trivial (it is simply a *comb. et stat nov.*) it is not necessarily the case that the two concepts (*H. leptotheca* (J.R.Wheeler) K.R.Thiele and *H. spicata* subsp. *leptotheca* J.R.Wheeler) will always have the same circumscription. I could have added to or removed from Wheeler's subsp. *leptotheca* when publishing my *H. leptotheca*, and still had a *comb. et stat. nov.* For this reason, the clear statement of taxonomic equivalence (no change in circumscription) is still necessary.

Given this, I propose the flow chart in Figure 1 to construct the standard statements. Note that the best APNI concept to use, when possible, is the one that has the APC tick in APNI (but see below).

Determinavit slips (and other references to taxa)

In my last article I suggested that determinavit slips should reference a taxonID as well as the taxon name, and suggested slips of the form:

DETERMINAVIT

Hibbertia spicata F. Muell.: APC-126-656

Det: K.R.Thiele 15 Jan 2020

The idea was that the string after the colon (e.g. 'APC-126-656') would be some form of alphanumeric taxonID. It has been helpfully pointed out to me, firstly, that random alphanumeric strings like these are hard for

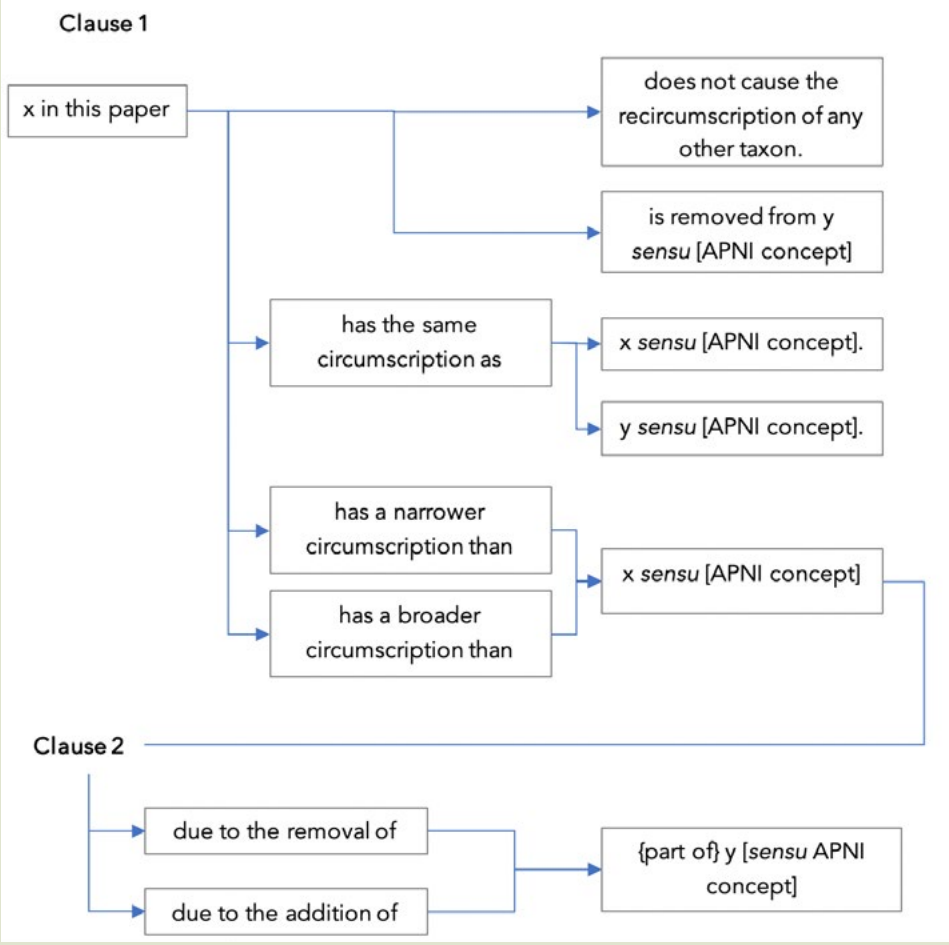


Figure 1: Revised flow chart for standardised circumscriptional statements in taxonomic papers

humans to remember, and secondly, that this leaves great room for error by, for example, the mistaken transposition of numbers.

Again, APNI provides a useful solution which, as with the taxon circumscriptions, is to use an APNI name instance as the reference. The determinavit above would then be, e.g.:

DETERMINAVIT

Hibbertia spicata F. Muell. *sensu* Thiele 2019

Det: K.R.Thiele 15 Jan 2020

where 'Thiele 2019' is a reference to the APNI instance of this name.

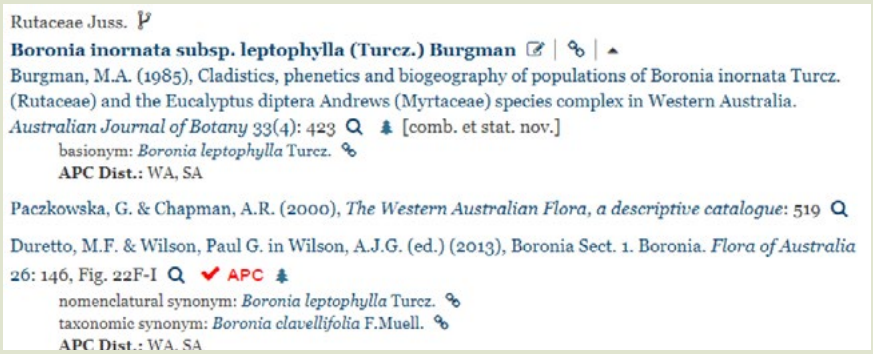
An obvious question is – which APNI instance to use? Because of the way APNI is organised (lists of name instances in date order), there is a simple rule of thumb:

If the last name instance in APNI has the APC tick, then use that one.

If there are name instances after the APC tick, then use one of those if and only if you understand the differences (if any) between the subsequent instances and the instance that has the APC tick, and mean to use that concept. (That is, don't just guess which one to use.) Note also that if the subsequent instances in APNI do not differ in circumscription from the instance that has an APC tick, then use the APC-tick instance instead.

For those not familiar with APNI/APC, some examples will be helpful.

Example 1: Suppose you need to put a det slip on a specimen of *Boronia inornata* subsp. leptophylla. The APNI record is as follows:


Rutaceae Juss.

Boronia inornata subsp. leptophylla (Turcz.) Burgman

Burgman, M.A. (1985), Cladistics, phenetics and biogeography of populations of Boronia inornata Turcz. (Rutaceae) and the Eucalyptus diptera Andrews (Myrtaceae) species complex in Western Australia. *Australian Journal of Botany* 33(4): 423 [comb. et stat. nov.]

basionym: *Boronia leptophylla* Turcz.

APC Dist.: WA, SA

Paczkowska, G. & Chapman, A.R. (2000), *The Western Australian Flora, a descriptive catalogue*: 519

Duretto, M.F. & Wilson, Paul G. in Wilson, A.J.G. (ed.) (2013), Boronia Sect. 1. Boronia. *Flora of Australia* 26: 146, Fig. 22F-I APC

nomenclatural synonym: *Boronia leptophylla* Turcz.

taxonomic synonym: *Boronia clavellifolia* F.Muell.

APC Dist.: WA, SA

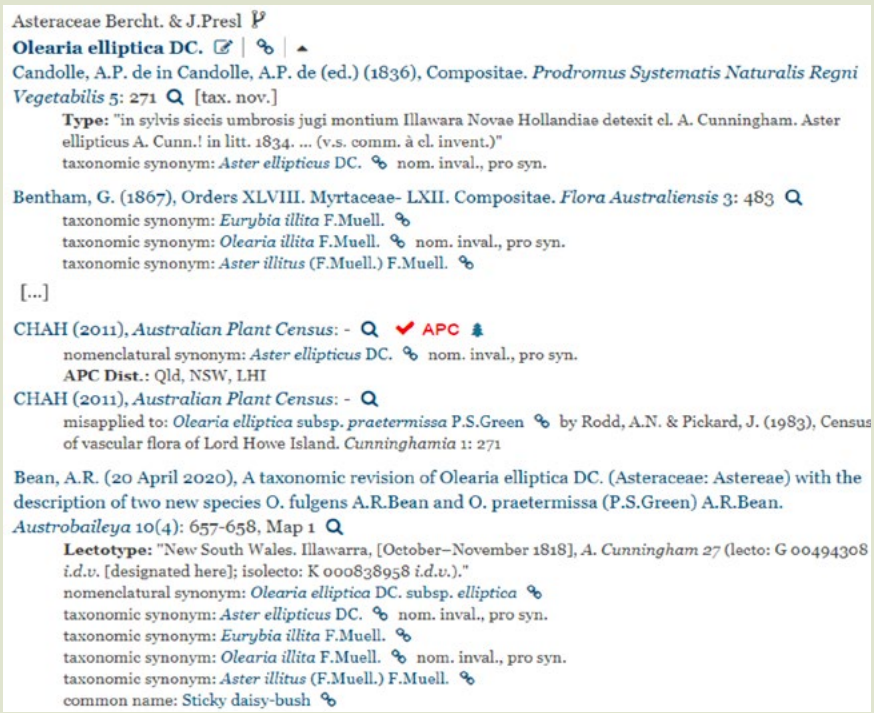
This record lists two APNI instances – Paczkowska & Chapman 2000, and Duretto & Wilson 2013. The latter has the tick, so a suitable set slip would be:

DETERMINAVIT

Boronia inornata subsp. *leptophylla* (Tucz.) Burgman *sensu* Duretto & Wilson 2013

Det: J. Doe 15 Jan 2020

Example 2: Suppose you need to put a det slip on a specimen of *Olearia elliptica*, and you are following Tony Bean's recent paper in *Austrobaileya* 10(4): 656-662. Checking APNI for this species gives the following:


Asteraceae Bercht. & J.Presl

Olearia elliptica DC.

Candolle, A.P. de in Candolle, A.P. de (ed.) (1836), Compositae. *Prodromus Systematis Naturalis Regni Vegetabilis* 5: 271 [tax. nov.]

Type: "in sylvis siccis umbrosis jugi montium Illawara Novae Hollandiae detexit cl. A. Cunningham. Aster ellipticus A. Cunn.! in litt. 1834. ... (v.s. comm. à cl. invent.)"

taxonomic synonym: *Aster ellipticus* DC. nom. inval., pro syn.

Bentham, G. (1867), Orders XLVIII. Myrtaceae- LXII. Compositae. *Flora Australiensis* 3: 483

taxonomic synonym: *Eurybia illita* F.Muell.

taxonomic synonym: *Olearia illita* F.Muell. nom. inval., pro syn.

taxonomic synonym: *Aster illitus* (F.Muell.) F.Muell.

[...]

CHAH (2011), *Australian Plant Census*: - APC

nomenclatural synonym: *Aster ellipticus* DC. nom. inval., pro syn.

APC Dist.: Qld, NSW, LHI

CHAH (2011), *Australian Plant Census*: -

misapplied to: *Olearia elliptica* subsp. *praetermissa* P.S.Green by Rodd, A.N. & Pickard, J. (1983), Census of vascular flora of Lord Howe Island. *Cunninghamia* 1: 271

Bean, A.R. (20 April 2020), A taxonomic revision of Olearia elliptica DC. (Asteraceae: Astereae) with the description of two new species O. fulgens A.R.Bean and O. praetermissa (P.S.Green) A.R.Bean. *Austrobaileya* 10(4): 657-658, Map 1

Lectotype: "New South Wales. Illawarra, [October–November 1818], *A. Cunningham 27* (lecto: G 00494308 *i.d.v.* [designated here]; isolecto: K 000838958 *i.d.v.*)."

nomenclatural synonym: *Olearia elliptica* DC. subsp. *elliptica*

taxonomic synonym: *Aster ellipticus* DC. nom. inval., pro syn.

taxonomic synonym: *Eurybia illita* F.Muell.

taxonomic synonym: *Olearia illita* F.Muell. nom. inval., pro syn.

taxonomic synonym: *Aster illitus* (F.Muell.) F.Muell.

common name: Sticky daisy-bush

The APC tick is on CHAH 2011, but given that your determination is following the concept in Bean 2020, your determinavit would be:

DETERMINAVIT

Olearia elliptica DC. *sensu* Bean 2020

Det: J. Doe 15 Jan 2020

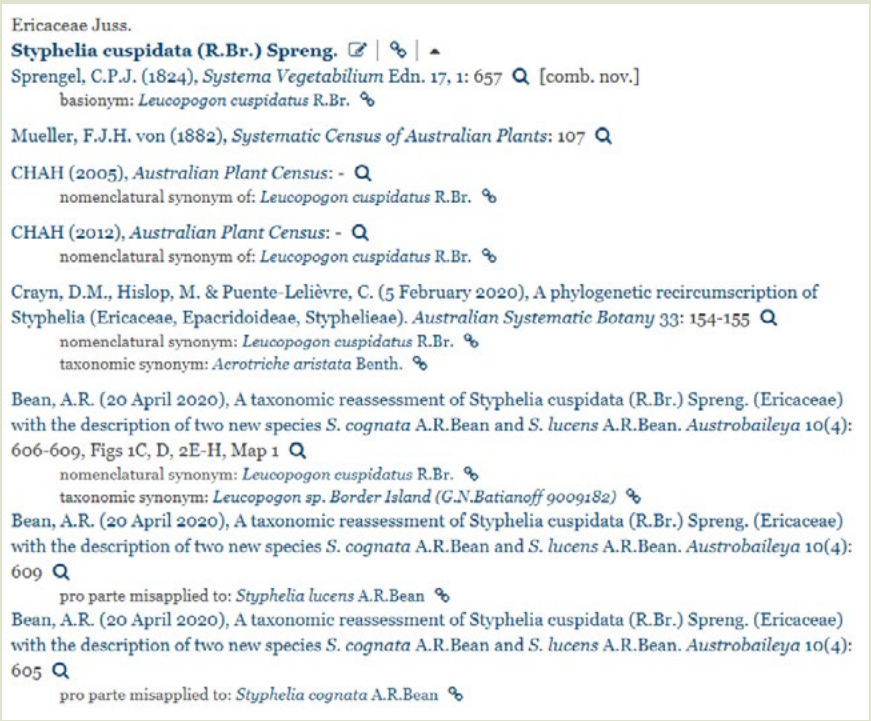
Example 3: Suppose you need to put a det slip on a specimen of *Olearia elliptica*, and you choose not to follow, or are unable to follow, Tony Bean's recent *Austrobaileya* paper (that is, you plan to use *Olearia elliptica sensu lato*). Checking the APNI entry, your determinavit would be:

DETERMINAVIT

Olearia elliptica DC. *sensu* CHAH 2011

Det: J. Doe 15 Jan 2020

Example 4: There will occasionally be cases where there is no APC tick in APNI, if you are dealing with very recent taxonomy. Suppose you need to put a det slip on a specimen of *Styphelia cuspidata*. Because this is a relatively recent name (the species was in *Leucopogon* before), the APNI entry has no APC tick:


Ericaceae Juss.

Styphelia cuspidata (R.Br.) Spreng.

Sprengel, C.P.J. (1824), *Systema Vegetabilium* Edn. 17, 1: 657 [comb. nov.]
basionym: *Leucopogon cuspidatus* R.Br.

Mueller, F.J.H. von (1882), *Systematic Census of Australian Plants*: 107

CHAH (2005), *Australian Plant Census*: -
nomenclatural synonym of: *Leucopogon cuspidatus* R.Br.

CHAH (2012), *Australian Plant Census*: -
nomenclatural synonym of: *Leucopogon cuspidatus* R.Br.

Crayn, D.M., Hislop, M. & Puente-Lelièvre, C. (5 February 2020), A phylogenetic recircumscription of Styphelia (Ericaceae, Epacridoideae, Stypheliеae). *Australian Systematic Botany* 33: 154-155
nomenclatural synonym: *Leucopogon cuspidatus* R.Br.
taxonomic synonym: *Acrotriche aristata* Benth.

Bean, A.R. (20 April 2020), A taxonomic reassessment of Styphelia cuspidata (R.Br.) Spreng. (Ericaceae) with the description of two new species *S. cognata* A.R.Bean and *S. lucens* A.R.Bean. *Austrobaileya* 10(4): 606-609, Figs 1C, D, 2E-H, Map 1
nomenclatural synonym: *Leucopogon cuspidatus* R.Br.
taxonomic synonym: *Leucopogon sp. Border Island (G.N.Batianoff 9009182)*

Bean, A.R. (20 April 2020), A taxonomic reassessment of Styphelia cuspidata (R.Br.) Spreng. (Ericaceae) with the description of two new species *S. cognata* A.R.Bean and *S. lucens* A.R.Bean. *Austrobaileya* 10(4): 609
pro parte misapplied to: *Styphelia lucens* A.R.Bean

Bean, A.R. (20 April 2020), A taxonomic reassessment of Styphelia cuspidata (R.Br.) Spreng. (Ericaceae) with the description of two new species *S. cognata* A.R.Bean and *S. lucens* A.R.Bean. *Austrobaileya* 10(4): 605
pro parte misapplied to: *Styphelia cognata* A.R.Bean

Nevertheless, it is straightforward to determine that if you are applying your det slip to a specimen of *S. cuspidata sens. str.* following Bean (2020) then you should use:

DETERMINAVIT

Styphelia cuspidata (R.Br.) Spreng. *sensu* Bean 2020

Det: J. Doe 25 Dec 2020

If, however, you prefer the broader concept of this species your det slip would be:

DETERMINAVIT

Styphelia cuspidata (R.Br.) Spreng. *sensu* Crayn & Puente-Lelièvre 2020

Det: J. Doe 25 Dec 2020

Potential objections to this scheme, and responses

Discussions have also revealed several potential objections to implementing a scheme such as this. These are as follows, with responses.

1. This all sounds like too much work

Yes, it will be more work using taxon concepts on determinavit slips rather than just names. However, good taxonomy requires precision and lack of ambiguity, and this practice significantly tightens precision compared with using names alone. In any case where there are differing concepts of a name (such as *sens. lat.* and *sens. str.*), now or at any time in the future, specimens annotated with names alone will be difficult to place unambiguously. I believe this simple change to practice will substantially improve taxonomy for all of us and for our users.

It is also not actually much work. Checking APNI to reference a concept rather than just a name is the work of a moment, and once familiar will be no more onerous than ensuring that the correct authority is used for the name.

2. Taxon concepts are personal things - everyone has a different concept of a species

Taxon concepts are often regarded as slippery, indefinable things. From an informatics perspective, it has been hard for many decades to find a good way to exactly pin down a taxon concept, and for this reason many have decided that they are effectively unusable.

However, I believe that taxon concepts (or circumscriptions) are quite readily understandable. Most taxonomists share an understanding of species, such as *Eucalyptus melliodora*; furthermore, the reason they share a concept of *Eucalyptus melliodora* is that few taxonomists arrive uniquely at their taxon concepts, except for species they directly study. Rather, we all derive our concepts from others.

The main cases where different taxonomists do indeed have different concepts of species are cases where the circumscriptions differ for important reasons – and these are exactly the differences that the proposed system is designed to manage.

3. Surely there are better ways to deal with this issue that don't require us to change our ways

If there were a good way to deal with the problems caused by using naked taxon names rather than taxa, and that did not require a change in taxonomic practice, this would clearly be preferable. However, there are no other comprehensive solutions. If specimens (and other items such as images) are connected to a taxon by name only, and the name includes different concepts, then from first principles we have a problem, and the solution to the problem must be to reference taxa more explicitly than by name alone.

4. Do we all need to do this, all the time?

The system proposed here (explicitly stating changes to circumcriptions in taxonomic papers, and referring to taxon concepts on det slips rather than using names alone) will work best if widely adopted. However, the system will still work even if some taxonomists choose not to adopt it, or not all the time. In those cases, we will be no better off, but also no worse off, than at present.

Conclusion

The present practice, of referring to taxa using their names alone rather than specifying taxon concepts, worked well for several

centuries. However, in the modern world where taxonomic data is increasingly connected, aggregated, analysed and managed using computers rather than (or at least, in addition to) humans, this centuries-old practice is no longer adequate.

Fortunately, for taxonomist working in Australia on Australian plants, we have a ready-made and readily applicable solution. The Australian Plant Name Index is our friend, because it collects and lists taxon concepts (in the form of taxon name instances) as well as taxon names. Referring to these is easy, informative, precise and readily achievable.

If we as a community of taxonomists begin (1) clearly specifying in our taxonomic papers the changes to circumscriptions that we are publishing and (2) specifying taxon concepts in addition to taxon names on our det slips (and other places where we refer to taxa), we can gain substantially better precision, less ambiguity and more clarity in all our taxonomic works, including those such as Australia's Virtual Herbarium, the Atlas of Living Australia, and other places where taxonomic information is managed by computers in addition to human minds.

I strongly recommend that we begin applying these practices.

Don't reinvent the wheel: extended synonymies already compare taxa and names in divergent taxonomies

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Summary

In response to Kevin Thiele's article in the last issue of the *ASBS Newsletter*, we draw attention to an existing method long practised by plant taxonomists, but often not understood, that provides the primary way of mapping competing taxonomies by direct bibliographic reference to the taxon circumscriptions in each taxonomy. This is fundamental to harvesting from the web of information about a plant whatever its name. Best practice in other areas discussed include addition to determinavit slips of the widely used abbreviated reference to the publication used for the identification, archiving of lists of all specimens examined for a taxonomic revision, and using all specimens in Australasian herbaria for revisions for optimal results and to avoid unreasonable curatorial demands of not doing this.

Our Newsletter rarely discusses taxonomic practice. A few years ago we had a call for better standards in taxonomic revisions (Thiele 2014; Barker, Barker & Waycott 2014) and now Kevin Thiele (2020) draws attention to issues surrounding the communication of new and changed taxon concepts in the publication of taxonomic papers. Kevin calls for a change to our work practices:

> 'So that database managers can correctly manage their records when taxon circumscriptions change (or don't change, as the case may be).'

We agree it is essential that taxonomic publications provide clear, consistent and comprehensive, but at the same time concise, information transformable into data that allows mapping of past taxonomies (classifications) against the new. However, any improvements that involve what taxonomists and herbaria do should involve existing work practices for there to be any chance of them being taken up by taxonomists, whose primary role is to advance knowledge, and by herbaria, who are severely under-resourced.

Thiele's proposals for changes to taxonomic and curatorial practice

Kevin has proposed two additions to our work practices as taxonomists and curators. The first is the provision in each taxonomic revision of a plain-English summary documenting the taxonomic changes for each taxon circumscription. The second is in the curation of specimens by the reviser in completing a revision and in general herbarium curation, namely the addition to determinavit slips of a unique taxon identifier (taxonID) referencing the published taxonomy used for the identification.

We believe Kevin's solution does not solve the problem of mapping taxonomies presented in different publications, but instead creates more problems, which we discuss later.

Taxonomies with their named taxa of defined circumscription have for centuries been the frameworks by which information about plants is communicated. Traditionally, users have relied on publications with taxonomies, e.g. floras and censuses and the revisions themselves, to independently link their own data and information to these taxonomies. Users have rarely stated the taxonomy they apply, so that two publications may reference the same species name, but they may be referring to two different species.

We are now developing ways of deriving, managing and transferring data about the relationships within and between taxonomies that enable the circumscriptions to be mapped against each other (Geoffroy & Berendsohn 2003; Taxonomic Names and Concepts Interest Group 2006; Franz & Peet 2009). This information will not only benefit the taxonomic community but, for example, will also enable more sophisticated searching and analysis of data and electronic objects. Currently the lack of ready access to the data that maps taxonomies means that information on a taxon may be missed, ambiguous data may have to be excluded, and incorrect data about a taxon may be unintentionally included. We agree with Kevin that taxonomists have the expertise and knowledge that could improve this situation by presenting their unique knowledge more completely and consistently in a standard form that can be translated into the data defining their taxonomies.

Defining differences in taxon relationships in new and previous taxonomies

The description of differences in the relationship between one taxonomy and another can be very complex. In one taxonomy a set of taxa may change their circumscriptions but remain quite separate. In another the relationships of some of the taxa may change because the circumscriptions are significantly modified or divided.

Kevin's (2020) example is relatively straightforward for general understanding. A well-known Western Australian species *Hibbertia spicata* is divided, with the recognition of six species (Thiele 2019). Kevin maps the relationship changes through a plain English summary in a form that he proposes as a standard for comparing taxonomies. For each of his species his summary references the name that had been applied to the specimens in the Western Australian Herbarium (PERTH) prior to his revision. In this example, Kevin proposes that any explicit comparison to past taxonomies should be gained through the specimens and their identifications, to each of which is attached a reference to the taxonomy used to provide the identification.

Yet circumscription embodies more than just the specimens. Taxonomists know how their new taxonomy maps against preceding published taxonomies.

In Kevin's paper on *Hibbertia* (Thiele 2019), discussions of published past taxonomies are found in the text, notably in a taxonomic history section, but also where discussion is warranted under a particular species. In his example all newly erected species were of course most recently known as *H. spicata*. Other previous taxonomies are referenced in the formal synonymy under each species where a name has its type specimen falling under that species. In the formal synonymy listed under the taxa are references to the protologues of any nomenclatural or taxonomic synonyms and some other nomenclaturally important references. Kevin's paper is a good example of modern regional taxonomic work accepted by a refereed journal.

In his recent call for change, Kevin says (Thiele 2020, p. 17, our underlining) that:

> 'Over centuries of practice, we've become very good at rigorously managing the names of taxa, and (fairly) clearly and unambiguously explaining in taxonomic papers what's happening to our taxon names. The nomenclature block at the beginning of a protologue does this in a well-standardised way. But there is no equivalent standardisation for explaining in our taxonomic papers what has happened with our taxa.'

This is where our major point of concern with Kevin's proposed approach lies. He suggests that we adopt a new approach by moving descriptions of the relationship between taxonomies from notes and other discussion into a single section of plain English text under each taxon (p. 18).

Contrary to Kevin's statement, a standardisation equivalent to a 'nomenclature block' exists. This practice of the past, still followed by some taxonomists, extends the content and format of such a 'nomenclature block' (we call it a nomenclatural synonymy) to a 'taxonomic block' (a taxonomic synonymy), whereby we meet the need to provide an accurate, comprehensive way of representing how taxonomies map against each other and deliver the data needed to deal with the problem that a taxon can be known by more than one name.

Redefining the synonymy block

To map taxon relationships it is important that the synonymy is extended from its purely nomenclatural function to also have a taxonomic function, which requires that all published taxonomies are listed. However it is currently common to cite just the first published instance (protologue) of a particular name, even if the circumscription of a taxon has changed in relation to other taxa. By extending synonymies to include previous name usages we can map the new or newly circumscribed taxon against other taxonomies.

To extend the synonymy format to a summary list of taxon relationships the following synonyms would be listed:

- names that have the same type as the new taxon (homotypic or nomenclatural synonyms),
- names with a different type that fall within the new circumscription of the taxon (heterotypic or taxonomic synonyms),
- names whose types [now] fall outside the circumscription of the new taxon (misapplied names),
- names that have been applied that are not acceptable for use under the rules of nomenclature.

Such comprehensive synonymies are achievable and, for those of us schooled in their compilation, a routine inclusion in publications making taxonomic changes. Correctly mapping some past applications of names may require research, but most of the work is done rapidly by a revising taxonomist who should have become aware of the past literature as part of their study as well as having easy access to lists of names from authori-

tative sources (e.g. APNI, IPNI, APC, NZPN, GRIN, POWO). The practice retains the function of nomenclatural synonymies: assisting the recognition of nomenclatural errors in past taxonomies and choice of the correct name for each taxon.

This mapping of taxonomies showing the application of published names against each in a taxonomic work was recommended as best practice in works of 50 years ago by Leenhouts (1968) for global taxonomists, and Briggs *et al.* (1976) and Eichler (1977) for Australian taxonomists. It continues to be recommended for *Australian Systematic Botany* and the *Flora of Australia Online*, driven among other things by the needs of the APNI-APC. However, of these, only Eichler's includes all publications, not just a protologue or first use of a misapplied name. The documentation of 'usages' is essential in the taxonomic synonymy for mapping one author's concept of each taxon against others'. Examples of taxonomic synonymies by the authors were already being produced several decades ago (R. Barker 1986, W. Barker 1974, 1982; Haegi & Barker 1985; Orchard 1975) with the aim of 'mapping the history of taxonomic concepts' (Haegi & Barker l.c., p. 250). We continue to adopt this approach when able. An example is shown in Figure 1.

These comprehensive taxonomic synonymies provide a basis for the future development of a standardised approach to an English language summary of differences from past taxonomies, and their production could be readily automated. Published as structured data they can also provide a basis for updating databased objects bearing older names such as specimens, images, documentation, scientific preparations such as microscope slides, though the absence of vouchers is a problem in some of these.

We endorse the adoption of the compilation of such comprehensive synonymies as standard taxonomic practice in taxonomic revisions, and in any publication that presents a taxonomy, and the implementation of taxon relationship mapping for biodiversity data management and information interchange.

A worked example of a conversion to the Taxonomic Concept Transfer Schema (TCS)

The synonymy of *Euphrasia gibbsiae* from a revision (Barker 1982) that utilised full synonymies through all sections, species and subspecies in order to compare their circumscriptions with those of past taxonomies has been used in discussions in the continuing development of the Taxon Concept Transfer Schema (TCS) (Taxonomic Names and Concepts Interest Group 2006). We show an example of how the synonymy of this one species translates into TCS (Figure 2). There are still instances in this synonymy that are not yet dealt with under the TCS schema. The example shows that there are 21 relationships between Barker's taxonomy and past taxonomies represented in the cited publications. A nomenclatural synonymy as is usually provid-

3. Euphrasia gibbsiae Du Rietz, Sv. Bot. Tidskr. 42 (2) (1948) 104, pl. 3, 4, f. 2-6; 42 (4) (1948) 351, 362

Curtis, Stud. Fl. Tasm. (1967) 531; Willis, Muelleria 1 (1967) 147, p.p. (as to Tasmanian occurrences and f. *subglabrifolia* in Victoria); Cochrane, Fuhrer, Rotherham & Willis, Fl. Pl. Vict. (1968) 204; Harris, Alp. Pl. Austral. (1970) 138, p.p. (excl. "f. *comberi*" in Victoria); Willis, Hdbk Pl. Vict. 2 (1973) 573, p.p. (as to f. *subglabrifolia*); Curtis in Stones & Curtis, End. Fl. Tasm. (1978) 470, 477. ***Holotype***: *L.S. Gibbs 6502*, xi.1914, Lake Fenton, BM (p.p.), (illustr. Du Rietz 1948a, pl. 3, f. 2); *isotype*: K.

E. kingii Curtis, Stud. Fl. Tasm. (1967) 650, 530; Stones & Curtis, End. Fl. Tasm. (1973) 248, pl. 79. For type, see p. 124.

E. gibbsiae Du Rietz, Sv. Bot. Tidskr. 24 (1932) 532, nomen nudum; Comber, Field Notes Tasm. Pl. coll. H.F. Comber 1929/30 (1931) 32 (non vidi).

E. brownii FvM., Fragm. Phyt. Austral. 5 (1865) 89, p.p. (as to var. *psilantherea* p.p.) nom. illeg.; ?Spicer, Hdbk Pl. Tasm. (1878) 77, p.p. (probably as to some plants with "streaked" corollas); ?Rodway, Fl. Tasm. (1903) 143, p.p.

E. striata auct. non. R.Br.: Benth., Fl. Austral. 4 (1868) 521, p.p. (as to *Stuart 1745*, *Milligan MEL41451*, p.p., *Mueller MEL41539*); Wettst., Monogr. Gatt. *Euphrasia* (1896) 252, p.p. (as to *Oldfield W36919*, *W36922*).

E. collina auct. non R.Br.: Wettst., Monogr. Gatt. *Euphrasia* (1896) 254, p.p. (as to *Labillardière G*).

E. milliganii Du Rietz, Sv. Bot. Tidskr. 42 (1948) 358, 362, nomen nudum; Willis, Muelleria 1 (1967) 148.

Figure 1: A taxonomic synonymy taken from the published revision of *Euphrasia* in Australia (Barker 1982); (*p. p.*, partly; *nom. illeg.*, an illegitimate name; *nomen nudum;* a name alone; *non vidi*, not seen by the author of the work; Oldfield W36919, a specimen specified by a herbarium accession number).

Euphrasia gibbsiae Du Rietz sec. Barker 1982
= *Euphrasia kingii* Curtis sec. Barker 1982
= *Euphrasia gibbsiae* Du Rietz, nom. nud. sec. Barker 1982
= *Euphrasia milliganii* Du Rietz, nom. nud. sec. Barker 1982
> *Euphrasia gibbsiae* sec. Curtis 1967
Euphrasia gibbsiae sec. Barker 1982 also includes *Euphrasia kingii* sec. Curtis 1967
< *Euphrasia gibbsiae* sec. Willis 1967
Only Tasmanian occurrences and *Euphrasia gibbsiae* f. *subglabrifolia* sec. Willis 1967 are included in *Euphrasia gibbsiae* sec. Barker 1982
> *Euphrasia gibbsiae* f. *subglabrifolia* sec. Willis 1967
≙ *Euphrasia gibbsiae sec. Cochrane et al. 1968*
< *Euphrasia gibbsiae* Harris 1970
Euphrasia gibbsiae sec. Barker 1982 does not include Victorian plants of *Euphrasia* f. *comberi* sec. Harris 1970
>< *Euphrasia gibbsiae* f. *comberi* sec. Harris 1970
< *Euphrasia gibbsiae* sec. Willis 1973
> *Euphrasia gibbsiae* f. subglabrifolia sec. Willis 1973
≙ *Euphrasia gibbsiae* sec. Curtis 1978
> *Euphrasia kingii* sec. Curtis 1967
> *Euphrasia kingii* sec. Curtis & Stones 1973
>< *Euphrasia brownii* sec Mueller 1865
>< *Euphrasia brownii* var. *psilantherea* sec. Mueller 1865
?>< *Euphrasia brownii* Spicer 1878
Some plants with 'streaked' corollas in *Euphrasia brownii* sec. Spicer 1878 probably are in *Euphrasia gibbsiae* sec. Barker 1982
?>< *Euphrasia brownii* sec. Rodway 1903
>< *Euphrasia striata* sec. Bentham 1868
Only Stuart 1745, Milligan MEL41451 and Mueller MEL451 (of the cited herbarium specimens) belong to *Euphrasia gibbsiae* sec. Barker 1982
>< *Euphrasia striata* sec. Wettstein 1896
Only Oldfield W36919 and Oldfield W36922 belong to *Euphrasia gibbsiae* sec. Barker 1982
> *Euphrasia milliganii* sec. Willis 1967

Figure 2: An example, provided by Dr Niels Klazenga (pers. comm.), of the translation of the taxon circumscription mapping from the taxonomic synonymy of *Euphrasia gibbsiae* using the Taxonomic Concept Transfer Schema. Underlined are the synonyms that would be delivered from a nomenclatural synonymy, Entry of the other synonyms would not be readily located in taxonomic revision. (sec., *secundum*, according to; ≡, homotypic synonym; =, heterotypic synonym; ≙, is congruent to; <, is included in; >, includes; ><, overlaps)

ed these days in publications would deliver only four relationships; it would be impossible to harvest the other 17 relationships from textual discussion, even if it were presented adequately for interpretation.

Other aspects raised by Thiele (2020)

Should we apply a unique taxon identifier to our determinavit slips?

Specimens in herbaria may be identified using different publications using alternative taxonomies, which result in different names for taxa owing to their use of a different taxonomy of the group. We have all seen distribution maps from the Australasian Virtual Herbarium that do not reflect the distribution in the latest revision. Kevin suggests part of the solution may be the application of a globally unique identifier called a *taxonID*, distinguishing the publication used for identification.

The view in the IT world is that such identifiers are applied to data objects and used in the background to link to other objects and information resources. Furthermore, these data objects should have human-readable labels provided as meta-data for use in natural-language interfaces, for searching, display, and interpretation. An opaque *taxonID* that requires the persistent presence of a remote

service to resolve a determination should not be used to annotate specimens. We do not believe that this approach should be adopted.

However, we agree that it would be useful for those identifying specimens to include a reference to the taxonomy being used for identifying the material. The traditional abbreviated literature reference is all that is required and is well known by the taxonomic community, meaning it would require minimal extra time and effort.

Archiving the data associated with specimens used to define a taxon circumscription

While we disagree with Kevin's use of specimens as a prime basis for mapping taxon circumscription, we agree that in any taxonomic work it is an important to provide the full list of specimens examined for each taxon, a traditional best-practice approach in taxonomic publications of the past (see also R. Barker, Barker & Waycott 2014). Such lists were acceptable and often encouraged in journals up until the 1980s (e.g. Orchard 1975), but, with publication costs increasingly problematic, a selection was generally required where the specimens were many. These lists of specimens, along with references to illustrations and other associated data, do provide a view of the circumscription of the taxon complementary to a taxonomic synonymy.

The resurrection of these lists as an online deposition of all specimens examined should not be as onerous for revisers as it was in the past and, even if journals do not support them, there are data repositories (e.g. ANDS 2020) available for their storage. Such lists are then able to be tied to the taxonomy mapping framework via schema such as TCS. Full lists have many other uses, not the least for herbaria updating identifications of replicates not examined in developing the taxonomy (but see below). Today's practice may rely on accessing details of all specimens examined for a taxonomic revision in an herbarium database or the Australasian Virtual Herbarium, but it is not a substitute. Because not all herbaria can provide the history of determination of specimens, inevitable future re-identification will diminish the records from the full set of specimens examined. This will affect the ability of some herbaria to re-determine duplicates not examined, making long delays in curation inevitable.

Taxonomists should not feel confused

Kevin has made a few points that seem more applicable to non-taxonomists, but even they should have no concerns as long as it is realised that a name can mean different things. Referencing a taxon name and the taxon it defines is the bread-and-butter of human communication. 'Sydney' can apply to: the name itself; a city; one of the herbaria in that city, where the context might define which one; a football team where the context will indicate which particular brand of football is being referenced.

It is important, nevertheless, to be precise if the context demands it. So we may need to specify whether the name is used in the sense of a taxon name, taxon, taxon circumscription or taxon relationship, where this is not implicit.

In his discussion Kevin alludes to a corollary with the way Western society names people (John Smith). There can be many John Smiths. However, the parallel in taxonomy, called homonymy, is not permitted. *The International Code of Nomenclature for Algae, Fungi, and Plants* (ICN: Turland *et al.* 2018: Art. 53) explicitly disallows two taxa of plants having the same name. It may, by mistake, occur, but anyone can correct this by providing a unique replacement name that conforms with the Rules.

Further considerations impacting data harvesting and specimen curation

Providing dated instances in on-line Censuses

Online censuses and electronic Floras are generally intended to be dynamic, being kept up to date with new data and information. Users of these works apply names at a particular point in time, and the basis

for their decision may not be retrievable without readily available dated snapshots of these works. Such works should be able to be referenced using a standard publication citation in a permanently archived digital form, either as a whole, perhaps annually, or in part, as the taxonomy of a group changes. Now widely adopted, their inclusion in synonymies is critical. Publication of changes for the last year do not satisfy the need to document unchanged taxon relationships.

Negative consequence of 'efficiencies' in producing revisional work

There are good reasons why taxonomists today are discouraged from requesting loans: e.g. to protect the collection from damage or loss in transit and to avoid prolonged loss of access in the home collection. However, this is not without negative consequences (Barker, Barker & Waycott 2014). Not only is the taxonomist deprived of the full suite of geographical and morphological coverage to refine their revision, but, until curated, collections not seen by the taxonomist will remain classified according to past taxonomies, with a mix of identifications that may or may not align with the new taxonomy. Bringing such collections into alignment with the new taxonomy can be more time consuming than if done by the taxonomist. The revising taxonomist may do the job in one to a few hours; those taking on this task subsequently may take much longer or find it proves insurmountable.

But there are more important scientific considerations. A loan considered not vital to the main outcomes of a revision might still be encouraged for a short term at its final stages. There have been real instances where a recently published taxonomic revision does not align at all well with a rich set of specimens from the herbarium with jurisdiction over a region encompassed by the revision, and that should have been examined. The taxonomy is immediately questionable, though this may not be widely known, and a decision has to be made whether to persevere with updating identifications. These considerations have serious repercussions for accuracy and optimisation of results of specimen data harvesting and production of maps and other data compilations. As a taxonomic community we should try to avoid such poor practice as it risks damage to our credibility amongst users of our science.

Conclusion

In publishing taxonomies we propose it would be an appropriate best-practice, and of great use to users of our work, to provide a comprehensive synonymy that maps past taxon circumscriptions against each taxon. Such a synonymy would be an extension of existing practice, meeting traditional standards of formatting and largely complying with the recommendations of the ICN on citation. In this form it could be readily converted into data that facilitates improved access and appropriate use of biological data linked via taxonomic names. It should include all names, authorised by the ICN or not, that appear in publications.

All taxonomists are capable of providing the necessary data for this in a routine way (and indeed most have assembled data or have accessed it in the relevant publications). The norm has been to include in the text as routine, descriptions and discussion of taxon circumscription changes and widely utilised published informal names. The standard comprehensive approach to mapping taxon relationships that we advocate has been used by experienced taxonomists for many years, but not especially widely adopted. The reasons for adopting this approach are strong at this time when our science and our user community have high expectations of ready access to data and information on-line. There is an expectation that taxonomists will play their part in gaining access to alternative names for taxa, so vital for accessing data about each taxon.

We also have the potential to be more efficient in bringing the identification of our collections into line with the current adopted taxonomies of groups. It would mean adopting best practice when undertaking identifications, as well as in our revisions, by

including a list of cited specimens, and by adopting a change to approaches to loans for such work.

Our taxonomies and associated taxon-related data are being used more frequently and in much more diverse ways than ever before. While appetite for change is diminished by the poor level of resourcing for our science, institutes and infrastructure, the changes in our work practices that we promote, calling for clear, consistent documentation of data that taxonomists already gather and apply as part of our science, are relatively small and routine and will not only service our diverse set of stakeholders better, but also be beneficial for the needs of our own science.

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Why we need to close the gap between phylogenies and classifications, and how to do it

Kevin Thiele

In the last *ASBS Newsletter* I discussed the confusion that arises when we taxonomists fail to account for the important differences between taxa and the names of taxa. This is a confusion that has bedevilled us since the time of Linnaeus, and is still not solved.

In this article I want to discuss another bedevilling issue in taxonomy, this one perhaps more recent but with its antecedents in Linnaeus again. This is the gap between phylogeny and classification.

Classifications have been around for a long time. The formal classification of taxa of course began with Linnaeus, who introduced the powerful and long-lasting concept of a hierarchy of named ranks, with names of taxa conforming with those ranks. While Linnaeus and his contemporaries probably thought of this as a box-in-box structure, since Darwin we've been accustomed to thinking about it as a tree—species connected to genera, which are connected to families, and so on up.

Linnaeus himself had a fairly simple system based on five ranks, using which we could draw a tree for all life that's five levels deep. The Linnaean ranks were later codified as the seven 'principle ranks' (Kingdom, phylum, class etc.), allowing a tree seven levels deep. So far so good, but as taxonomists began to elucidate or infer more and more knowledge about the structure (and later, the evolution) of life, even seven ranks were insufficient, and we began interpolating ranks. There are now 75 available ranks across both the botanical and zoological codes, including such marvels as microphyla, infracohorts, sublegions, gigaorders and epifamilies (see my article 'What can you do with a claudius?' in *ASBS Newsletter* No.134, March 2008 for a discussion).

If anyone were foolish enough to use all available ranks, it would be possible to construct a classification tree with quite high depth. And we want depth in the tree because more depth allows us to express evolutionary relationships more completely.

A second stream of activity, beginning with Hennig in the 1950s, has been phylogenetics. Like classifications, phylogenies are a powerful way to represent our knowledge of evolution and evolutionary relationships. And like classifications, phylogenies are usually represented graphically as trees.

There are two main differences between phylogenetic and classification trees. In a classification tree, all nodes have names and most nodes (in most classifications) are relatively poorly resolved (that is, nodes will often have many children), while in typical phylogenies most nodes are un-named and many nodes are relatively highly resolved (an ideal phylogeny is one in which every node has only two children) (Figure 1). Another difference is that branches in phylogenetic trees have meaningful length but branches in a classification do not, but this difference is not directly salient to this article.

There is an unfortunate gap between phylogenetics and classification in modern taxonomy. We're all aware of phylogenies that fail to be translated into taxonomic classifications, and classifications that fail to reflect known phylogenetic relationships (though this is increasingly rare).

The gap is unfortunate because, when you

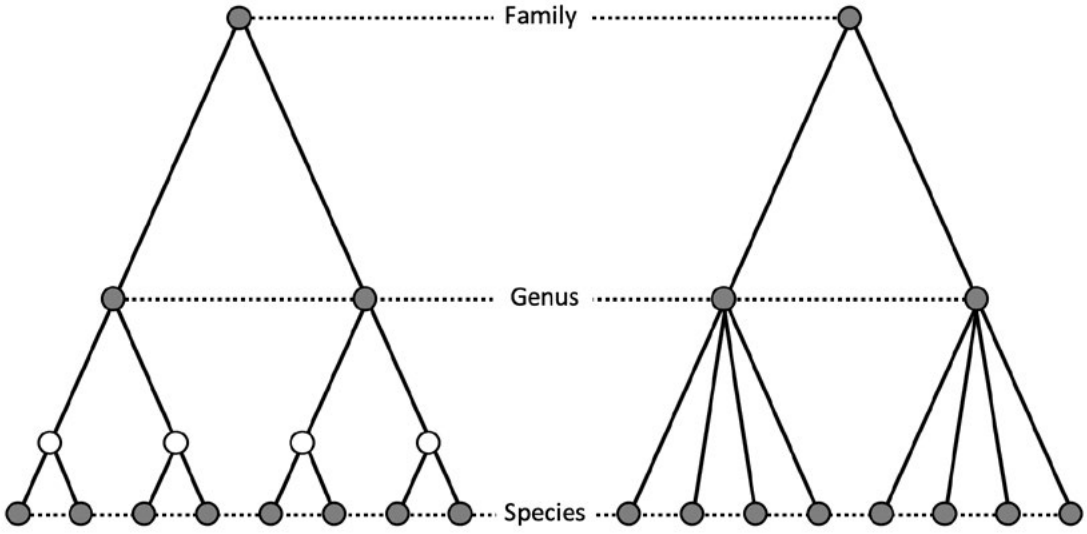

Figure 1: A simple phylogeny (left) and classification (right) for eight species in two genera in a family. Grey nodes are named taxa, open nodes are un-named. The phylogeny carries more information (the arrangement of species into four clades) than does the classification. It can be readily collapsed to derive the classification, but the classification cannot be unfolded to represent the phylogeny. Of course, in this simple example it would be possible to use subgenera to represent the missing information in the classification, but for more complex examples with more taxa, this is not possible.

think about it, we're all working towards the same goal—a system of knowledge that captures, reflects and informs our understanding of the evolutionary relationships of taxa. We just have two different tools that each partially helps us achieve that goal.

There's an opportunity here in the fact that classifications and phylogenies are both trees; in fact, they are increasingly closely related trees—good classifications do reflect and are concordant with phylogenetic relationships, and good phylogenies include, and label, those nodes that represent named ranks. So—why don't we close the gap, and bring phylogeny and classification together?

An important issue here is that phylogenies hold more information than classifications (that is, they are usually better-resolved and have more depth). This sets up an information asymmetry—the information content of a classification can be captured in a phylogeny, but the information content in most phylogenies cannot be adequately captured in a classification. Another way of expressing this is that phylogenies are more powerful, expressive, and information-rich. For this reason, we can store classifications in, and retrieve them from, phylogenies, but not vice versa (Figure 1).

This also means we can have our cake and be able to eat it too. If we were to build and manage a system to capture and curate an agreed, accepted phylogeny of all Australian organisms, we could use the same system to capture and curate our agreed classification of all Australian organisms. I reckon this would be a powerful tool and a wonderful thing. We currently don't do this, only, I believe, because of the historical gap between classification and phylogeny, and because we haven't fully thought through the opportunities opened up by the close (though asymmetric) complementarity between classifications and phylogenies. As a result, phylogenies are published but not adequately captured or managed as our taxonomic backbone, and classifications (such as in the National Species Lists and Australian Plant Census) are carefully managed, but fail to accommodate all the knowledge expressed in phylogenies. We can remedy

this by building a taxonomic backbone that encompasses both phylogenetics and classification.

To do this would simply require a classification system that can handle nodes that have no name.

In practice, it could work like this. Our starting point would be the current classification tree, and we build a mechanism for 'injecting' new nodes into the tree. As phylogenies are published, we have a consensus mechanism (human consensus, not to be confused with phylogenetic consensus algorithms) to agree on well-supported nodes. If, for example, phylogenies agree that a genus comprises two reciprocally monophyletic clades but don't agree on the topology within those clades, we may choose to inject the node we all agree on into our consensus tree. If subsequent phylogenies show that further nodes are well-supported and we gain community consensus, then we inject further nodes. Our tree, by consensus, over time, and with deliberation, gradually becomes a phylogenetic (and classification) super-tree.

Note that this super-tree would not be or become a true phylogeny in that it will capture only an agreed topology, and will not include e.g. branch lengths or node support values. These latter are properties of a single phylogeny; ours would comprise a (human) consensus built on many phylogenies, so branch lengths and node support have no meaning (well, strictly speaking, node support is a binary—if the node is supported it's there, if not, it's not).

All this raises an interesting question (well, it seems interesting to me at least). A taxon is a fairly well-understood thing—it's a node in a classification tree with a label (its name). So, what should we call an un-named node in a phylogeny? Is it a taxon? It could become a taxon in the usual sense if we choose to give it a name. Before we give it a name is it a not-taxon, and as soon as we give it a name it becomes a taxon? There's no real difference between the node before it gets its name label and the node afterwards. This surely merely reflects our confusion between names and taxa. The only way I can think this through logically is to say that every agreed grouping of subtaxa is a taxon, whether it's named or not. So, a phylogeny is a nested set of taxa (or, at least, putative taxa), some of which have names and some of which do not.

Interestingly and as an aside, the gap between classifications and phylogenies is also the gap between taxonomy and systematics, a gap that I believe should be relegated to history given that taxonomists and systematists have a shared goal, to build a system of knowledge that expresses our understanding of evolutionary relationships.

Of course, on one level the question of exactly what is a taxon is a purely semantic issue, but as suggested in the last article about taxa and their names, semantics can trap. One reason we confuse taxa and their names is because of the semantic shortcut we all take when, for example, we refer to a tree as '*Banksia grandis*' rather than as (tediously but correctly) 'an individual of a taxon the currently accepted name of which is *Banksia grandis*'. Similarly, if we decide that named nodes in a phylogenetic tree are taxa but un-named nodes are not-taxa, I believe we propagate the false idea that the name of a node is some type of essential property, rather than a mere (very powerful and important) tag.

In summary: our knowledge of evolutionary relationships is growing in leaps and bounds; a classification based on named ranks is not expressive enough to capture all of this knowledge; and we need a taxonomic backbone that is as richly informative of these relationships as possible. So—let's enhance our systems to accommodate nodes that have no names, let's curate an agreed, accepted phylogeny of Australian organisms in the same way that we curate their agreed, accepted names and classification, and let's close the gap between classification and phylogeny, and between taxonomy and systematics.

Teaching field botany in the year of wonders

Stuart Worboys *Australian Tropical Herbarium, James Cook University*

I think we all know that teaching field botany has a hidden agenda. Underneath all that work running transects, recording substrate and landform and consulting field herbaria, is the secret goal of instilling in the students the joy of natural history: in other words, being able to read a landscape and understand why a plant grows where it does. The red wine by the campfire is just the icing on the cake for us teaching staff.

For the last 20 years, James Cook University's Cairns Campus has run a field botany course, first as a semester-long weekly field trip, and more recently as a two-week intensive. Within two hours' drive of Cairns, we were able to introduce students to a rich diversity of tropical communities: lowland and upland tropical rainforests, savanna woodlands, orchid-infested mangroves and wet sclerophyll forests. At each of these locations, the academic staff would take deep dives into ecology, phylogenetics and biogeography, whilst it was my job to teach plant identification.

The course has always given special focus to rainforest plant identification. With well over a thousand tree species, and flowers or fruits invariably inaccessible, plant ID in the Wet Tropics bioregion can seem an overwhelming and near-impossible task. For us, teaching students they could identify plants to family (or even species) by carefully examining leaf and bark features was a key learning outcome that could only be taught in the field.

And then COVID-19 hit…

Taking busloads of students to remote field locations suddenly became impossible. Running tightly-packed labs full of shared equipment and specimens was a disease-transmission opportunity *par excellence*. And the logistics of preparing and presenting a student herbarium became overwhelming. So, the question all of a sudden became: how could I present the field botany/plant identification aspects of the course, and share the joy of botanical exploration without actually being there?

Left: The good ol' pre-pandemic days: Stu showing third-year undergraduate students *Idiospermum australiense* in the field near Noah Creek in 2017.
Photo credit: Lizzy Joyce

Solution 1. The training video

Despite years of conscientious avoidance, I've found myself in front the TV cameras several times. My learnings from these occasions are: (1) I have a great face for radio, and (2) I have the onscreen charisma of a dehydrated *Nephrolepis cordifolia*. So you can imagine I was overjoyed that much of James Cook University's teaching was to be presented online for the duration of the COVID-19 lockdowns.

The university made available equipment, staff and technical support for the filming. Indeed, one of our wonderful tech staff, also an old friend, had been a documentary film-maker in a previous life. But before any filming could be done, I had to have the content and presentation clear in my head. This could not be a simple 'chalk and talk' video lecture – it had to be filmed outside in the rainforest, it had to show me demonstrating basic field techniques, and it had to incorporate slides showing magnified images of the plant features being described. Although intimately familiar with the content, *ad libbing* without a structure would have led to an incoherent mess. The solution was a story board. This turned out to be incredibly easy to prepare in Microsoft PowerPoint, with a bunch of images borrowed from the net to provide guidance for the filmographer, and the relevant text in the notes view. The storyboard proved equally useful in the final editing of the video, which was undertaken by university tech staff. It ended up looking something like this:

VIDEO: Opens on narrator in the rainforest wearing appropriate PPE.
NARRATION: Welcome to the second video in the Australian Tropical Herbarium's series on rainforest plant identification.

Right: Storyboard slide outlining opening scene of the plant ID training video

Below: A screenshot of the finished product

The end product was a fairly well polished video, not the embarrassing disaster I'd imagined. The secret to success was not so much in the filming or the presentation – it was all in the initial planning and final editing. Having a well-developed script and illustrated storyboard enabled the editor to follow the plan, drop in additional material, cut out awkward pauses and stutters, and present a final product that can be used for years to come.

Solution 2. The online student herbarium

Part of the students' assessable work was to present a herbarium with a focus on a particular family or genus. We've had students criss-crossing the Atherton Tableland hunting for *Grevilleas*, wandering rainforested roadsides to grab at overhanging Vitaceae and sneaking into parks to snaffle *Melaleucas* (those samples were rejected – no cultivated specimens allowed!). For most of the students this seems to be good fun. It gets them out exploring and hones their observation skills. There's also the preparation of herbarium specimens, which is a skill in itself.

Unfortunately, because of the need for physical separation, it wasn't possible for students to collect and submit herbaria. Instead, this year we utilised iNaturalist. For those not familiar, iNaturalist (inaturalist.org) is an online community that allows users to upload photographs of plants or animals for identification. At the time of writing, 46.9 million observations can be viewed on the platform. The uploaded photos are geolocated (the coordinates of rare plants are blurred), and are publicly viewable, so that any iNaturalist member can suggest an identification. What's more, the iNaturalist platform allows you to create 'Projects' so that observations can be linked to a particular activity, data collection exercise or class. Whilst still forming part of the whole iNaturalist dataset, additional data fields can be added to 'Projects' to tailor them to the activity. The widely publicized 'Wild Orchid Watch Australia' project is a recently launched example of such a project.

To create an assessable herbarium, we requested that students:

- create an account and enroll in the project;
- make observations of 50 different species, including ten from a target genus or family;
- suggest an identification for each observation, and document how they reached that conclusion, and
- provide records of plant habit and habitat for each observation.

As students were required to provide an identification when uploading, it limited the likelihood they could rely on community identifications. Further, more marks were assigned to documenting how they reached an identification and to habit/habitat records than to correct identifications.

Overall, replacing a herbarium with iNaturalist was a success. Of course I was disappointed that students missed learning the skill of drying and mounting specimens, but that's something they can pick up with relative ease when needed. We saw their observations and identifications improve over time, and we saw that they were making use of the identification resources we recommended. Best of all, we saw that students were getting out and about, making observations from Mt Elliott near Townsville all the way to the Daintree rainforests.

The founding of the Queensland Herbarium

Tony Bean Queensland Herbarium

The Queensland Herbarium (BRI) has variously been said to date from 1855 (Everist 1982; Holland 2005), or from 1874 (Holmgren *et al*. 1990), or from 1881 (Thiers 2020). Clearly some clarification is needed.

An herbarium is a collection of dried plants mounted, labelled, and systematically arranged for use in scientific study, or a place or institution where such a collection is kept. Hence, the founding date of an herbarium should reflect the time when a scientifically arranged collection is commenced in a place suitable for its study and maintenance.

Walter Hill (1820–1904) was appointed as superintendent of the Botanic Gardens in Brisbane in 1855. When Queensland became a separate colony in 1859, Hill became Colonial Botanist and Director of the Brisbane Botanic Gardens, positions he held until his retirement in 1881. Hill made the Botanic Gardens a pleasant place to relax for the residents of Brisbane by planting ornamental flowers and shade trees. However, his main contribution was in the cultivation and enthusiastic dispersal of crop plants and edible fruits. This earned him many accolades as he enabled the colony to be largely self-sufficient in fruits and vegetables, and his efforts allowed the establishment of profitable industries such as sugar cane production.

Above: 'Botanical Gardens, Brisbane' c. 1880, photographed by Henry King. Glass plate negative from Museum of Applied Arts & Sciences, https://ma.as/30784

Hill established a library of botanical books, and also had a collection of dried plant specimens (Dowe 2016), but in an 1875 report to the Colonial government, he stated that his house in the Botanic Gardens was 'infested with white ants in all directions, and the damp, both of the walls and from below, is something fearful, while the rain finds free admission in many parts of the building'. It was further stated that the building containing the library and plant specimens suffered from the same afflictions, and that 'the binding and even portions of the works [in the library] have been destroyed, as well as almost the whole of his valuable collection of dried specimens, the labour of twenty years in the colony' (Anon. 1875). Around the same time, Hill (1874) commented that because of the dampness problem, 'it would be useless for me to attempt to keep a herbarium'.

In Queensland in the 1870s, F.M. Bailey's reputation as a botanist was growing, and in 1873, he was appointed 'collector' for the Acclimatisation Society (Anon. 1873). In October 1873, in a report to the Acclimatisation Society, Bailey wrote:

'the want of a public herbarium in

F. M. Bailey. Image credit: Wikimedia Commons

> Brisbane, where specimens could be compared and identified, is a very great drawback, for it is seldom that a collector is so fortunate as to find flowers and fruit on a tree at the same time, and it often happens that he can obtain neither; yet from a full specimen to compare with, he would find it comparatively easy to determine the correct name. There are many other uses of course to be made of the herbarium. I only mention one, that for the identity of plants, and would, if it is not out of place, ask your society to urge on the Government the desirability of taking some steps towards the formation of so useful a work.' (Bailey 1873).

The Acclimatisation Society acted immediately on Bailey's advice, writing to the government in October 1873. At a meeting of the Acclimatisation Society on 6th June 1874, the Chairman (L.A. Bernays) reported that 'efforts to initiate the establishment of a public herbarium of the Queensland flora, had, after long delay, … resulted in success'. The reason for the 'long delay' was that the Secretary for Lands wanted to consult with Hill on the matter (Anon. 1874a), but had to wait for Hill's return from north Queensland where he was acting as botanist for the Dalrymple expedition, from September to late December 1873 (Dowe 2016). Bernays then tabled a letter dated 30th May 1874, from the Under-secretary for Lands, saying

> 'I have the honour by direction to apprise you that the Minister for Works has approved of the sum of one hundred pounds being devoted to the establishment of a herbarium, provided sufficient accommodation can be found in the present Museum building for the purpose, and that Mr Commissioner Coxen has been instructed to make the necessary arrangements for obtaining a collection of plants, a knowledge of which would prove of use to the colonists generally, and also to provide suitable furniture for their preservation and exhibition' (Anon. 1874b).

Bailey's name was not mentioned in this letter, but he was the obvious choice for the role of curator, and he promptly took on the task. By December 1874, the herbarium comprised 'several scores of the grasses of the colony, and a numerous collection of other plants' (Anon. 1874c). The term 'Queensland Herbarium' was first used in print in November 1876, when the government allotted a further 100 pounds towards the endeavour (Anon. 1876).

Today the Queensland Herbarium collection is fully databased, and so it can be said with some confidence that no specimen from Hill's original dried plant collection has survived. The type collection of *Syncarpia hillii* F.M.Bailey is currently attributed to Hill, but there is no evidence to support that. In the rather large paper in which Bailey described *S. hillii*, he also named or recorded numerous other species. For all species except *S. hillii*, Bailey cited 'Hab. [Locality] [Collector]', but for *S. hillii*, he gave only 'Hab. Fraser's Island'. The omission of a collector indicates that Bailey was not sure who collected the specimen, and the handwriting on the original label

does not match that of Hill. Bailey named the species for Hill not because he contributed specimens of it, but because he was 'the first to draw attention to it as a valuable timber' (Bailey 1884). A specimen of *Akania bidwillii* (R.Hogg) Mabb. at BRI has been attributed to W. Hill on a typed herbarium label; the adjacent original label has handwriting consistent with that of Hill, but the verbose descriptive notes are not typical of Hill's labels.

The only specimens definitely collected by Hill now present at BRI are a few that were distributed in the late 19th or early 20th century from other herbaria, and a specimen of *Harpullia hillii* F.Muell. apparently given to Bailey after 1874, as it bears the 'Herbarium Queensland Museum' printed label used by Bailey in the formative years of the herbarium.

It appears that the oldest specimens making up the Queensland Herbarium at its inception were those collected by Bailey in May 1873 from the Cardwell area. The herbarium now holds some much older collections, including some collected by Allan Cunningham, Robert Brown, and Banks & Solander, but they were donated (mainly by Kew) decades after the herbarium was established.

In summary, the Queensland Herbarium was founded in May 1874, with the oldest specimens being those of F.M. Bailey dating from May 1873.

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A reassessment of *Bidens* (Asteraceae) in Australia

Tony Bean Queensland Herbarium

Bidens L. is one of the most common weedy genera of Asteraceae in Australia. There are only a handful of taxa in Australia, but their identification has been problematic.

Three species were listed by Bentham (1867), namely *B. tripartita* L., *B. pilosa* L. and *B. bipinnata* L. Relatively recently, *B. alba* var. *radiata* (Sch. Bip.) Ballard ex T.E. Melchert was recognised as distinct from *B. pilosa*, and *B. aurea* (Aiton) Sherff has been recorded as naturalised in the Sydney area (Hosking *et al*. 2011).

The only other species name that has been widely used in Australia is *B. subalternans* DC. Beadle et al. (1962) were the first to use this name for Australia, with the description 'Leaflets deeply divided or the leaves bipinnate; rays yellow', which are the salient features of *B. bipinnata*. The only other species included in their account is *B. pilosa*. These authors provided no information as to why the name *B. subalternans* was used, or why *B. bipinnata* was not used instead. Nevertheless, *B. subalternans* was subsequently taken up by Willis (1973), and in the Plants of Western N.S.W. (Cunningham *et al*. 1981) and in the Flora of New South Wales (Everett 1992).

Cunningham *et al*. (1981) were the first to give distinctions between *B. subalternans* and *B. bipinnata*, citing the shape and hairiness of the leaf lobes, the length of the outer and inner achenes, and length of the achene awns. Similar differences were cited by Everett (1992), but the primary character given in her key is 'pappus awns erect' (for *B. subalternans*) vs 'pappus awns spreading' (for *B. bipinnata*). This is belied by the accompanying illustrations which show erect awns for both species.

Orchard (2015) accepted both *B. bipinnata* and *B. subalternans*, and he took things even further by recognising three taxonomic varieties of *B. subalternans* in Australia. Although I have extensively investigated this, I cannot distinguish specimens identified as *B. bipinnata* from those identified as *B. subalternans* using Orchard's key, let alone the varieties of *B. subalternans*. Nor can I detect any discontinuity of the reportedly diagnostic characters associated with the involucral bracts. In my opinion, *B. subalternans sensu* Australian botanists is synonymous with *B. bipinnata*. Orchard (2015) conceded that 'it is possible that all these taxa [*B. bipinnata* and the varieties of *B. subalternans*] should be amalgamated in a single species …', and I believe that such an amalgamation is warranted.

The type of *B. subalternans* (image seen), collected from Brazil, with its predominantly pinnatisect leaves, would suggest another taxon altogether, and it is notable that de Candolle (1836) placed it in a different section from *B. bipinnata*.

While examining *Bidens* material at BRI, it became clear that a distinct taxon with pinnate leaves and flower heads with yellow ligules, is widespread in Australia, but has been overlooked by Australian botanists. Some specimens of this taxon had been identified as *B. pilosa* (because of its pinnate leaves), while others had been identified as *B. bipinnata* or *B. subalternans* (because of its relatively long achenes and yellow ligules). By examining Floras from other countries (e.g. Koster 1979; Mesfin 1984; Chen & Hind 2011), this taxon was soon identified as *B. biternata* (Lour.) Merr. & Sherff. Sherff (1937) had in fact recorded *B. biternata* for Australia based on a specimen from Lizard Island (Qld), and a specimen at US from Nightcliff, Darwin (image on internet), has been determined by Sherff as *B. biternata*. Koster (1979) and Mesfin (1984) both stated that *B. biternata* occurs in Australia. I have now determined about 60 specimens at BRI as *B. biternata*, mainly from northern Australia (Kimberley, Top End of N.T. and northern Qld), but also from southern Queensland, to within 10 km of the New South Wales border.

Two varieties of *B. pilosa*, *B. pilosa* var. *pilosa* and *B. pilosa* var. *minor* (Blume) Sherff are sometimes accepted (e.g. FloraBase, FloraNT, Orchard (2015)). The former lacks ligules on the outer florets while the latter has short white ligules on the outer florets. My field observations in several locations have clearly shown that the non-ligulate form (var. *pilosa*) and the ligulate form (var. *minor*) occur mixed within the same population, even side by side. For this reason, I suggest that varieties should

not be recognised in *B. pilosa*.

It is very helpful if collectors record the colour of the ligules; in *B. alba* var. *radiata* and *B. pilosa* they are white (or absent), while in *B. bipinnata* and *B. biternata* they are yellow.

I have placed an identification key to the Queensland *Bidens* species on Keybase (Bean 2020).

Acknowledgements

I thank Ailsa Holland for discussions on the taxonomy of Bidens, and for giving me her comprehensive file of reprints and photocopies. I am grateful to Barbara Waterhouse for her numerous herbarium specimens of Bidens, each with detailed associated notes.

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What is spidery about *Tradescantia*?

Roger Hnatiuk & Alex George

The following text is a species name, pre the Linnaean binomial system:

> '*Tradescantia ephemerum phalangoides tripetalum non repens Virginianum gramineum*'.

Have you seen it before? And have you seen the almost-standard English translation that usually accompanies it:

> 'the upright *Tradescantia* from Virginia with a grass-like habit, three petals and stamens with hairs like spider legs'.

If you haven't, try Googling it. It appears in an introductory botany text (Berg 1997) as well as in a paper on the Neolithic (Foster 2010). It has been quoted by a number of others since. But it has a longer, much longer history.

I (RH) first ran into these sets of words when a colleague of mine presented them to a Guides training course we were involved with running at the then-new National Arboretum Canberra. As nearly all of the guides-to-be had little or no formal biological training, especially in the esoterica of naming, we wanted to at least give them an introduction to the origin of the binomial system of nomenclature and a sense of how profoundly useful it is. My colleague chose this as an example. I am not a Latin scholar, but I stumbled over the lines each time I read them – they just didn't match well. Finally, I did some research, checking an online edition of *Species Plantarum* (Linnaeus, 1753) amongst others, tried my own translation, admitted failure, and contacted someone who knew Latin – our esteemed Latin scholar and my joint author (AG). His story follows and it is worth reading. He started by telling me of the 'can of worms' the query opened.

The diagnosis that you provided is almost the same as in Linnaeus' protologue (original description) of *Tradescantia virginiana* in his *Species Plantarum* 1: 288 (1753) but he gives only *Ephemerum phalangoides tripetalum non repens virginianum gramineum*. He indicates (it's in the same paragraph) that this is taken from R. Morison, *Plantarum Historia Universalis Oxoniensis* part 3 (Morison, 1699). Morison's account, under the name *Ephemerum Phalan-*

gioides, runs to several lines but the points in his description critical to this matter are *gramineis vel porraceis foliis* (with grass-like or leek-like leaves), *tripetalon* [sic] (three-petalled) and *non-repens* (not creeping). Among several 'species' he lists five. V*irginianum gramineum flora ampliore-caerulea, rubra,* & *alba*. Note that Morison used *Phalangioides* whereas Linnaeus spelt it *phalangoides*.

In this context *phalangioides* is derived from Latin *phalangium* meaning 'a kind of venomous spider', also used by the ancient Romans for a plant called spider-root (*Anthericum*). The adjectival word derived from this by adding -oides (meaning 'like', 'resembling') would appear to be *phalangioides* and several plants have this as the specific epithet. Under Article 60.10 Example 39 of the International Code of Nomenclature for algae, fungi, and plants (Turland *et al*., 2018), however, the correct spelling should be *phalangoides*. So, it appears that Linnaeus anticipated the Code in his spelling! Linnaeus used *phalangoides* several times in *Species Plantarum*, e.g. pp 41–42 when citing synonyms of *Commelina*. He certainly knew *Phalangium* since he adopted it as the name of a genus of spiders in 1758, and it turns up 12 times in citations of synonyms under *Anthericum*, pp 310–312.

Another interpretation of *phalangoides* is a construction from phalanx (genitive *phalangis*) plus the suffix *-oides* meaning 'phalanx [host] -like'. This meaning does not seem appropriate to the plants in question.

Regarding *gramineus*, going by Morison's account it refers to the grass-like leaves. You could argue that it refers to a grassy place but this is less likely [the species is recorded from a diversity of habitats (Faden, 2000)].

Linnaeus's format appears to treat the first word of a diagnosis such as *Ephemerum phalangoides tripetalum non repens virginianum gramineum* as a generic name. It turns up at least six times in the *Species Plantarum*, see *Eranthemum* (p. 9) and *Commelina* (pp 41–42). From my little delving it would be another exercise to find the origin of *Ephemerum* in this context (it's of Greek origin, taken into Latin as *ephemeron/ephemerum*—to the ancients a [now] unknown plant, either toxic or non-toxic).

Thus, in the diagnosis at the head of this article (*Tradescantia ephemerum* …), an author later than Linnaeus has added *Tradescantia*, which could be interpreted as virtually giving it two generic names, though it could also be argued that later authors simply took '*ephemerum*' to refer to the short-lived nature of the plant rather than as a generic name.

As a result of all this, the original diagnosis of Linnaeus, *Ephemerum phalangoides tripetalum non repens virginianum gramineum*, would be translated as:

An ephemeral spiderwort with three petals, not creeping, from Virginia, grass-like.

There is also the question, what is the origin of the name 'spiderwort'? We know what a spider is, an arachnid with eight legs. Wort is derived from *wyrt* (itself from German *wurz*), an old English word for a plant or root. Initially it meant a herb used for food or medicine. I can't find an explanation why the two words are associated to refer to *Tradescantia* but it would appear to be a reference to the 'spidery' appearance of the stamens—even though the flower has only six, not like the eight legs of a spider—and the use of some species of the genus in food. Thus, it's of English, not American, origin, coined when the plants were brought to Britain in the 17th century.

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Tiny art for the Day of the Species

Tanya Scharaschkin Tasmania scharasc@gmail.com

Towards the end of March, I found out about a nation-wide community art project highlighting the biodiversity crisis; the Day of the Species project. The aim of the project is to draw each of the 1,798 species on the EPBC Act Threatened Species List to raise awareness of the need for stronger environmental laws at the Federal level.

The artworks are tiny (3 × 7 cm) and drawn onto the backs of household packaging. I found cat food boxes worked best for me. Creating a tiny artwork, based on online photographs, has been a new experience for me. I usually draw plants I have seen, examined in detail and photographed myself. I found the challenge rewarding as it forced me to think of simple ways to capture the main features of the plant. I used markers and highlighter pens that have been lying around unused, and that led to some creative ways of making the artwork aesthetically pleasing whilst maintaining some botanical accuracy.

The instructions required the use of common names rather than scientific names. The reasons given were that scientific names are difficult and too long to write out on the card. The systematist in me found it difficult to comply with this guideline! I got around it by selecting those plants on the list that did not have a common name. This got me wondering why people are hesitant to use scientific names for plants. Perhaps it is because we tend to use common names for animals. There has been an attempt to standardise common names for birds, mammals and fish so as to avoid confusion by using the same name for different species, but no such standardisation exists for plant names. I don't think people realise that, apart from all the various issues associated with the use of common names, they too can be long (and in some cases longer), for example Yellow Mountain Triggerplant (*Stylidium galioides*) and Small-fruited Queensland Nut (*Macadamia ternifolia*).

I found the project somewhat addictive and ended up doing about 150 drawings. I started by selecting a few wattles because I have enjoyed drawing wattles in the past. Soon I found myself drawing other plants, selecting them somewhat randomly from the list provided by the organisers. After a while, I decided to draw plants I was not familiar with or had not heard of at all. And finally, I decided I would include at least one plant from each letter of the alphabet!

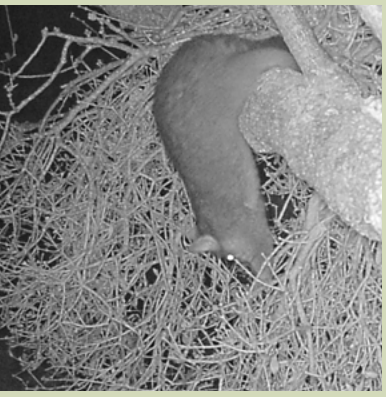
In meeting my self-imposed criterion of illustrating a plant from each letter of the alphabet, I noticed there were none in the list whose scientific names started with the letters Q or Y. If any of you are naming a new species that also happens to be threatened, rare or endangered, and requires the creation of a new genus, then please give the letters Q and Y due consideration!

All 1,798 national threatened species have now been rendered in textas, paints and coloured pencils by hundreds of art and nature lovers from every state and territory in Australia. I congratulate Carmel Killin, the organiser of the project, on coordinating what must have been a massive undertaking. An exhibition was scheduled to launch in Melbourne on the weekend before National Threatened Species Day in September. Given the COVID-19 pandemic, there will be a virtual exhibition instead. For more details head to https://the-lifesustainable.com.au/tiny-art-for-nature/.

Right: Some of the 150 artworks completed by Tanya for the Day of the Species art project

An update on the 'Possum Tax' collected at the 2019 ASBS-NZPCN Conference

Heidi Meudt & John Clarkson



Top: *Tupeia antarctica* one of only 5 extant New Zealand mistletoes; **Middle:** possum caught on night vision camera; **Bottom:** all of the leaves on this *Tupeia* have been devoured by possums. Photo credit: Zoe Lunniss

In December 2019, many of the Australian members of ASBS who attended the 2019 ASBS-NZPCN Conference in Wellington, New Zealand generously decided to donate money to a fund lovingly called the 'Possum Tax' (see http://www.asbs.org.au/newsletter/pdf/19-dec-181.pdf). The idea was that these funds would be tallied up and given to the New Zealand Plant Conservation Network to donate to a suitable conservation project that aimed to reduce possum numbers in New Zealand, where they are not native and cause numerous environmental problems (see for example, https://www.doc.govt.nz/nature/pests-and-threats/animal-pests/possums/). Possums have no natural predators in New Zealand and are omnivores that will eat bird eggs, invertebrates and buds, fruit and flowers from native trees. They also spread bovine tuberculosis.

All up, the participating Australians raised NZD $750 through their self-imposed Possum Tax, which was transferred to the NZPCN. In May 2020, the NZPCN announced that it would match this amount, making $1,500 available to a suitable conservation project. Applications were due on 30 June, and the only criteria were that the project had to be about possum control, and ideally would help protect a threatened native plants species (see https://www.nzpcn.org.nz/site/assets/files/0/55/983/trilepidea_may_2020_final.pdf).

In July 2020, a winner was announced: the Otanewainuku Kiwi Trust! Otanewainuku (https://kiwitrust.org/) is a 1,200 ha block of forest with a high conservation value near Tauranga in the Bay of Plenty region on New Zealand's North Island. The forest has apparently never been logged and it has over 300 species of native plants. The Otanewainuku Kiwi Trust (OKT) have an integrated pest management program to protect these native plants, and populations of the North Island brown kiwi and kōkako. They actively trap stoats, rats and cats, and have also used toxin to target possums and rats. However they have also recently started trapping ferrets and possums. The New Zealand Department of Conservation recently donated hundreds of 'pre-loved' possum traps to the OKT. With some simple but clever modifications designed by one of their team members, several of the traps have been refurbished and were trialled to see if they could be effective in the forest. The trial was successful, and with this grant of $1,500 they will now clean, re-coat and modify 175 of the 320 traps that were gifted to them. The plan is to get the traps set up and working immediately. We will certainly look forward to hearing about whether and how these traps have made difference in the forest in due course.

Many thanks to the Australians who generously donated to the Possum Tax, and to the NZPCN for matching the funds and awarding the money to a very worthy cause. For more details, see https://www.nzpcn.org.nz/site/assets/files/0/58/581/trilepidea_august_2020_final.pdf.

Herbarium happenings

WELT News

Leon Perrie

Museum of New Zealand Te Papa Tongarewa

The museum's IT systems meant non-specimen work continued largely normally for WELT's staff during the COVID-19 lockdown. Those researching got lots of writing done. Anticipating the closure of the museum (and herbarium), technician Bridget Hatton made preparations to continue databasing backlog specimens – see Bridget's blog post: https://blog.tepapa.govt.nz/2020/07/14. With everyone back at work, Bridget is now focused on accessioning a large donation of specimens collected by the late John Lovis.

Earlier, over the summer, Researcher Heidi Meudt had several weeks of successful fieldwork collecting *Myosotis*, after recovering from co-leading the hosting of the ASBS conference last November. She was assisted in the field by Collection Manager Antony Kusabs. Antony is again processing loans of herbarium specimens within New Zealand; overseas lending is still on hold while the integrity of international transportation links remains compromised.

Curator Carlos Lehnebach and the museum's geneticist Lara Shepherd are assessing the taxonomic status of 21 terrestrial, tag-named, New Zealand orchids, with funding from the Australia & Pacific Science Foundation. Research Fellow Patrick Brownsey and Curator Leon Perrie have just published the Lycopodiaceae treatment for the electronic Flora of New Zealand. Twenty-seven families are now published here: http://www.nzflora.info/publications.html. The Blechnaceae treatment is in press, and the Pteridaceae is nearly ready

The busy and smiling WELT staff and volunteers in July, 2020

to be submitted.

Research Associates Peter Beveridge and Barry Sneddon are continuing to publish new species of *Cheilolejeunea* liverworts and accession weeds, respectively. Technicians Jess Calcutt and Ashleigh Immers are collectively spending three days a week in the herbarium, primarily databasing backlog specimens. Former Collection Manager Jenn Dalen is back as a volunteer to help tidy the seaweed backlog. The mounting and imaging of new accessions is being tackled by our team of volunteers – special thanks to Bev, Eleanor, Jane, Jill, and Sue.

BRI News

Gillian Brown & Paul Forster

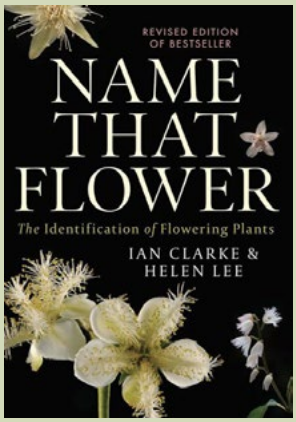
Queensland Herbarium

For the last 15 weeks most of the staff at the Queensland Herbarium have been working from home with just a core left *in situ*, including a specimen digital imaging team that has now completed *circa* 20% of the Queensland collection. These images will soon be available with our data on AVH. Unfortunately, due to COVID-19 budget changes this project has been suspended until further funding eventuates. Our loans and volunteer programs, as well as visits to the collection remain suspended due to COVID-19.

The Species and Herbarium Collections group at BRI has undergone some changes in the past 12 months. Andrew Franks has been appointed as the new collections manager. In the course of his career, Andy has worked in a number of roles at the Queensland Herbarium and private industry. He has expertise in bryophyte identification and systematics, together with long term experience in plant ecology, vegetation survey and mapping. The former collections manager, Gill Brown, has stepped up to the role of Science Leader of the Species and Herbarium Collection group after Ailsa Holland retired in late 2019. In late 2019 we also welcomed a new Botanist to the team, Laura Simmons, who has expertise in conservation genetics and plant ecology. This is a revamped position, rather than an additional person in the team, after our botanical illustrator Will Smith retired in early 2019. The other scientists in our team include: Tony Bean who leads our QLD flora and keybase projects; Nigel Fechner who works on QLD fungi taxonomy and responds to forensic and poisons enquiries; Paul Forster who works on vascular plant systematics, threatened plant species surveys and is the editor of our journal *Austrobaileya*; Ashley Field (based in Cairns) who works on systematics and conservation of ferns and lycophytes; Melinda Laidlaw who leads both the Weed Spotter program and Species Distribution Modelling projects; and Gerry Turpin (based in Cairns) who leads the work done by the Tropical Indigenous Ethnobotany Centre.

Still naming that flower

Book review by Grace Boxshall



Name that Flower: The Identification of Flowering Plants
Ian Clarke and Helen Lee
ISBN 9780522876048 (paperback) 208 x 148 mm
Melbourne University Press, 3rd edn, pp. 374.
RRP $39.99

Thirty-two years after we first began to Name that flower, Ian Clarke and Helen Lee released the third edition of their botanical bible. The third edition of *Name That Flower* has been updated to better follow the 2016 Angiosperm Phylogeny Group classification system (APG IV) and reflect recent advances in our understanding of plant evolutionary history (as informed by DNA-based analyses). As such, this latest edition of *Name That Flower* has folded another 74 pages and 19 plant families between its covers. In addition, the third edition contains new explanations of multi-flowered inflorescences, common practice in applying inflorescence terminology, tips on cutting sections and a sample bracketed key for the species illustrated in the book.

Name That Flower is a resource designed to be used alongside keys, floras, and field guides. It aims to guide beginners through the how-to of plant identification by breaking down terminology and dissection, showing readers what to look for and how to interpret what they're seeing. *Name That Flower* comprehensively grounds its readers in background theory: basic structure of flowers as well as some of the common variations in flower structure, inflorescence arrangement and branching types, plant reproduction, basic plant structure and function, as well as an introduction to classification and nomenclature. Readers are directed through the process of identifying a flower, including sectioning, recommended equipment, and tips on navigating keys. All this before diving into the bulk of the book: plant families! Nearly 200 pages of this book are devoted to introducing 46 plant families of Magnoliids, Monocotyledons and Eudicotyledons. Each group and family are described with background notes, their characteristic floral structures and key spotting characters. Accompanying these family descriptions and scattered throughout the text are exquisite labelled diagrams and colour plates of examples of plant species likely to be found and identified in south-eastern Australia. These plates and illustrations highlight and explain the key features of each example with images of both entire and dissected plant structures. Finally *Name That Flower* features lists of references, recommended websites, symbols, abbreviations, contractions, and of course an extensive glossary.

I was commissioned to review this book back in January, in a time before lockdown and while we were still running face-to-face practical classes at the University of Melbourne. I was assisting in practical classes for summer intensive botany subject, Flora of Victoria and it only seemed natural for me to bring along my brand new copy of *Name That Flower.* That means that long before I read this book cover to cover, I had sticky notes and pens bookmarking pages to refer to when students needed help understanding anther tubes, pappus hairs, and what on earth a naked receptacle is. I can say with all confidence that being able to point to an enlarged, dissected floret in a book is very helpful! Especially when the alternatives are doodled diagrams, lots of hand waving, and trying to hold your forceps steady and keep the structure in question within the field of view while a student dubiously gazes down the eyepiece.

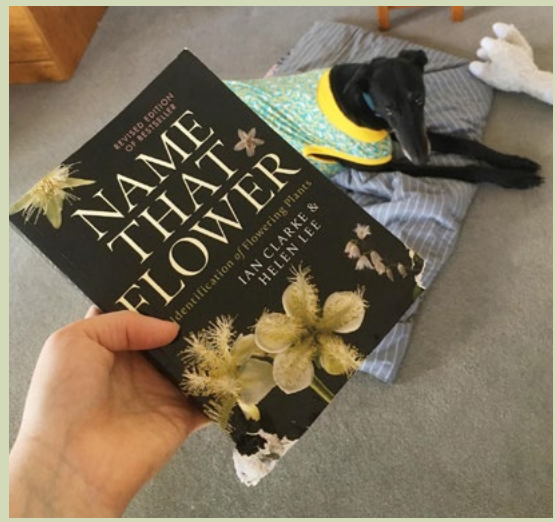
Now that I've had plenty of opportunity to read *Name That Flower* in its entirety while working from home, I'm blown away by just how many useful titbits are tucked inside its covers alongside those glorious plates and illustrations. I particularly enjoyed the figures

on leaf arrangement, attachment, and shape. I learned lots of new terminology and theory, and plan to reread different sections in more detail before I head back into the teaching lab (whenever that ends up being). I must admit that the demonstrator in me sighed with relief when the authors advised writing down key steps for when we invariably take the wrong turn, and I was also unusually excited about the list of recommended equipment. Remembering my own experiences as an overwhelmed second-year student studying Plant Biodiversity, I would have loved to have had this book by my side as I peered down the microscope. I would love to see *Name That Flower* on the recommended reading list for undergraduate botany subjects. Even in an era of google search and digitised floras, I can still see a place for *Name That Flower*: for plant identification, yes, but more importantly as an introduction to botanical terminology and theory, a guide for how to go about the process of identifying a plant, and as companion for floral dissections.

Not surprisingly, this isn't the first time *Name That Flower* has been reviewed for the *ASBS Newsletter*: in 1988, Peter Bridgewater recommended the first edition and suggested that copies of *Name That Flower* would see lots of use until a *Flora of Australia* became available on CD for personal Walkman field computers. What an astoundingly accurate prediction given it predated publicly available internet and app-laden smartphones!

However, Peter raised concerns that the deluge of botanical terminology may drown the truly uninitiated who perhaps hoped to become an expert overnight. It's true that the authors introduce and then rapidly use a lot of new terminology; but I would argue that's to be expected in any textbook and could be combatted by restraining our botanical excitement and taking time to read through the book slowly rather than all in one sitting. While it's hard to mentally time travel back to the days before I knew basic botanical terminology, there are certainly some sections that I felt were a little too opaque for the raw beginner (and possibly not-so-raw beginners too). I was particularly confused by the section on racemose and cymose branching. Generally though, I think the authors did an admirable job at explaining concepts clearly and engagingly. As Peter said: I don't see how they could have done much better! Peter also expressed concern that *Name That Flower* focuses too much on south eastern species. Many of the species used as examples are predominantly found in sout-eastern Australia, either as indigenous plants, common garden plants or weeds. This doesn't bother me quite as much-possibly because I'm based in that part of the country. However, the examples provided can easily be translated to assist in understanding other, closely related species with similar morphology and broader distributions. And, as the authors themselves say in the *Getting Started* chapter: "the principles of identification are not geographically confined, and the basic information is applicable in any region."

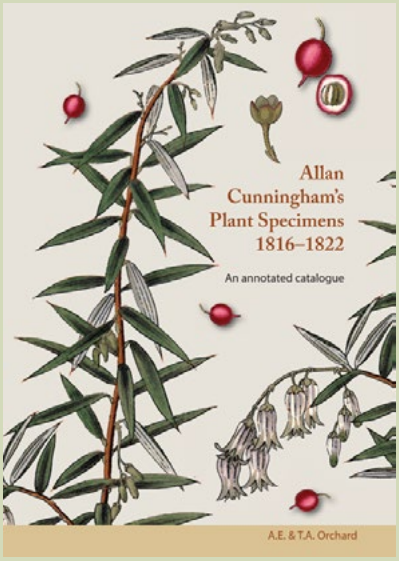
Overall, I thoroughly recommend the latest edition of Name That Flower — especially for botany students. I know I'll be frequently pulling out my copy of it in the coming years as I brush up on my theory and bring it along to teaching. But I see *Name That Flower* making the most difference in the hands of the students themselves. As such, I'm hanging out for the day when I can see more copies in the teaching labs, keeping students company as they begin their own journeys towards naming that flower — shaky forceps, and all.



Brock's Review: Grace's six year old greyhound Brock has an appetite for plant systematic literature, having digested the *ASBS Newsletter* last month. He gave rave reviews of *Name That Flower*, saying not only does it read well, but it also smells and tastes great!

Onward and upward

Book review by Alex George



Allan Cunningham's Plant Specimens 1816–1822: An annotated catalogue
A.E. and T.A. Orchard
ISBN 9780994150554 (paperback) 208 × 296 mm
Privately published, pp. 471. RRP $45.00; postage within Australia $15.00

This is one of very few books on the Australian flora (scientific or popular) to feature an epacrid on its front cover (*Lissanthe sapida*, painting by William Hooker, Curtis's Botanical Magazine t. 3147). Victoria quite properly has its State floral emblem, *Epacris impressa*, on the dust jacket of vol. 1 of its *Flora* (1993).

This is the sixth book by the Orchard team on Allan Cunningham, with more to come. It brings together their records of all the collections they have found from his most productive period—about 9,000, now housed in 28 herbaria. Along the way they took some 30,000 photographs of specimens. They describe how Cunningham worked in collecting and despatching his specimens. On his return to England in 1831 to work though these, he paid particular attention to providing Augustin P. de Candolle with duplicates for use in preparing the *Prodromus*. He sent material to others, sometimes renumbering specimens, sometimes even unnumbered. The numbers given to specimens usually differ from those in the seed lists that he compiled for Aiton at Kew. Further, the details accompanying specimens vary between herbaria. In compiling the tables in this book the many inconsistencies in collection data (often due to curatorial practices in herbaria) have been taken into account. For example, a number of sheets at BM bear printed labels attributing them to the first King expedition of 1818 when they are actually from the Oxley expedition of 1817. At the end of each despatch are listed collections that cannot be matched with the main list but appear to be from that despatch.

Like most early collectors who numbered their specimens, Cunningham sorted his material after collection, usually into families as then understood, before applying numbers (a challenge for you all: who was the first collector—anywhere—to apply numbers chronologically, in the field?).

The background to the main sets, at K and BM, is outlined but these were discussed fully in an earlier volume. The collections are then listed in eight tables, each listing the collections from a despatch (consignment) as sent to Aiton. The despatches left Sydney in 1817 (two), 1818, 1819, 1820 (two), 1821 (two), 1822 and 1823. An introduction to each despatch explains the areas of the collections included, the ship by which they were sent, and C's heading for the set, e.g.

> *A List of Specimens of plants, collected in a Voyage of Discovery on the Coasts of Australia, performed on board H.M.'s Cutter Mermaid, by P. P. King Esq^re^, Lieut. Command^r^, between the Months of May and November 1819'.*

In four columns the data are: specimen number, C's collection data, seed list number, and a compilation of all specimens found that can be assigned to the shipping number. These last give the data from each sheet seen, the herbarium, the name filed under, and the current name, e.g., Figure 1. It's clear that he was well schooled in botanical Latin!

Essentially, what the book allows you to do is search for any specimen or seed number, any of the names used by C, or any of his collections by their current accepted name. You will then find a list of the relevant herbarium sheets and the institutions where they are housed.

326	Acacia ligulata; foliis angusto-oblongis basi attenuatis uninervibus crassis apice mucronatis uncinato-obliquis, racemis terminalibus legumine plano obtuso, valvis aequilatis ligulaeformibus, ramulis diffusis gracilis subflexuosis. A Shrubby bushy plant, among Brushwood. Cliffs, Dirk Hartog's Island, West Coast. [Collected 21st January, see Journal].	315	A.Cunningham 326, Dirk Hartog's Island, W.Coast, s.d. (**K, herb. Hook.**), filed as Acacia ligulata A.Cunn. ex Benth. A.Cunningham 326, Dirk Hartog's Island, W. Coast, Jan. 1822 (**K779894, herb. Linn. Soc.**), filed as Acacia ligulata A.Cunn. ex Benth. A.Cunningham 326, Dirk Hartog's Island, 21 Jan. 1822 (**PERTH938629**, image), filed as Acacia ligulata A.Cunn. ex Benth., det. Maslin, 1988. A.Cunningham 326, N end of Dirk Hartog Island, 1822 (**PERTH856088**, image), filed as Acacia didyma A.R.Chapman & Maslin, det. Maslin, 1988. A.Cunningham 326, Dirk Hartog Island, Jan. 1822 (**GH58346**), filed as Acacia ligulata A.Cunn. ex Benth. Syntypes of Acacia ligulata A.Cunn. ex Benth. (lecto: K). **Acacia ligulata A.Cunn. ex Benth.**

Figure 1

Curiously, C's type collection of Sturt Pea, at G, has somehow missed being listed. There is no gap in the collection numbers for that stage of the voyage.

C's field data are extremely useful, since quite often they do not appear on herbarium sheets. The best are at BM but even many of those don't include his notes. For detail they far exceed those of any other early collector, commonly including brief descriptions that, had they been published at the time, would have effectively validated C's manuscript names.

On p. 18 is a selection of labels from nine herbaria, showing examples of handwriting of the period and the challenge of interpreting them, including abbreviations.

For someone wanting a little historical project it would be interesting to search through the Ninth Despatch, in conjunction with C's journal, to find which collections were gathered by John Cummings, his assistant who sometimes went shore alone, e.g. on 21 August 1821 when he collected what became the type of *Grevillea pyramidalis*. Cummings has never been cited as the collector of these (as was also the case, for example, with Peter Good who made a number of collections attributed to Robert Brown).

The 27-page index lists all accepted names as well as C's manuscript (field) names.

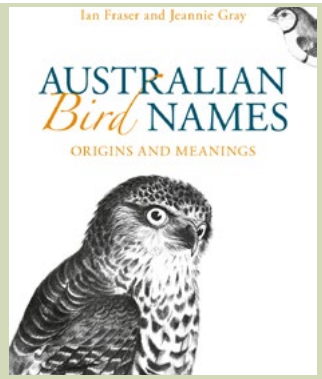
It is bitter-sweet to think that the 'Cunningham project' arose from the term of the final (53rd) ABLO, showing how productive such a posting could be, tempered by the thought that no Australian botanist will have such an opportunity again.

This will be an instant standard reference for anyone studying Allan Cunningham's collections. It should already be in the library of each Australian herbarium. The price is remarkably reasonable.

A bird by almost any name you can think of

Book review by Alex George

Australian Bird Names: Origins and Meanings
Ian Fraser and Jeannie Gray
ISBN 9781 486311637 (paperback)
CSIRO Publishing, 2019, 2nd edn, pp. 347. RRP $55.00



A review of a bird book in our Newsletter? I bought it because I thought there would be some names in common with plants, and indeed found a number of epithets, e.g. *acuminata*, *barbatus*, *flammea*, *halmaturinus*, *maculatus*, *pileata*. But it's fascinating to look at the nomenclature of a group that we must all, to some extent, be aware of through our work and daily lives.

The date of the first edition is not given but can be deduced from the Introduction which refers to the '6 years since we wrote the first edition'. During this period 55 vagrant (asylum seeking?) species have been added to the national list and 21 species added by taxonomic splitting though, frustratingly, I can find no mention of the total number of bird species in Australia (online sources give a figure of around 900 including offshore territories and vagrants).

The names are arranged in the order followed in the *International Ornithological Committee World Bird List* version 8.2 (27 June 2018), which means that they are not in alphabetical order, even within genera, but in a presumed systematic arrangement. This is an online list, not included in the references but updated 'regularly' [there is already version 10.2 with a number of name changes and re-ordering].

Included is every common name that the authors have been able to trace, including in the vast resource of the National Library's Trove. This means that you should find any name even if it's not the accepted one, e.g. Mudlark, with which I grew up, now Magpie-lark. The use of capitals and hyphens is a matter of contention, especially the latter on which the authors say that 'unanimity on this question would seem to be a distant dream'.

Showing the significance of common names in ornithology, the scientific name is relegated to the last part of a species entry. First comes the accepted common name with its explanation and a note on its occurrence (breeding resident, non-breeding migrant, vagrant etc.), followed by *Other names*, being other common names, each also explained, and finally the scientific name with its author and year (but not reference), its pronunciation, a literal translation (e.g. *Dupetor flavicollis*: 'yellow-necked clatterer'; *Nycticorax nycticorax*, 'nightraven nightraven'—in fact, the Australian record is the typical subspecies, *Nycticorax nycticorax nycticorax*) and the derivation of the epithet. For a meaning of the generic name you are told 'see genus name' to which you must turn. There are some colourful names, e.g. Dreg-Beaked Scrap Fowl and Spangled Drongo-shrike. New South Wales Rifle Bird-of-Paradise is rather a mouthful.

Zoological scientific nomenclature is less complex than botanical, reflected here in a much shorter discussion than that for common names. As shown in an example above, tautonyms are allowed. Another is *Chloris chloris*, its meaning given as Greek, greenfinch, whereas the botanical *Chloris* is said to be for the Greek goddess of flowers. There appear to be few names based on bird calls; I noted *Colluricincla harmonica* (Grey Shrikethrush). You will find plenty of biographical information on natural history collectors, museum curators etc. Placenames feature far less in bird names.

A few people who are commemorated in plant names also appear here, e.g. *banksii*, *leschenaultii*, but generally plants feature rarely in the scientific names, an example being *Lonchura oryzivora*. More have been used for the common names, e.g. Grass Parrot, Grasswrens, Banana-bird, Cabbage Bird, Casuarina Cockatoo, Cedar Bird, Figbird, Mangrove Bittern. But Wattle Bird has nothing to do with *Acacia*.

There are two indexes, one to common names, one to scientific names. The latter has separate entries for full names and epithets.

The book is illustrated with a selection of fine black-and-white drawings by Silvester Diggles from his *Companion to Gould's Handbook* (1877).

Dr Pakshirajan Lakshminarasimhan

28 August 1959 – 15 July 2020

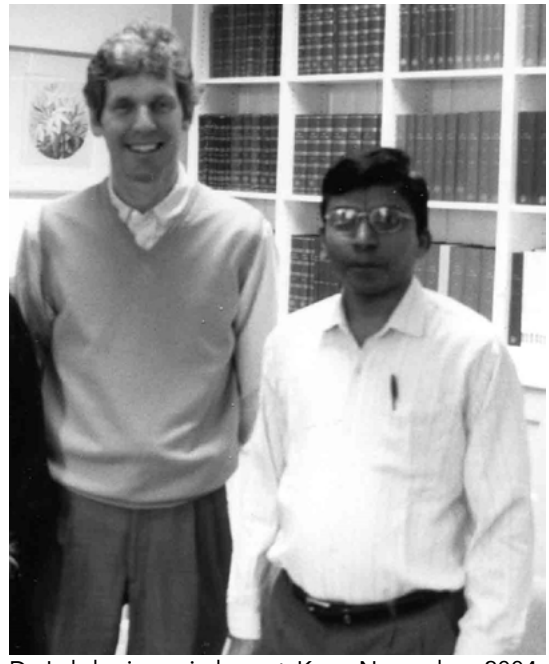
Alex George

Based on an obituary by W. Arisdason, Botanical Survey of India, Nelumbo 62 (1): 103–106 (2020)

Respected Indian botanist Pakshirajan Lakshminarasimhan, known to a number of Australian botanists, passed away on 15 July 2020. Known to friends and colleagues as Lakshmi or Narasimhan, he was born in Pune, Maharashtra, on 28 August 1959. He graduated in 1980 with a BSc from Loyola College, Chennai, followed by a master's degree from Pune University in 1982. He joined the Ministry of Environment and Forest at Western Circle in Pune and spent six years documenting the flora of Nasik District, Maharashtra, for which he was awarded a PhD from Pune University in 1989.

In December 1989 he was appointed Scientist "B" of the Botanical Survey of India by the Union Public Service Commission, Central National Herbarium Service Commission, and surveyed the flora of Interview Island, in the Andaman Islands. He contributed the taxonomic accounts of 16 families to volume 1 of Flora of Andaman and Nicobar Islands, published by the BSI in 1999. In 1995 he was promoted to Scientist "C".

From May 2002 to November 2004 he was Indian Botanical Liaison Officer at the Royal Botanic Gardens, Kew, occupying an office in Hunter House just two doors away from the ABLO's office. His research focused in the Loganiaceae. After the completion of his tenure he was posted at Central National Herbarium, Howrah. Here, he and colleagues/students documented the floral wealth of Dalma, Koderma and Palkot wildlife sanctuaries in the state of Jharkhand during 2007–2014. He also explored the plant diversity of Lakshadweep Islands between 2007 and 2009. From January 2010 to May 2015, he was in charge of the ENVIS Centre on Floral Diversity of BSI, Howrah, instigating publication of the ENVIS Newsletter (biannual), Bibliography and Abstracts of Papers on Flora of West Bengal, Andaman and Nicobar Islands, Maharashtra, Kerala, Tamil Nadu, Goa and Karnataka, and A Pictorial Guide to some of the Indian Plants listed in CITES and Negative List of Exports. The Centre also conducted capacity-building training courses and workshops in plant taxonomy and herbarium techniques and methodology, for college and university students. From January–May 2010 and March 2013–July 2015 he was Head of Office at the Central National Herbarium, Howrah (CAL).



Dr Lakshminarasimhan at Kew, November 2004, with the Keeper Simon Owens. Photo: Alex George.

Lakshmi organized the first Botanical Nomenclature Course in India, held in January 2013. This was followed by three more courses—in February 2017 at Pune, in March 2019 at Coimbatore, and in January 2020 at Shillong. Dr. Kanchi Gandhi served as the Course Director for this series of Botanical Nomenclature Courses. This series of nomenclature course has promoted the spreading of nomenclature knowledge effectively among the Indian botanical fraternity. He was also instrumen-

tal in organising a one-week Botanical Latin Workshop at BSI, Southern Regional Centre, Coimbatore in January 2011.

In 2012, Lakshmi was deputed by BSI to participate in a CITES Regional Workshop held at Thimphu, Bhutan, where he delivered a presentation on CITES, Endemic and Medicinal Plants of India. In 2017, he was deputed again by BSI to participate in the IUCN Red List Assessor Training and Ebony Assessment Workshop held at Royal Botanic Gardens, Peradeniya, Sri Lanka, where he also delivered a paper on 'Ebonies of India'.

During his 30-year research career, he individually or jointly with his colleagues and students wrote or edited some 25 books and about 175 research papers in national and international journals. He served as an editorial board member of journals such as Nelumbo, Journal of Economic and Taxonomic Botany, Rheedea, Journal of Threatened Taxa and Phytotaxonomy. He also served as a member of the India Checklist Editorial Committee of The Missouri Botanical Garden, St. Louis, USA. He described 28 new taxa from India, jointly with his colleagues and students.

In 2010, the Indian Association for Angiosperm Taxonomy honoured him with the Professor V.V. Sivarajan Medal, and the Association for Plant Taxonomy awarded him the Dr. M.B. Raizada Medal, for his significant contributions to taxonomy of angiosperms in India. A new species, Portulaca lakshminarasimhaniana S.R. Yadav & Dalavi, was named in his honour in 2018.

Daphne Joan (Choules) Edinger

13 December 1927 – 18 March 2020

Kevin Kenneally

Daphne Edinger was born in the Naval Maternity Hospital in Portsmouth, England during a snow storm. Her father Chief Petty Officer Claude Choules was stationed in England to prepare and deliver HMAS *Canberra* to the Australian Navy. Claude would achieve international acclaim in 2010, aged 110, when he became the world's last living combatant of World War 1. His autobiography 'The last of the last', compiled by Daphne, was published in 2009.

Daphne's early years were spent in North Sydney where her father taught her to swim at the tidal swimming baths at Lavender Beach where she developed a love for the ocean. The family moved to Perth in 1931. Being a sailor's daughter involved many maritime adventures. In 1933 the family travelled on the State Ship *Kybra* on a 14-day trip to Fortescue Island off the Pilbara coast. There were day trips to Rottnest Island and summer school holidays spent under canvas at Coogee Beach, south of Fremantle.

Daphne attended Girton College, Fremantle, and later Presbyterian Ladies College. After

Daphne Edinger at Rottnest Island in August 1947, aged 19.

matriculating she studied music and chemistry at Perth Technical College, then obtained a BSc with Honours for a thesis on 'The Ecology of the Western Australian Limestone Reefs', from The University of Western Australia. This included field work on the intertidal reefs at Rottnest Island.

In 1950, Daphne joined the WA Department of Agriculture in South Perth as an entomologist but in 1951 she married John Edinger, an industrial chemist, and, as required under public service regulations at that time, had to resign. She and John raised four children, three sons (Robert, Andrew and Malcolm) and a daughter Louise.

From 1967–72 and 1974–82, Daphne was head teacher of biology at Presbyterian Ladies College, remembered by her students as inspirational, energetic and hip. Her marriage to John ended in 1975. In 1979 she joined the Australian and New Zealand Scientific Exploration Society (ANZSES) and participated in their inaugural trip to the Fitzgerald River National Park. She became a botanist with the popular Westrail Wildflower Bus Tours. In 1983 she joined a month-long ANZSES expedition to Walcott Inlet in the West Kimberley. On this expedition she met Kevin Kenneally from the Western Australian Herbarium, a specialist on Kimberley vegetation and plants. She asked Kevin if he needed assistance with his research and the rest, as they say, is history. Daphne volunteered as a full-time assistant with Kevin and in 1986 became the first Honorary Research Assistant at the Herbarium. For the next 20 years

Top right: Daphne Edinger and Kevin Kenneally processing plant specimens at the Sale River, West Kimberley, 1986.

Bottom right: Helen Aston, botanist and ornithologist (National Herbarium of Victoria), Daphne Edinger and technical officer Phil Spencer pressing specimens of *Cycnogeton dubium* at Bobby's Creek near Beagle Bay on the Dampier Peninsula, April 1988.

she assisted Kevin and other botanists at the Herbarium with their research projects. She also assisted Kevin with botanical collecting and teaching at the WA Gould League's annual Year 6 Science Camp School at the Bickley Outdoor Recreation Camp.

In 1988, Daphne was a member of a research team surveying rainforest patches in the Kimberley as part of the Federally funded National Rainforest Conservation Program. In 1996, she was a joint recipient (with Kevin Kenneally and Tim Willing) of the CSIRO External Research Medal for Excellence for the project and book *Broome and Beyond: Plants and People of the Dampier Peninsula, Kimberley, Western Australia*.

In 2000, Daphne joined Kevin, Jean Paton and Cheryl Tonts at Landscope Expeditions, a citizen science program conducted jointly between UWA Extension at The University of Western Australia and the Department of Conservation and Land Management and participated as a leader on many expeditions to remote areas of W.A. In 1990 she received an Outstanding Service Award for her volunteer contribution to the W.A. Herbarium. In 2007 she was awarded Conservation Volunteer of the Year for her contribution 'as a botanist and volunteer' to the Landscope Expedition's research program.

In 2007 and 2008 Daphne, accompanied by retired engineer and W.A. Herbarium volunteer Gilbert Marsh, joined botanist Bruce Maslin's field team assisting with his taxonomic and genetic population sampling of Mulga (*Acacia aneura*) in W.A. In 2004 she and Gilbert assisted ecologist Mark Cowan with vegetation and flora surveys of the Black Range and Lake Mason, former pastoral stations in the Murchison Bioregion.

Daphne contributed 403 collections as sole collector and over 7,000 specimens with other collectors to the W.A. Herbarium. Nine of her collections became types of new species, most being conservation-listed as poorly known, poorly collected or

Kevin Kenneally, Daphne Edinger and Tim Willing in Canberra at the presentation of the CSIRO Medal for research achievement, 1996.

geographically restricted. She is recognised in two plant names: Daphne's Mulla-Mulla (*Ptilotus daphne*) and Daphne's Triggerplant (*Stylidium daphne*). She was the co-author of a number of botanical papers.

Daphne's contribution to botany and conservation, particularly her work in the Kimberley and Murchison, was outstanding. She was intelligent, extremely diligent and was happiest sleeping under the stars in her swag or processing thousands of plant specimens in the Herbarium. Daphne would scramble up sandstone escarpments searching for plant specimens, endure the myriad bites of green ants in Kimberley rainforests and sandflies in mangroves, but nothing deterred her. Attired in her hallmark black Akubra hat, she greeted everyone with a booming "Hello darling!" Daphne was an intrepid, inspiring and unforgettable person whose warmth and good humour were appreciated by all who met her.

Daphne is survived by her brother, four children, eight grandchildren and one great grandchild.

News

Todd McLay

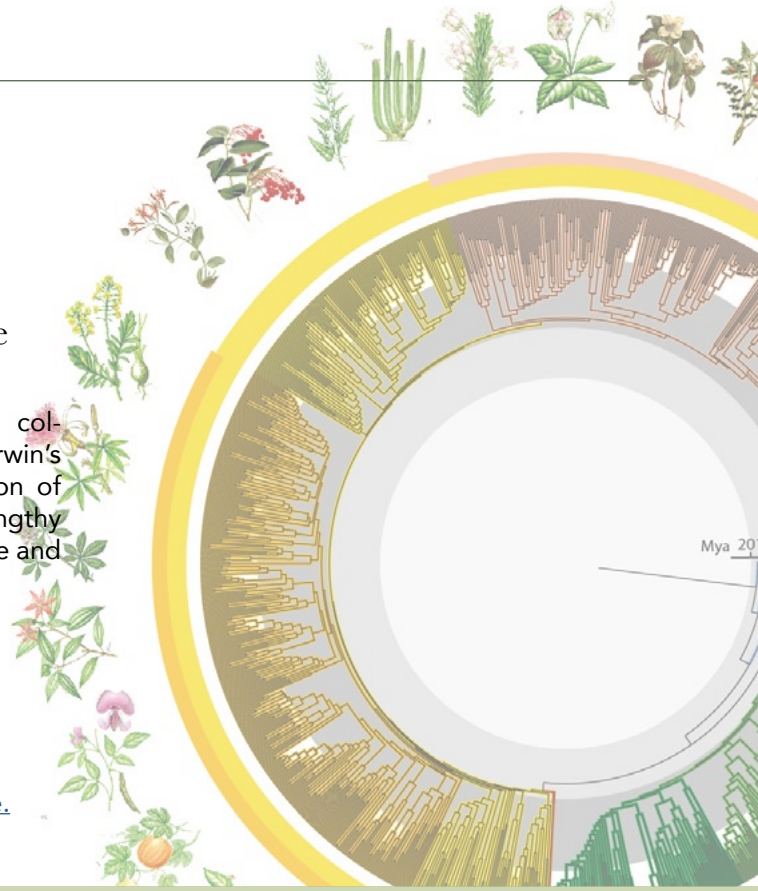
Papers and publications

When did flowering plants take over the world?

ASBS Secretary Hervé Sauquet and colleagues had a crack at resolving Darwin's 'abominable mystery' on the evolution of flowering plants, detailed in this lengthy ABC Science article. Impressive science and impressive reporting.

Link to the ABC article: https://www.abc.net.au/news/science/2020-07-07/flowering-plants-complete-evolutionary-tree/12425054

Link to the paper: https://www.nature.com/articles/s41559-020-1241-3



New Guinea home to richest island flora

A recently published checklist of the New Guinean flora (in *Nature*!) by an enormous cast of authors

It outlines the incredible diversity of Earth's largest tropical island. Their checklist identified 13,634 species (at 68% endemism), 1,742 genera and 264 families, leading the authors to suggest that New Guinea is the most floristically diverse island in the world. I'm not sure which is more impressive, the combined effort of the authors to create this checklist or the fact that they managed to get it into *Nature*.

Link to original paper: https://www.nature.com/articles/s41586-020-2549-5

Comment on paper by Barry Conn *et al.*: https://theconversation.com/majestic-stunning-intriguing-and-bizarre-new-guinea-has-13-634-species-of-plants-and-these-are-some-of-our-favourites-144279?fbclid=IwAR2c8uwpkNKexHl1RDFH-3kV4MUJgr71u5W5GQ6kaR7mtz3k6HqlSPzwE-aY

Another comment on the paper: https://cosmosmagazine.com/nature/plants/new-guinea-home-to-richest-island-flora/

It's all Good(enia)

Summarising phylogenetic and morphological work in Goodeniaceae has led to an expanded *Goodenia*, including new keys and infrageneric classification.

https://phytokeys.pensoft.net/article/49604/?fbclid=IwAR2swtbql6L_eLU9RyDSYefh4LfTwjCPHPUvsduRxKyTdIx-AmzMV0zdom90

DIATOM-ITE new volume about the diatom flora of arid Australia

A treatment of the arid diatom flora, including 400 taxa from 90 genera (three genera new to science).

John, J. (2020). "Diatom Flora of Australia. Vol. 3: Diatoms from Arid Australia. Taxonomy and Biogeography" *Koeltz Scientific Books.* (ISBN 978-3-946583-25-7)

Buy it here: https://koeltz.com/en/diatom-flora-of-australia-vol-3-diatoms-of-arid-australia-taxonomy-and-biogeography-2019-4to-hardcoverisbn-978-3-946583-25-7?fbclid=IwAR1xYi9NGndEuV-oaNMpWSO1HrvPATeYWkfsVtMEAxMAlygEut3TZv2Ej3w

A national biodiversity strategy for Aotearoa New Zealand, Te Mana o te Taiao

New Zealand's plan for biodiversity protection and recovery is Te Mana o te Taiao. The plan sets out five core goals for the next 30 years, and provides the overall strategic direction for biodiversity in Aotearoa New Zealand. Now that the plan is established, the next phase includes require collaboratively design an implementation plan for 2021-2022. Those who went to ASBS 2019 in Wellington will recall NZ Minister for the Environment, Eugenie Sage, outlining the strategy.

The strategy: https://www.doc.govt.nz/nature/biodiversity/aotearoa-new-zealand-biodiversity-strategy/te-mana-o-te-taiao-summary/

Article about the strategy: https://www.rnz.co.nz/news/national/423154/kiwi-roaming-in-backyards-minister-launches-biodiversity-strategy

AJB Special Issue on dry-adapted vegetation

The Australian Journal of Botany has recently published a Special Issue on the evolution of dry-adapted vegetation in Australia. Papers include fossil discoveries, anatomical analyses, and biogeography.

Find the Special Issue here: https://www.publish.csiro.au/BT/issue/9985

Assessing taxonomic shortfalls in AVH (or collections in general)

An interesting summary of the gaps in collecting of Australian plants, or at least those found on AVH. This might be a good one for a journal club.

https://link.springer.com/article/10.1007/s10531-019-01885-7

Online and in the media

International Humboldt Day September 14-18

A pioneer of biogeography (perhaps *the* pioneer), Alexander von Humboldt's work on botanical geography paved the way for modern biogeography. It's his 250th birthday, and to celebrate the International Biogeography Society is launching International Humboldt Day. Between 14-18th September a series of events will be held all over the world, showcasing biogeographical research. Two events of particular interest to ASBS members will be a symposium organised by ANU's Centre for Biodiversity Analysis (CBA), and a talk about morphological changes in the NZ island flora.

More info here: https://humboldtday.org/

CBA symposium: https://humboldtday.org/event/humboldt-day-evolutionary-biogeography-symposium/?wcs_timestamp=1600344020

NZ flora morphology talk: https://humboldtday.org/event/morphological-changes-in-island-flora-nz/

iNaturalist backyard species discovery

The iNaturalist hosted, Bush Blitz-backed species discovery project is coming to a close. Initially set up because COVID-19 put real life field expeditions on hold, this project asked people to document biodiversity found in their backyard and upload the information to iNaturalist. This is potentially useful and interesting data for scientists, but as our community knows this sort of data is only as good as the identifications applied to the observations. Experts are encouraged to contribute and interact with the community collecting the data, and clean up the data as it comes in.

https://www.inaturalist.org/projects/backyard-species-discovery-with-bush-blitz-australia

Early view of Kew's 'Tree of Life Explorer' online

The Plant and Fungal Tree of Life (PAFTOL) project spearheaded by Kew is continuing their lofty goal of sequencing representatives of every genus of plant and fungi, and they have now released their 'Tree of Life Explorer'. At the moment it includes sequences from 310 species, but eventually their entire sequencing effort will be hosted here, as well as interactive phylogenies of plants (and one day fungi).

https://treeoflife.kew.org/

ABC Landline First Nation Farmers series - Bunya Nuts

A nice little story about bunya pines, their historical indigenous uses, and how people are using them now (just ignore the part where the presenter describes them 'flowering').

Watch it here: https://www.youtube.com/watch?v=G0f6XNMDb64

http://www.abcaustralia.net.au/program/first-nation-farmers/RA1917Q/

Really, really old plant grown

Scientists have successfully grown plants from 30,000 year old frozen tissue of *Silene stenophylla*. While the seeds weren't viable, the tissue was able to be cultured and the plant eventually produced flowers and seeds. Who says old collections aren't valuable?

https://www.earthlymission.com/scientists-revive-32000-year-old-plant-siberia-permafrost/?fbclid=IwAR1cN_Ltld94ontzbtAmBejpitnwL2JL-7TxOA0R_W6oKEM-FCe5V6bCbOk#

Preiss: The forgotten botanist who brought 200,000 Australian plants to Europe

A detailed article about the life of Johann Ludwig Preiss, his time collecting in Australia, his return to Europe, and his contributions to understanding the diversity of the Australian flora, especially in Western Australia. A couple of great stories about his interactions with frenemy James Drummond, another early explorer and plant collector in WA.

https://theconversation.com/friday-essay-the-forgotten-german-botanist-who-took-200-000-australian-plants-to-europe-143099

Interview with the article's author (some in German): https://www.sbs.com.au/language/english/audio/johann-preiss-the-forgotten-german-botanist-in-australia

Sombre reading on the 2019-2020 bushfire season impacts on biodiversity

Research on the impacts of the disastrous summer bushfires are starting to appear, and here are some of the early comments on that research and the impacts on biodiversity.

Interactive guide to the species impacted: https://theconversation.com/click-through-the-tragic-stories-of-119-species-still-struggling-after-black-summer-in-this-interactive-and-how-to-help-131025

Fifty (animal) species set to have threatened classification: https://www.theguardian.com/environment/2020/jul/21/bushfire-devastation-leaves-almost-50-australian-native-species-at-risk-of-becoming-threatened

Weed impacts quoll recovery: https://www.tenterfieldstar.com.au/story/6830696/post-bushfire-weed-invasion-threatens-the-spotted-tail-quoll/

Why is Australia a global leader in extinction? https://www.smh.com.au/politics/federal/why-is-australia-a-global-leader-in-wildlife-extinctions-20200717-p55cyd.html

30,000 new images on AVH from RBGV

You may have noticed another tab has appeared on AVH called 'Record Images'. Recently, over 30,000 images were contributed by the Royal Botanic Gardens Victoria to AVH. Most of the images are of type specimens that have been photographed for the Global Plants on JSTOR project, but the dataset also includes images of MEL's *Eucalyptus* 'exemplar' specimens. A really impressive feature worth checking out.

AVH Facebook story: https://m.facebook.com/story.php?story_fbid=1782198171904254&id=272827696174650&ref=content_filter

The newsletter

The ASBS newsletter keeps members informed of society events and news, and provides a platform for debate and discussion. The newsletter is published quarterly on the ASBS website and in print. Original articles, notes and letters (not exceeding ten published pages in length) are encouraged for submission by ASBS members.

Have an article or an idea for the newsletter?
Send it to Lizzy (Editor):
lizzy.joyce@my.jcu.edu.au,
or Alex (Associate Editor):
a.george@murdoch.edu.au

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Full page: $200
Half page: $100
Flyers: $250

A 20% discount applies for regular advertisements. ASBS members are exempt from advertisement fees but not insertion costs for flyers ($50). For advertising enquiries please contact the editor.

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The society

The Australasian Systematic Botany Society is an incorporated association of over 300 people with professional or amateur interest in botany. The aim of the society is to promote the study of plant systematics.

Membership is open to all interested in plant systematics. Members are entitled to attend general and chapter meetings, and to receive the ASBS *Newsletter*. Any person may apply for membership by filling in a membership application form available at http://www.asbs.org.au/asbs/membership.html, and forwarding it to the Treasurer. Subscriptions become due on 1 January each year.

The ASBS annual membership subscription is AUD $45, and a concessional rate of AUD $25 is offered to full-time students, retirees and unemployed people. Payment may be by credit card or by cheque made out to Australasian Systematic Botany Society Inc., and remitted to the Treasurer. All changes of address should be sent directly to the Treasurer as well.

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