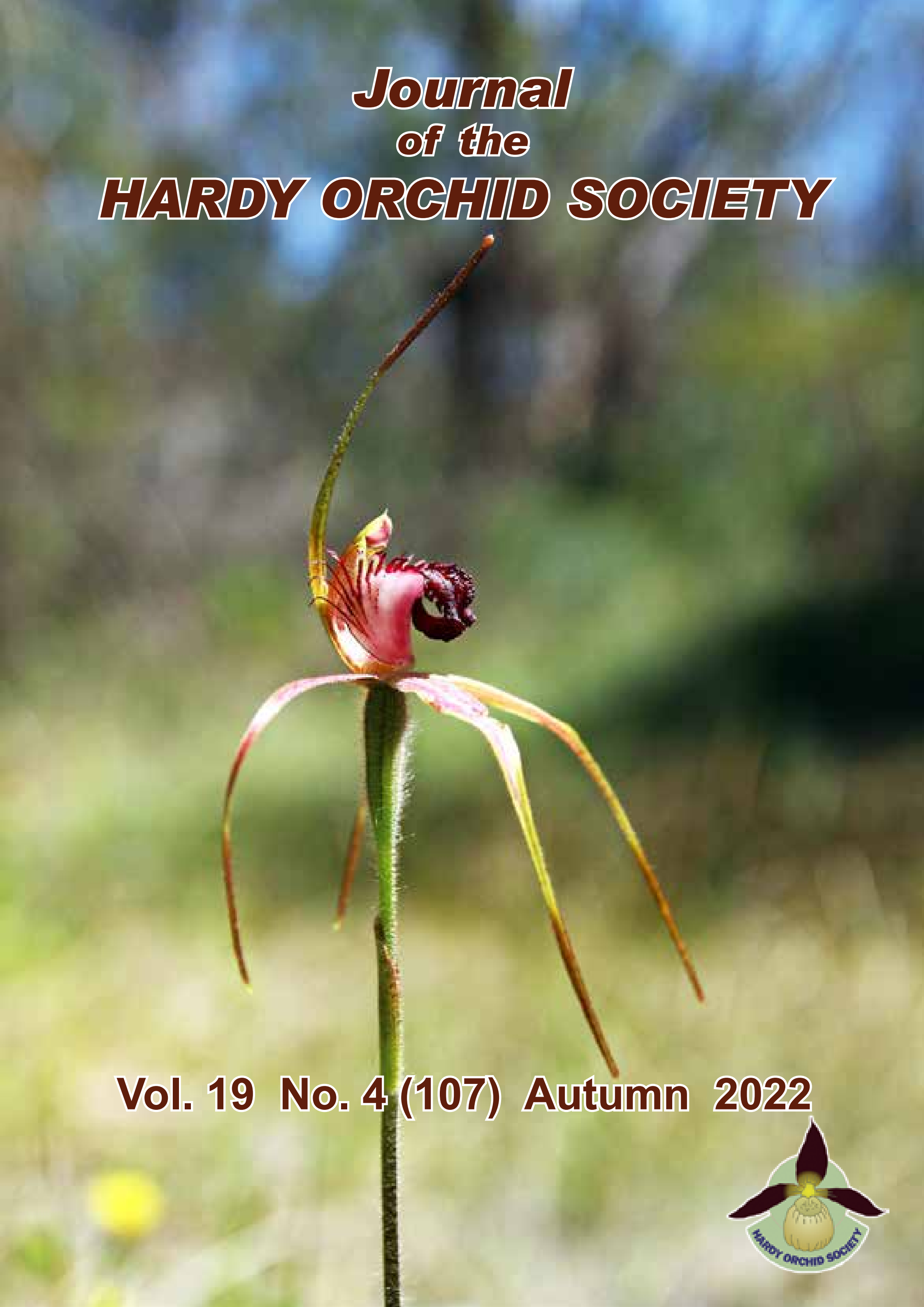
Journal
of the
HARDY ORCHID SOCIETY



Vol. 19 No. 4 (107) Autumn 2022

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Front Cover Photograph

Carousel Spider Orchid (*Caladenia arenicola*) at King's Park, Perth, W. Australia photographed by Colin Scrutton. See page 132 for the article on Australian Spider Orchids.

JOURNAL of the HARDY ORCHID SOCIETY Vol. 19 No.4 (107) Autumn 2022

The Hardy Orchid Society

Our aim is to promote interest in the study of Native European Orchids and those from similar temperate climates throughout the world. We cover such varied aspects as field study, cultivation and propagation, photography, taxonomy and systematics, and practical conservation. We welcome articles relating to any of these subjects, which will be considered for publication by the editorial committee. Please send your submissions to the Editor, and please structure your text according to the "Advice to Authors" (see Members' Handbook, website www.hardyorchidsociety.org.uk, or contact the Editor). Views expressed in journal articles are those of their author(s) and may not reflect those of HOS.

Contents

Editorial Note

Mike Gasson

This time we have an issue with two larger articles from our President Richard Bateman and former Chairman Colin Scrutton and Angela Scrutton. Richard draws on his former geological life working on fossilised vegetation to provide us with a perspective on what to expect from our orchid flora going forwards in a world of climate change. A curious coincidence for me is that my son works on climate change at Exeter University and happened to do his PhD with the author of one of Richard's referenced papers and source of Figure 2 – small world even if it is getting hotter! Colin and Angela provide another of their detailed travelogues from interesting corners of the world, this time covering the Spider Orchids of Australia.

I have included results from the 2022 Plant Show and managed to fit in all of the winners, taking advantage of Simon Tarrant's sterling efforts to get decent images during the event. Having taken on that task in the past myself I know how tricky it is to capture everything with limited time and the inevitable conflicting things going on. Lastly, please note that the website Members' Area has an updated password (see top of facing page 110) that will take effect once this *JHOS* has been distributed.

Chairman’s Note

Carol Armstrong

Hope you are all keeping well. For me, Summer has raced by. No doubt for you too, and like me you probably kept a wary eye on having to suddenly cancel or change plans due to Covid-19. This year it seemed that many shows, exhibitions and walks were running on the same day and it was sometimes difficult to decide which one to go to and some of our members supported multiple events in one day.

Our Society’s summer activities included organised walks, a seed sowing workshop, indoor meetings and orchid-related competitions, all of which were thoroughly enjoyed. My thanks to those who put a lot of time and effort into organising these events. After a busy, enjoyable summer, I am sure that you will have new tales to tell about orchids.

Congratulations to Monkton Nature Reserve who were awarded the first HOS Conservation Grant (HOSCG) this summer. They are going to use the grant to rabbit-proof the wild orchid areas on the reserve and also produce an information board for visitors. HOS will be acknowledged and we can look forward to progress reports about the project. HOSCG demonstrates our Society’s aim to promote interest in the study of native orchids by helping the floral communities in which they grow, and also help the wider general public to appreciate our wild orchids. I wish to propose that this grant is offered again in 2023.

November will see our Southern Meeting with the Photographic Competition – see the enclosed application form for details.

Can I ask for any member(s) who would be willing to take the role of projectionist at the indoor meetings in 2023 to make contact with myself or any other Committee Member. I look forward to seeing you in Kidlington and hope to hear some of those orchid tales from this summer in the chats that we have with each other that day.

HOS Field Trips

We always need new ideas for trips, as well as new leaders. Or you might know a site warden who welcomes small visits by interested naturalists. We want to help new generations develop their enthusiasm for, and knowledge of, our wild orchids. Help spread the love!

Contact Richard Kulczycki: hosft@hardyorchidsociety.org

HOS Photographic Competition 2022

Here are the entry details for the competition at Kidlington, November 20th 2022:

Please note that rule 6 will be enforced this year:- All entries for any class must be photographed within the current or preceding calendar year. Digital entries are to be emailed to Neil Evans, or use a file transfer service for larger files, by the end of 23rd October 2022. For print entries email Neil by the end of 23rd October 2022 with the classes to be entered and a digital copy of the image. For entrants who are unable to attend the meeting Neil will accept prints by post and will take them to the meeting for you. Enclose an SAE if return of the prints is required. Neil's postal address is inside the front cover of the Journal.

Please name your files in the following format: Your Name, Class, Name of Orchid, Location. The full Schedule of Classes and Rules can be found on the HOS website.

Hardy Orchids for Sale

John Haggar

As many members are aware I have for many years sold my excess stock both at plant shows and using Ebay. It is my intention to reduce my reliance on Ebay and will instead send out E-mails to interested parties when I have stock for sale. This is usually at repotting time whenever that might be.

All orchids offered will comply fully with current UK legislation as it relates to mail-order plants. All are grown from the seed of cultivated plants obtained from reliable British or EU (pre-Brexit) sources or from wild seed collected with the landowner's written permission or with appropriate licence where necessary.

Propagation begins in a laboratory setting and subsequently seedlings are grown on to flowering size in appropriate composts in pots. None are grown on, nor dug up from soil. Sometimes divisions of cultivated stock may be offered. All will be provided with the legally required Plant Passports and are inspected for quality and freedom from disease prior to packing.

If you are a grower of hardy orchids and would be interested in being included on my mailing list, please send your email address to me at johnsorchids57@gmail.com and I will keep you updated. Limited stock will mean first come, first served. The first mailshot will be in the autumn when I begin my yearly repottings.

Results of HOS Plant Show 2022

Class 4: Three pots hardy orchids, distinct varieties, any country of origin.

1st Steve Clements: *Bletilla* Coritani (a); *Bletilla* Richard's Gift (b); *Epipactis* Sabine (c) [Best in Show]

Class 5: One pot native British orchid.

1st Steve Clements: *Dactylorhiza fuchsii*
2nd Steve Clements: *Spiranthes aestivalis*

Class 6: One pot native European (not native to Britain) orchid.

1st Steve Clements: *Dactylorhiza kalopisii*

Class 7: One pot non-European orchid.

1st Steve Clements: *Diuris drummondii*
2nd Peter Ward: *Epipactis gigantea*
3rd Neil Evans: *Bletilla ochracea*

Class 8: One pot *Dactylorhiza.*

1st John Haggar: *Dactylorhiza kalopisii*
2nd Steve Clements: *Dactylorhiza* garden hybrid

Class 10: One pot *Ophrys.*

1st Neil Evans: *Ophrys apifera*

Class 15: One pot *Epipactis*.

1st Steve Clements: *Epipactis* Sabine
2nd Steve Clements: *Epipactis* Lowland Legacy [Chairman's Award]
3rd John Haggar: *Epipactis* Heart of Virginia

Class 16: One plant or pan of plants raised from seed by the grower.

1st Peter Ward: *Dactylorhiza fuchsii* [Grower's Award]

Winner of Best in Show Trophy:
Steve Clements for *Epipactis* Sabine in Class 4

Chairman's Award
Steve Clements for *Epipactis* Lowland Legacy in Class 15

Banksian Medal
Steve Clements

Thanks to Diane Clement for judging the Plant Show

All of the winning entries are featured on the following four pages. Numbers match the Class entered and the position (i.e. 5-1 is first place in Class 5). For Class 4 the three plants are identified by a letter (a-c) as indicated in the results above.

All photos by Simon Tarrant

4-1a

4-1c

4-1b


5-1


6-1


5-2


7-1


7-2


10-1


7-3


8-1


16-1


15-3


15-1


15-2

Out of the Frying Pan?
Predicting the British and Irish Orchid Flora of the late 21st Century
Richard Bateman

Most HOS members will likely think of me primarily as an enthusiastic student of living temperate orchids, and so I am. But in fact, I earned my living in that role for a relatively short period of time, after moving from Oxford to Edinburgh in 1994. Throughout the previous decade I had been funded to study fossilised vegetation, focusing on Pompeii-like assemblages of plants preserved in the volcanic terrains that dominated southern Scotland during the Carboniferous – a period approximately 350–290 million years ago when a then tropical Britain lay close to the equator. And before that, I had spent seven years using sedimentological techniques to reconstruct past climates of the Younger Dryas – the last brief period when Britain sported modest glaciers – which ended just 11,700 years ago. Unfortunately, interpreting past climates attracted little interest or funding in the 1980s, so the research group of which I was part was forcibly phased out.

Today, anyone working as a professional plant scientist or ecologist will find it extremely difficult to obtain funding for any project that does NOT emphasise its supposed contribution to understanding and/or combating climate change. The wheel has truly turned full circle, to a point where climate change has gained its rightful place as a major social and political issue and Greta Thunberg has become as influential as David Attenborough. Within the botanical research community, the development and protection of crops inevitably garners most resources in a world still beset by an ever-increasing human population. But climate change is also increasingly debated in the context of conservation planning, having joined habitat destruction as the two greatest threats to our remaining natural resources. I now find that my past research foci on the Carboniferous and Younger Dryas periods have a renewed relevance, as they influence my perspective on the present climate crisis and colour my concerns for the future of our flora. Here, I place some recent studies predicting future changes in our orchid flora within a conceptual framework born of my own diverse research experiences.

A geological perspective
We are now reaping the benefits of the vast amount of work that has been invested in refining plots through geological time of key parameters such as mean annual temperature (MAT: Fig. 1) and atmospheric composition (Fig. 2) (graphs reproduced respectively from Keating-Bitonti & Chang 2018; Foster *et al.* 2014). Many kinds of data have contributed to these crucial curves, ranging from measuring the density of stomata (breathing pores) on the surfaces of fossilised leaves to determining the relative thickness of – and the composition of air trapped within – annual layers visualised in polar ice cores. Note that time-scales in both graphs change several

times, narrowing from left to right as precision of measurement increases towards the present day.

It is now widely argued that an anthropogenic increase in MAT of just 1.5^{0}C could prove to be a disastrous tipping point, irreversibly imposing upon us an almost unimaginably altered world (e.g. Carbon Brief 2020). This may indeed be true, yet Fig. 1 tells us that MAT exceeded the present by an estimated 12^{0}C at about 380 million years ago – the period when seed-bearing plants first evolved. And MAT did so again at about 50 million years ago, when fossil seeds recovered from the Thames estuary show us that the area was a tropical swamp inhabited by mangroves and *Nypa* swamp-palms, vegetation akin to that of modern-day Malaysia (these habitats presumably supported a far higher diversity of orchids than today, dominated by epiphytes). Indeed, the only periods when MAT was even slightly lower than that of today were much of the last 2.5 million years (concluding with the Younger Dryas) and between 330 and 220 million years ago – including that portion of the Carboniferous period when coal-forests dominated much of the Northern Hemisphere. At that time, O_2 levels are estimated to have been half as much again as they are today, meaning for example that vegetation would have burned exceptionally fiercely and extensively following lightning strikes.

Variation in MAT is strongly positively correlated with atmospheric levels of the 'greenhouse' gas CO_2, though admittedly many factors other than CO_2 influence MAT. Nonetheless, CO_2 peaked at the same times as MAT, periodically reaching levels at least three times higher than those of today (Fig. 2). Perhaps more startlingly, CO_2 exceeded mid-20th century levels for almost the whole of geological history, not dipping below 350 ppm until about 2.5 million years ago. In short, these graphs show that, viewed from the perspective of deep geological time, it is actually the last 2.5 million years that have been anomalous. For most of the history of land vegetation, plants have been obliged to contend with an atmosphere and climate far more challenging than that predicted for the immediate future by present-day climate change models.

Fig. 1: Plot of globally averaged Mean Annual Temperature through the last 500 million years, estimated using several methods. Note that time-scales shorten from left to right. The large red arrow marks the Younger Dryas period. Modified from a diagram prepared by Glen Fergus for Keating-Bitonti & Chang (2018, Fig. 6).

Fig. 2: Plot of globally averaged atmospheric carbon dioxide levels through the last 500 million years, estimated using several methods. Note that time-scales shorten from left to right, and that the CO_2 scale is logarithmic (Fig. 1 of Foster *et al*. 2014).

Figure 1

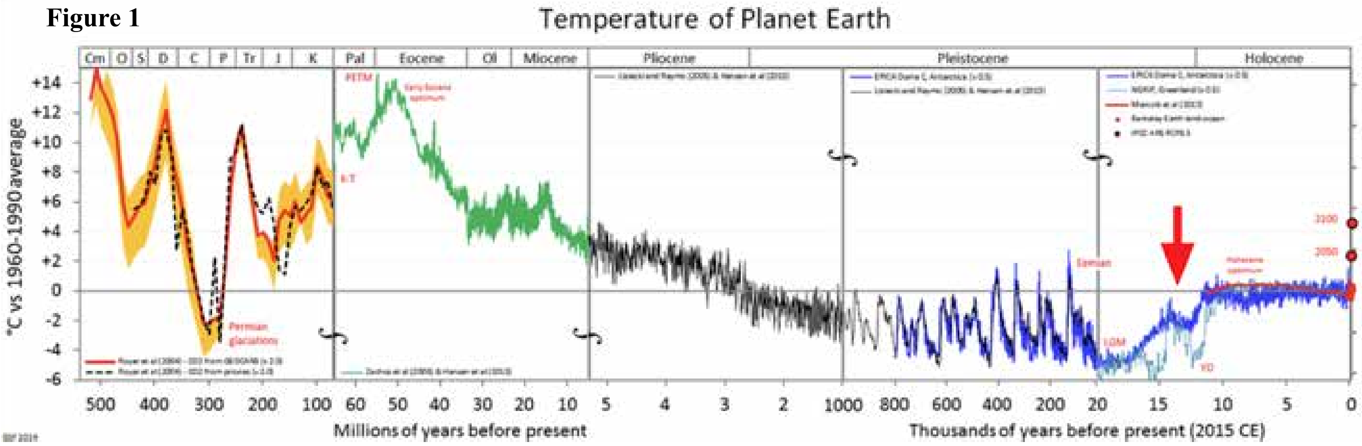
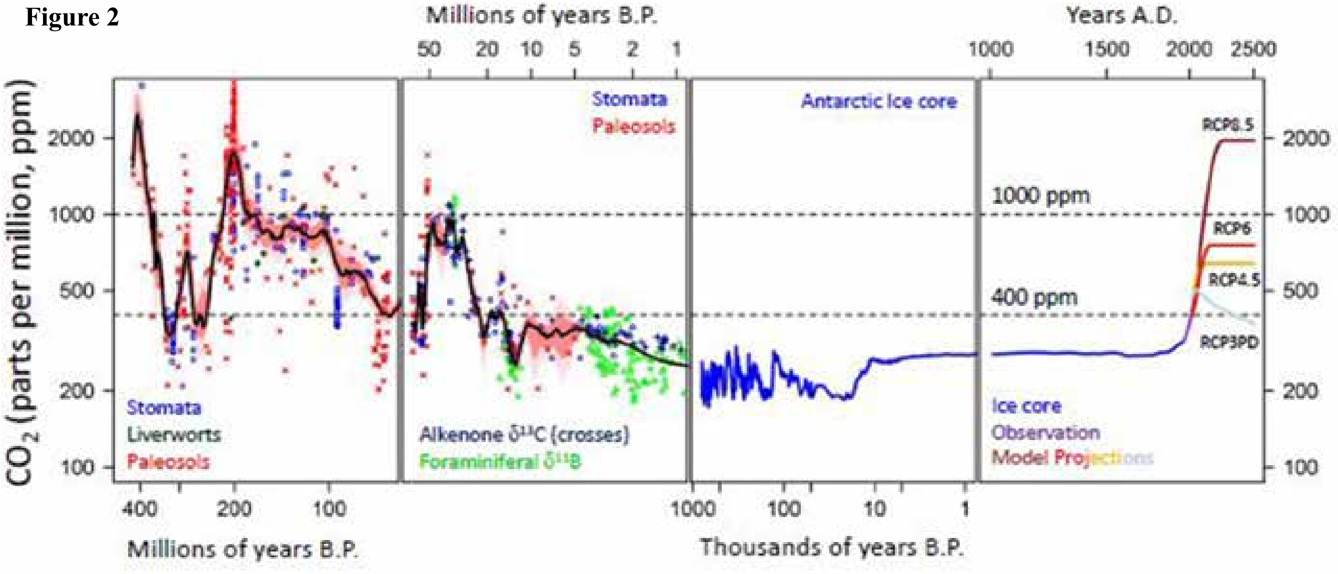


Figure 2



Significance of the Younger Dryas

The periodic rhythm of several glacial periods, separated by warmer interglacials, during the Pleistocene shows clearly (in blue) in Figures 1 and 2. The planet gradually warmed following the Late Glacial Maximum at ca 20,000 years ago, but a brief reversal to colder conditions, named the Younger Dryas, is evident between 12,900 and 11,700 (red arrow in Fig. 1). This phenomenon is far more pronounced in the Northern Hemisphere (pale blue curve) than the southern hemisphere (dark blue curve). Evidence suggests that the onset of this cold period was exceptionally fast – perhaps occurring in as little as three years – and reflected sudden failure of the suite of oceanic currents termed collectively the ‘Atlantic Meridional Overturning Circulation’, the ‘North Atlantic Conveyor’ or, less accurately, the ‘Gulf Stream’ (e.g. Meissner 2007). Experts have for long speculated that this failure may have resulted from the sudden release of freshwater from postglacial lakes in North America, though (inevitably, given the excitement that they always cause) volcanic eruptions and asteroid impacts are also actively being sought that could credibly be dated to that crucial point 12,900 years ago. Moreover, the Younger Dryas seemingly ended as abruptly as it started.

Whatever the true cause, the net result in Europe was plummeting temperatures. Glaciers re-formed locally in parts of the British Isles, notably in western Scotland, and the remainder of the country was plunged back into periglacial conditions, akin to those found in modern tundra landscapes; present-day Iceland provides a valid comparison. Indeed, this period is formally named after the classic tundra plant Mountain Avens (*Dryas octopetala*), whose leaves and pollen characterise sediments laid down at that time. Much of our flora, and probably almost all of our orchid flora, reached these shores only after the Younger Dryas, having migrated northwards and north-westwards from southern Europe and North Africa. Thus, the Younger Dryas usefully tells us that radical climate change can occur on a human rather than a geological timescale. It tells us that its effects can be regional rather than global. It tells us that the underlying cause can be relatively small-scale, and can occur far away from the region where its (literally) downstream consequences are most acutely felt. And it tells us that those effects can rapidly and substantially alter vegetational composition. But, more optimistically, it also tells us that re-vegetation can be a relatively rapid process. Admittedly, the British flora is considerably less diverse than those of Mediterranean countries, but nonetheless, we have successfully acquired most of our ca 1,400 genuinely native species of vascular plant during just the last 11,700 years.

If you can’t stand the heat, why not get out of the kitchen?

When faced with a deteriorating environment, most animals can in theory simply walk away. But a sedentary plant can only stand and fight, while hoping that any seeds it produces will find a niche where they can experience a better life than its own.

Plant migration therefore becomes a process that occurs between, rather than within, generations. Natural barriers typically cited as impeding migration include seas and mountain ranges, though substantial differences in geology affecting soil type are arguably equally critical. Once a population is driven to the tip of a coastal peninsula, or the top of a mountain, it has nowhere else to go and must suffer whatever fate awaits it. One might have hoped that, given their dust-like seeds readily transported in high-level air currents, orchids would be less constrained by being Earth-bound than are most other plant families, but current evidence suggests otherwise. Mid-ocean archipelagos such as the Azores and Hawaiian Islands are strikingly impoverished in orchid species due to their isolation. Also, genetic studies increasingly suggest that European orchids migrated northwards postglacially at approximately the same speed as various tree species; it would appear that the dust-seed may actually migrate no faster than the acorn.

The speed with which the British Isles were recolonised following the last glaciation might be taken as reason for optimism, suggesting that natural migration could once again salvage a European flora placed under stress by climate change. However, those postglacial migrations occurred across landscapes that had barely been scratched by human activity. We have since placed additional major barriers to hinder plant movement, most notably vast monocultures of pastures, arable crops and alien conifers. Only recently has the idea been seriously mooted of establishing networks of wildlife corridors to assist future range shifts, and like so many conservation initiatives, such corridors are much easier to conceive than to implement. Of course, we are in a position to offer threatened plants assistance that is more interventionist; I will return to the topic of deliberate translocation later in this article.

Distributional changes in orchids through the recent past

It might legitimately be argued that the best way to predict future events is to study the recent past. Britain and Ireland have a fine track record of botanical field recording and databasing that has settled into a pattern of generating a new hectad-based plant atlas every 20 years. The distribution maps for the next Atlas, covering the period 2000–2019, were recently finalised prior to publication early in 2023 (Stroh *et al*. 2023), and preparing the captions for the orchid family provided me with a useful preview of the current status of each family. I recently published a detailed review of the last 20 years of research into British and Irish orchids (Bateman 2022), designed to accompany the new Atlas. In that review, I plotted the geographical distributions through three time slices of four native orchid species, two expanding and two contracting. When interpreting such diagrams, it is important to note that the intensity of both searching and reporting will have increased between each time-slice (e.g. Trudgill 2022), particularly in Ireland; it is also important to note that the human eye is easily deceived when seeking patterns in data.

Despite these codicils, it is clear that the Burnt Orchid (*Neotinea ustulata*) has undergone a rapid retreat to headquarters in three areas rich in calcareous grassland: Salisbury Plain, the East Sussex Downs and Swaledale. The similarly rapidly declining Lesser Butterfly-orchid (*Platanthera bifolia* s.l.) shows a more complex pattern, suffering mainly from habitat loss throughout its range during the 20th Century but apparently experiencing preferential losses in southern areas early in the 21st Century. In contrast, both the Southern Marsh-orchid (*Dactylorhiza praetermissa*) and Bee Orchid (*Ophrys apifera*: Fig. 3 – a species explored in greater detail by Bell 2015) have not only increased in frequency but also pushed northward the limit of their distributions. The former has almost reached the Scottish border whereas the latter has crossed it, leap-frogging the Southern Uplands in order to reach the greener pastures of the Scottish Midland Valley. It is difficult to attribute these rapid northward expansions to any cause other than climate change.

Here I have generated from the BSBI database additional maps for a fifth species, the Fly Orchid (*O. insectifera*: Fig. 4), in order to explore distributional change in a species that has already been subjected to Europe-wide distributional modelling. The results are discussed in the next section.

Recent attempts to model future orchid distributions

Early attempts to analyse and predict distributional change in plants were simply extrapolated from any existing data, rather than being truly analytical. However, the discipline has gradually

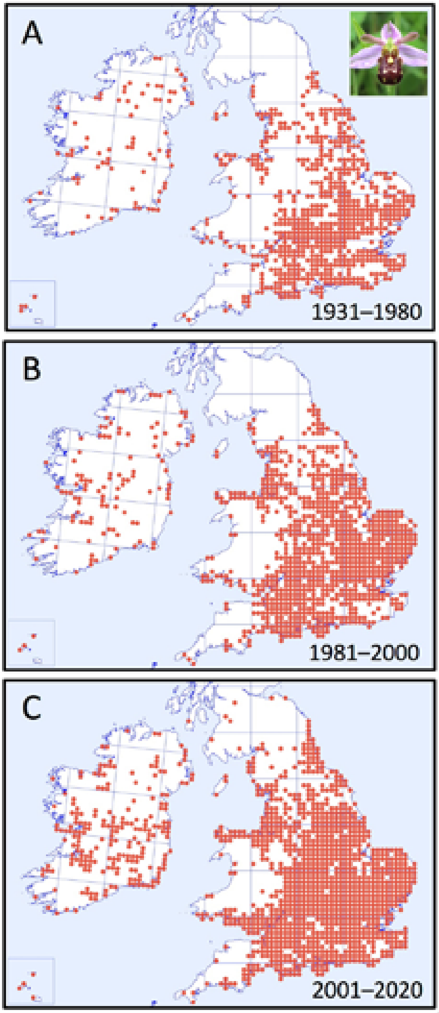


Fig. 3: Distribution maps for Bee Orchid, *Ophrys apifera* for the following periods: A, 1930–1980, B, 1981–2000, C, 2001–2020. Data derived from the Distribution Database (DDb) of the Botanical Society of Britain and Ireland (fig. 10 of Bateman 2022).

become more scientific, as climate data have accrued and climate models have increased in sophistication, aided by better mathematics and faster computers. In parallel, the quantity and quality of plant records in biogeographic databases have improved, while the databases themselves became better integrated and more interactive. Consequently, we have arguably reached a point where meaningful extrapolation of plant distributions into the future has become feasible. Unsurprisingly, given their charisma and popularity among field botanists, orchids have begun to feature increasingly frequently in such analyses (as predicted by Bateman 2011). However, it is more difficult to assess the credibility of the conclusions reached.

Most such studies attempt to project from the present-day to the period 2060–2080, or alternatively simply the years 2070 or 2080. They also tend to experiment with a range of climatic scenarios, often depending on the level of projected anthropogenic increases in various greenhouse gases. Recent examples have predicted the future European distributions of several *Epipactis* species (Evans & Jacquemyn 2022), *Ophrys insectifera* (Charitonidou *et al.* 2022), and several species of obligate mycoheterotrophs (Kolanowska *et al.* 2017).

Beginning with the obligate mycoheterotrophs, Kolanowska *et al.* (2017) suggest that, by 2080, *Neottia nidus-avis* will have retreated from southern limestone areas to become sparsely distributed across the north and west of the British Isles (Fig. 5). Having watched several chalk

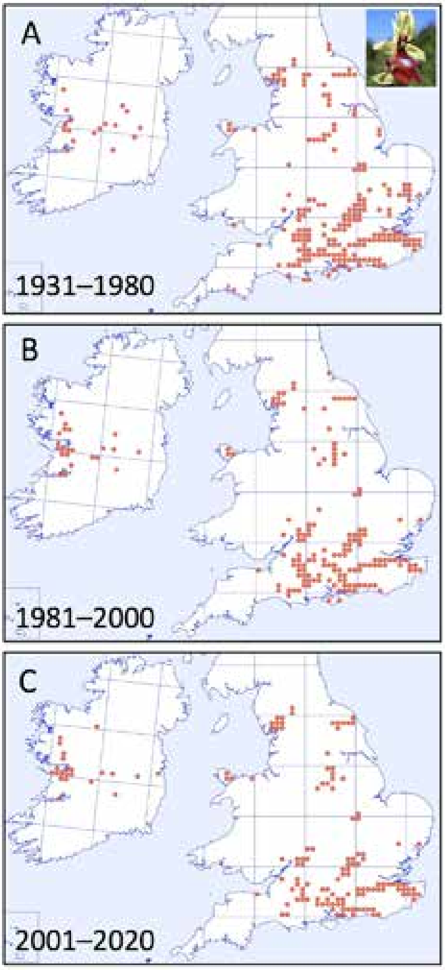


Fig. 4: Distribution maps for Fly Orchid, *Ophrys insectifera* for the following periods: A, 1930–1980, B, 1981–2000, C, 2001–2020. Data derived from the Distribution Database (DDb) of the Botanical Society of Britain and Ireland.

beechwood populations of Bird's-nest Orchid decline during the course of the last 45 years – I suspect primarily through decreased soil moisture in the spring and summer – I find it credible that a further 60 years of accelerating temperature increase could indeed eliminate *N. nidus-avis* from our chalklands. More difficult to envisage are the dense stands of *Epipogium aphyllum* that are predicted by their model to develop across southern and central England (Fig. 6). Given that several reasonably robust populations of Ghost Orchid declined in the Chiltern Hills and Welsh Borders during the 20th Century, and that only one (seedless) flower has been reported in Britain during the last 35 years, I find it hard to envision where this predicted population explosion is likely to spring from. If you are planning an invasion, it helps to be located close to the areas earmarked for conquest, whereas *Epipogium* presently appears happiest in montane central Europe.

The modelling of Fly Orchid across Europe by Charitonidou *et al*. (2022) used a range of more sophisticated models applied to a stronger data-set. The results generated by their "best case" (Fig. 7) and "worst-case" (Fig. 8) models are similar in overall pattern but differ strongly in the degree of distributional change that they predict, particularly in terms of regional extinctions. Both scenarios predict failure of the more southerly populations in the Balkans, Apennines and southern slopes of the Pyrenees, but the worst-case scenario also predicts extensive losses across the lowlands of central Europe. In compensation, both scenarios suggest considerable expansions in Scandinavia, the Low Countries, and southern and central England. But this is a case where 'ground-truthing' (directly examining the landscape) is likely to pour cold water on the predictions made; much of the area of England envisaged as suitable to host new orchid populations is actually intensively agricultural, and hence will hardly be conducive to colonisation by the Fly Orchid.

Figs. 5 and 6: Year 2080 distribution maps of suitable climatic niches predicted by modelling for Bird's-nest Orchid, *Neottia nidus-avis* (5) and Ghost Orchid, *Epipogium aphyllum* (6); darker browns indicate potentially greater frequencies (Fig. 5A and 5B respectively of Kolanowska *et al*. 2017).

Armed with these recent predictions, I generated the distribution maps for the Fly Orchid in the British Isles over the last 90 years (Fig. 4), which showed a reduction in total number of hectads (10 km squares) of 27% between 1980 and 2020 (admittedly, an analysis conducted at a finer spatial scale would no doubt have yielded a much greater estimated decrease). I was primarily seeking evidence of preferential losses in the south relative to gains in the north that might pre-empt the much greater future distributional changes envisaged by Charitonidou *et al.* (2022). Comparing by eye the three maps in Figure 4, I even managed to persuade myself that losses were indeed greater in the south, but when I counted the numbers of occupied hectads located north and south of a latitudinal line connecting Aberystwyth to Lowestoft, the proportion of hectads south of that line remained statistically constant (36% in 1930–1980, 37% in 1981–2000, 38% in 2001–2020). Having said that, the loss of all populations along the Devon–Dorset–Hampshire coast by 1980 may have some broader significance. The most obviously credible aspect of Charitonidou *et al.*'s predictions is the projected elimination of Fly Orchid populations in areas where this species favours calcareous fens, such as western Ireland, Anglesey and Gotland. A combination of increased temperatures and decreased rainfall would likely have a negative impact on fenland habitats, even those fed by groundwater.

Evans & Jacquemyn (2022) analysed no less than 14 "species" of *Epipactis* (not all of which would necessarily pass a DNA test), and asked a more specific question; will the species' range expand or contract by 2061–2080? If migration was modelled as unfettered, ranges of seven species expanded and seven species contracted, whereas if northward migration was constrained, 12 of the 14 study species suffered significant range reductions. Habitats deemed suitable

Figs. 7 and 8: Year 2070 distribution maps predicted by modelling for *Ophrys insectifera* for the best-case (7) and worst-case (8) scenarios, respectively. Grid cell notation: red = present in 2020 but absent in 2070; grey = present in 2020 and 2070; white = absent in both 2020 and 2070; blue = absent in 2020 but present in 2070 (Fig. 3Bi and ii of Charitonidou *et al.* 2022).

for dessiccation-tolerant *E. dunensis* (Dune Helleborine) were predicted to increase by up to an order of magnitude, whereas those of shade-loving *E. purpurata* (Violet Helleborine) would decrease by a similarly large amount. Within the British Isles, radical losses of *E. purpurata* and *E. leptochila* (Narrow-lipped Helleborine) from southern England are predicted to be compensated for by major northward invasions of the presently exclusively Continental *E. muelleri* and *E. microphylla*. In addition, *E. dunensis* is envisaged as spreading from its few current hotspots to conquer much of Britain and Ireland, conjuring up images of much of the British countryside resembling the present-day Lancashire dunes by 2070. Admittedly, the extensive populations of Dune Helleborine predicted for the Irish bog country appear a little fanciful, unless the model anticipates that the present acidic peat deposits will dry out and blow away in the interim.

Potential spanners in the works

Modelling nature is an inexact science because it is inevitably an attempt to model infinite complexity, necessitating a vast panoply of prior assumptions that tend to receive insufficient critical discussion. Numerous recent attempts to model the behaviour of the SARS-CoV-2 virus have proven poorly predictive, despite the fact that what was being modelled was a simple two-way interaction between one of the least complex organisms in existence and the organism best-known to science – humans. It is therefore monumentally ambitious to believe that we can credibly model organisms with life histories as complex as those of orchids, ruled not only by their own physiological constraints (which reflect a wide panoply of genetic and epigenetic processes: e.g. Paun *et al*. 2010; Aitkin & Whitlock 2013; Fournier-Level *et al*. 2016; Anderson & Song 2020) but also by their reliance on frequent interactions with pollinating animals at one end of the plant and continual interactions with mycorrhizal fungi at the other.

Scoring of environmental and climatic variables is of necessity equally simplistic. The analyses described above download their environmental data from pre-existing databases that summarise both land use and averaged climatic variables scored in grids that are far too coarse in scale to take into account factors such as aspect, soil depth or groundwater flow; this inevitably makes assessment of niche breadth a worryingly crude affair. A good example of the consequences of this constraint is the conclusion drawn by Evans & Jacquemyn (2022) that *Epipactis helleborine* (Broad-leaved Helleborine) and *E. palustris* (Marsh Helleborine) occupy similar niches when, in Britain at least, the ecological catholicism of the widespread, desiccation-tolerant *E. helleborine* contrasts starkly with the restriction of *E. palustris* to reliably damp soils in dune slacks, flushes and fens. I therefore believe it is important that modelling is conducted in tandem with projects that involve “ground-truthing”, particularly repeated field monitoring of small, comparatively uniform habitats such as that underpinning the Local Change (Braithwaite *et al*. 2006) and Threatened

Plants (Walker *et al*. 2017) initiatives of the Botanical Society of Britain and Ireland. Various forms of increasingly sophisticated remote sensing could form a valuable link between the large-scale and small-scale approaches.

I worry that the abundance of projections showing gradual (if rapid) increases in atmospheric CO_2 have created an intellectual environment in which it is assumed that the responses of Northern Hemisphere plants will also be gradual and amoeboid, the leading edge of a species distribution typically slithering northwards (or upwards) as populations along the southern (or lowland) margin wither and die. There are three serious problems with such assumptions, two of which are rarely discussed. Firstly, the range and extent of man-made barriers to migration are legion, making unassisted migration a far greater challenge than was previously the case. Even if wildlife corridors are eventually incorporated into our landscape, they will only partially compensate for our modern predilection for replacing natural habitats with monocultures. If the only option remaining to a plant population is to stand and fight, how much environmental change can a plant tolerate before succumbing to the inevitable? I was going to refer to this as the sixty-four-thousand-dollar question, but in truth, it has now become a whole set of multi-trillion-dollar questions – questions to which our answers remain worryingly ambiguous.

One recent experience suggests to me that our native plants may be a little cleverer than they are usually given credit for. When I first visited the native Kentish site for Monkey Orchid (*Orchis simia*) over 40 years ago, the plants were concentrated in the centre of a small patch of south-facing downland, but a re-visit in 2022 revealed only a handful of somewhat desiccated plants still occupying the downland, the centre of gravity of the population having shifted approximately 60 m to the west to where scrub and small trees offered the orchids partial shade. It is tempting to view this pattern as reflecting a multi-generational response to the potentially excessive aridity experienced in recent years by any plants resolutely persisting on the more exposed downland. Obviously, any kind of grid-based analysis such as those yielding Figures 5–8 would have failed to detect this intriguing, but quintessentially local, response.

Although our agriculture, industry and urbanisation may have made such creeping migration more difficult at larger scales, our gardening and conservation activities have in contrast made long-distance "saltational" migration events far more likely. We are constantly moving organisms around the world, both deliberately and accidentally. We notice this fact most often when the organisms concerned are obviously harmful to our interests, such as highly invasive "alien" plants or pathogenic fungi and viruses. These often escape into the "wild" from cultivated species (I note here the recent exchanges among concerned Hardy Orchid Society members regarding the "*Dactylorhiza* black spot" fungus, increasingly ravaging cultivated plants but now also apparently spreading into wild populations). A further factor complicating attempts to monitor the effects of climate change on our orchids is the cultivation of orchid species outside their natural distributions, thereby creating a high risk of accidental (or indeed deliberate) escape of seeds. The recent spate of discoveries of several orchid species in southern England that were previously confined to Continental Europe has emphasised the near-impossibility of distinguishing "natural (non-anthropogenic) from anthropogenic spread (Bateman 2010, 2022).

Lastly, there is the question of whether environmental changes could themselves prove to be saltational. In this context, I believe that the Younger Dryas provides us with an invaluable message. Optimists among our orchidological community are no doubt rubbing their hands with glee at the prospect of soon being invaded by a more diverse Mediterranean orchid flora rich in charismatic *Ophrys* pseudospecies. But if the North Atlantic Conveyor, presently in decline, were to fail suddenly and completely, as it did 12,900 years ago, global warming of 1.5^{0}C MAT would not be sufficient to prevent the British Isles being thrown back into a periglacial climate capable of supporting only an impoverished cold-temperate orchid flora more typical of present-day Iceland (as described in *JHOS* by Bateman & Rudall 2015). Such scenarios may appear far-fetched, but anyone who has made serious study of climate change will appreciate the crucial importance of tipping points (Carbon Brief 2020). Using a similar logic, could we appeal to the ability of plants to survive at a global MAT estimated at 12^{0}C higher than today during the Eocene period (50 million years ago: Fig. 1) as evidence that the likely impact of global warming has been exaggerated? I doubt it; Eocene plants benefited from having tens of millions of years of gradual increase in MAT to prepare themselves for such conditions and/or to migrate, whereas anthropogenic warming will offer only a negligible period of time for either adaptation or migration.

In summary, there now exists a crucial scientific challenge to make biologically related prediction more accurate. I find it concerning that, although scientific communities worldwide are presently obsessed with climate change, relatively little of that research (even that funded within Britain) primarily addresses the flora of the British Isles. It is perhaps symptomatic that a recently initiated project explicitly modelling the future of British orchids, titled ExOrChiST, was funded generously not by the British government but rather by the Greek government, their attention having been drawn to the greater density, precision and especially time-constrained repetition that is inherent in British botanical recording. Admittedly, the most crucial of all the outstanding questions in the area of climate change transcends orchidology: Are the citizens of any country in the world, let alone all 251 countries, willing to make the profound material sacrifices, and to engineer the substantially reduced reproductive output, that will be necessary in order to bring global warming under any kind of meaningful control?

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Australian Spider Orchids

Colin & Angela Scrutton

Australia has in excess of 1300 species of wild orchids (Jones 2006). Of these, around 350 species belong to the genus *Caladenia s.l.*, of which some 200 are referred to the group known informally as the Spider Orchids. These figures give some idea of the wealth of the Australian orchid flora, and more new species are being named all the time. *Caladenia* has been split up into several different genera by Jones (2006) of which the Spider Orchids were largely placed in the new genera *Arachnorchis*, and *Jonesiopsis*. However, these new generic subdivisions have not been generally accepted (Brown *et al*. 2013) and will not be used here.

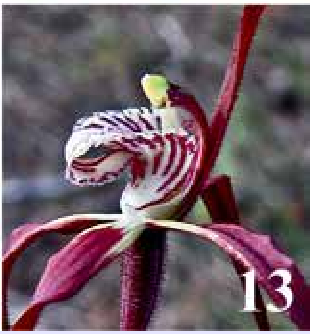
Fig.1: Map of localities mentioned in the text (SRNP is Sterling Range National Park). Only selected roads are shown.

Thus the Spider Orchids are a major element of the Australian orchid flora, with great diversity of form based on the distinctive pattern of elongated sepals and petals. There are some 88 species in the east, the bulk in South Australia and Victoria, and around 120 species in the west with a single species common to both areas (Jones 2006). On any orchid hunting visit to Australia, particularly in south-west Western Australia, you cannot fail to come across many examples of this group. In this article we focus on Spider Orchids from that area (Fig. 1).

Spider Orchids are characterised by a hairy stem, with a single narrow and elongated hairy leaf arising from close to the base of the stem. *Caladenia arenicola*, the Carousel Spider Orchid, which is common in the Perth area and the coastal plain

Figs. 2-6: Carousel Spider Orchid (*Caladenia arenicola*) at Wireless Hill, Perth suburbs (Fig. 2),.King's Park, Perth (Figs.3-4) and Hepburn Heights, Perth (Figs. 5-6). Scale for whole plants, 10cm, scale for closeups, 1 cm.
All Photos by Colin Scrutton

to the north and south, flowers from August to early October and shows the basic features of this group (Figs. 2-6). The orchid may have a single flower, or the stem is branched towards the upper end with usually 2 or 3 (the maximum in *C. arenicola*), but rarely up to a maximum of 8 flowers (Brown *et al*. 2013, p.44). Sepals and petals are generally narrow and elongated, radiating from the base of the column and labellum, which gives rise to the common name for these orchids. The labellum or lip bears glandular calli in a variety of forms and patterns which constitutes a major feature in distinguishing species. The column usually has an anther cap covering the



Figs. 7-9: Reaching Spider Orchid (*Caladenia arrecta*) at South Formby Road, Sterling Range National Park.
Figs. 10-13: Chapman's Spider Orchid (*Caladenia chapmanii*) at Yilliminning Rock, 22km east of Narrogin.

pollinia with the stigmatic surface not usually visually differentiated. Some spider orchids with brightly coloured flowers are pollinated by bees. However, the majority have evolved to attract male wasps as pollinators with thickened ends to sepals, and often petals, known as clubs, which release scents mimicking the pheromones of female wasps. In *C. arenicola*, thickening of the light brown ends of the sepals and petals is present but barely visible. Male wasps are attracted to the flowers with which they attempt to mate. In doing so, they displace the anther cap, pick up pollinia from the column of the flower or deposit pollen taken from another flower of the same species onto the stigma. The scents involved are species specific thus ensuring effective pollination of the flower. *C. arenicola* is a member of the King Spider Orchids group comprising 22 species (Brown *et al*. 2013).

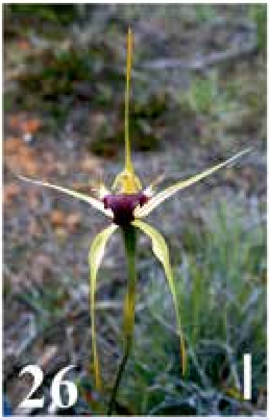
In contrast, the Reaching Spider Orchid (*Caladenia arrecta*), with a scattered distribution in south-west Western Australia, is a member of the group of Clubbed Spider Orchids (Figs. 7-9). It has relatively short sepals and petals which are prominently clubbed. The arrangement with the petals extending upwards and mirroring the descendent lateral sepals is unusual and distinctive. The column and labellum are rather similar to those in *C. arenicola* but the latter has six rows of calli rather than the four rows in this species. It is a short, highly distinctive orchid, with the single erect and hairy leaf reaching from two thirds to the full height of the flower. Although widespread it is rather uncommon.

The length of the sepals and petals in Spider Orchids varies considerably. Chapman’s Spider Orchid (*Caladenia chapmanii*) is a member of the group of Wispy Spider Orchids with extremely long, tapering, sepals and petals lacking any terminal thickening (Figs. 10-13). It is pollinated by bees. The labellum is white with reddish stripes, short marginal spines and two rows of white calli. It has a scattered distribution from the Geraldton area down to Albany on the south coast. There are 43 species of Wispy Spider Orchids but around 10 or so additional species in other groups are characterised by very long sepals and petals.

In many Spider Orchids pollinated by sexual deception, the labellum is modified to crudely mimic a female wasp. In *Caladenia plicata*, the Crab-lipped Spider Orchid, this is achieved by a narrow and elongated mass of dense dark red to purple calli on a delicately balanced labellum, which is fringed by long, usually upcurved, red filaments (Figs. 14-17). The labellum will tremble in the slightest breeze which helps to attract pollinators. The sepals all have slightly thickened ends, but with no thickening visible on the petals. *C. plicata* is found scattered in a band inland from Augusta to Albany as far north as the Sterling Ranges, where a specimen has deep purple calli and the fringing filaments, folded back, are a greenish yellow (Fig. 18). This figure also clearly shows the paired yellow glands at the base of the column, common to all Spider Orchids.

Figs. 14-18: Crab-lipped Spider Orchid (*Caladenia plicata*) at Mondurup Nature Reserve, Mt Barker (Fig. 14), Frosty Road, 40km east of Manjimup (Figs. 15-17) and Sterling Range National Park (Fig. 18).
Figs. 19-23: Dancing Spider Orchid (*Caladenia discoidea*) at Wireless Hill Park, Perth suburbs.

The Dancing Spider Orchid (*Caladenia discoidea*) is widespread in southwest Western Australia and common in the Perth area (Figs. 19-23). It is distinctive for the orientation of the floral parts. The lateral sepals and petals are held horizontally, with the curved dorsal sepal and lip arranged vertically. The sepals are broad and tapering to small, thickened tips, the petals narrower and tapering, the tips unthickened. The labellum is yellowish to reddish brown with radiating thin, dark red lines, relatively broad and fringed by long tapering filaments. There is a dense mass of dark purple calli in four rows in the centre of the labellum crudely suggesting the body of a female wasp.



Figs. 24-25: Leaping Spider Orchid (*Caladenia macrostylis*) at Gull Rock Road, Albany (Fig.24) and Mondurup Nature Reserve, Mt Barker (Fig.25).
Figs. 26-27: Funnel-tipped Spider Orchid (*Caladenia infundibularis*) at Flat Rock, Augusta.

The Leaping Spider Orchid (*Caladenia macrostylis*) has the most delicate dark thickening of the tips of the petals and sepals (Figs. 24-25). It is somewhat unusual in that the labellum has no marginal spines or filaments. It does have a dense mass of dark purple calli arching over the lip of the labellum and curling underneath. It

Figs. 28-30: Butterfly Spider Orchid (*Caladenia lobata*) at Mondurup Nature Reserve, Mt Barker.

is found scattered in the south-west corner of Western Australia between Perth and Albany and is readily identified from its distinctive appearance. The Funnel-tipped Spider Orchid (*Caladenia infundibularis*) has a much more restricted distribution in the south-western promontory between Dunsborough and Augusta (Figs. 26-27). The inner yellowy-green part of the labellum has fine spines along the margins, beyond which the labellum is solid glistening red, with a sharply downward-curved terminal section. The sepals are very narrowly clubbed. It belongs to the group of Green Spider Orchids (Brown *et al*. 2013) as does the following species.

The Butterfly Orchid (*Caladenia lobata*) is a striking and particularly attractive Spider Orchid growing inland from Bunbury to the Sterling Range (Figs. 28-30). The flower leans backwards with a very large yellow labellum, the red tip shading to dark purple, the yellow section fringed by upcurved spines. There are four or more rows of very thin, dark tipped calli on the inner part of the labellum. The petals are thin and extend sideways. The sepals, also mostly thin, have very narrow clubs at their outer ends. The dorsal sepal arches over the column and labellum, whilst the lateral sepals, where thicker, are in contact below the labellum before diverging with thinner, arched outer ends. There is a maximum of two flowers on the spike.

One of the rarest and smallest of Spider Orchids is the Dwarf Jester Orchid (*Caladenia bryceana* subsp. *bryceana* – the other subspecies *C. bryceana* subsp. *cracens* has a distribution between Northampton and Kalbarri, north of Geraldton). It is highly distinctive with a single light green flower on the spike and the spikes usually clustered (Figs. 31-34). The single leaf may extend up to the flower. The lateral sepals are broad and curved with the lateral petals, narrow, terminally curved and parallel with the sepals. There are no clubs. The dorsal sepal is curved against the column. The lip is broad, tapering and trough-shaped, with a dense narrow axial band of dark red to purple calli, plus proximal and terminal subspherical dark purple masses. It is found in a small area north-east of Albany. Due to its rarity it is on the list of Threatened Flora in Western Australia (Brown *et al*. 2013).

The two final orchids in this selection show more convincing lures on the labellum to attract pollinators. The Lazy Spider Orchid (*Caladenia multiclavia*) is unusual in having upcurved sepals and petals and a rather laid-back attitude which is reflected in its common name (Figs. 35-38). It is found in a belt from north-east of Perth down to the coast at Ravensthorpe. The sepals and petals are red proximally and red and cream striped distally, tapering and fine tipped. The dorsal sepal and petals are upright and typically clustered. The labellum is roughly diamond shaped with red and cream stripes and a raised central lobe covered with fine calli. When the labellum is depressed by a visiting pollinator, a dark gland on a narrow neck, crudely mimicking an insect’s head, is exposed (Fig. 38).

Figs. 31-34: Dwarf Jester Orchid (*Caladenia bryceana* subsp. *bryceana*) at Sterling Range National Park. Both scales 1cm.
Figs. 35-38: Lazy Spider Orchid (*Caladenia multiclavia*) 5km south of Jerramungup.

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There are four species of Dragon Orchids, a sub-group of the Spider Orchids, in Western Australia. The Common Dragon Orchid (*Caladenia barbarossa*) has a wide distribution between just north of Perth to Esperance. The spike, with a ground-hugging leaf, is between 10 and 30 cm high, usually with a single flower. The sepals and petals are thin and tapering, pale with a central dark stripe, with the lateral sepals and petals usually orientated downwards at roughly 45° to the stem. The labellum is densely hairy with an oval main section topped by a vertical gland and flanking, divergent antennae-like filaments, the whole crudely resembling the body of an insect (Fig. 41).

Figs. 39-41: Common Dragon Orchid (*Caladenia barbarossa*) at Foxes Lair Nature Reserve, Narrogin (Fig. 39) and Brookton Highway near Westdale (Figs. 40-41).

This is a small selection of the beautiful and fascinating tribe of Spider Orchids, scattered across Western Australia, but particularly common in the south-west corner of the state. They can be found in a wide variety of habitats. Peak flowering is between August and October but the full flowering range is April to February.

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The HOS Informative Photographic Display

The purpose of this event is for members to share their gems of information, gleaned or identified, about the fascinating world of orchids and their biology. Contributions will be displayed on boards so they can be viewed throughout the day.

Displays may be up to A2 in size. Ideally, they should be mounted on a backing board for easy display but this is not a requirement.

Members may bring more than one display.

Displays must include the name(s) of the members providing it.

Each display should consist of one or more images and a description or explanation of these. The text should be large enough for people to read easily but the area of text should not dominate the display.

Examples of suitable images may include but are not restricted to:
- An ultra-close image showing features not readily seen by the human eye
- A pollinator visiting a flower
- A predator consuming a pollinator
- A herbivore consuming a plant
- Mycorrhizal fungus infecting orchid roots
- Seeds and seedlings; germinating seeds, pollen
- Anatomical sections

Please let Neil Evans (hosphc@hardyorchidsociety.org) know how many contributions you intend to bring by the 13th November 2022. If you wish to contribute to the show but are unable to attend the meeting please contact Neil Evans to discuss ways of getting your contribution to the meeting.