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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 website www.hardyorchidsociety.org.uk, January 2004 Journal, Members' Handbook or contact the Editor). Views expressed in journal articles are those of their author(s) and may not reflect those of HOS.

The Hardy Orchid Society Committee

Cover Photographs

Front Cover: *Burnettia cuneata*
Back Cover: *Pyrorchis nigricans* (white variant)
Photos by Colin & Mischa Rowan – see article about orchids and Australian bushfires by George Tiong and Jim Cootes on page 101

Contents

Editorial Note

We have three major articles; two featuring orchids from overseas and one closer to home, especially mine. Swanton Novers Great Wood is one of three remaining large areas of ancient woodland in Norfolk that is closely managed by Natural England and only accessible by permit. Nick and Frankie Owens have taken advantage of this special site to study pollination in the Broad-leaved Helleborine, which is rather uncommon in Norfolk. They describe their observations together with studies of the Marsh Helleborine, which is rather more abundant in the county. Nick is interested to hear from members with their own pollination observations so do contact him if you have anything of interest to share. We have another significant article from Richard Bateman and Paula Rudall, this time describing their recent adventures in Iceland. Our last article comes from even further away and describes the fascinating and specialized Australian orchids that depend on bushfires. This piece is illustrated with some lovely photography by Colin and Mischa Rowan and I have made liberal use of these.

Whilst talking photographs, congratulations to David Pearce who won 2nd prize at the 2014 BOC Photographic Competition with his portrait of *Thelymitra nuda.*

The supply of articles for *JHOS* remains steady but this is a good time to send in new material as we need material to complete the October issue. As we are well through the 2015 season do consider contributing something if you have interesting observations or reports.

Chairman's Note
John Wallington

Greetings fellow orchid lovers.

This is my first HOS Chairman's Note since being elected to this position at the AGM in April. I hope that I will be able to achieve as much as Chairman as Celia Wright did during her tenure. Celia occupied the Chair of HOS for 5 years and led the Society from the front. We all owe her a great deal and I would like to take this opportunity to thank her on behalf of all of the members. Whilst she will not be part of the committee I am sure that we shall continue to benefit from her knowledge and enthusiasm.

As I write this piece the orchid season in the UK is getting into its stride. When you read this piece we will be seeking out the helleborines as we move into high summer. I shall be in Iceland hoping to find all or some of the seven species of orchid that grow there. Perhaps that will form the basis of a talk at one of our future meetings. And that brings me on to the first request. The programmes for our next meetings are nearly complete but we can always find space for short presentations from members whether they are growers, photographers or "hunters" – or all three. So if you think you can contribute to one of our meetings please contact David Hughes or any one of the committee members.

The committee held its first meeting of the year recently and one of the topics, as usual, was the future make up of the committee. We are always receptive to volunteers who wish to play their part in ensuring that HOS continues to serve the desires of its members. In particular, volunteers for the roles of Vice Chairman and Speakers Secretary are needed. And remember that as a committee member you will be contributing in a positive way to many people's enjoyment of hardy orchids. Please note that our Membership Secretary and Publicity Officer both have new email addresses – details inside front cover.

There will be some changes to the AGM next year. The committee decided that we will not provide copies of minutes and financial statements for every attendee. We will try to save resources by making all of the information available on the Forum and projected at the meeting, with a few hard copies available on request at the meeting.

It just remains for me to wish you a good remainder of the orchid season, whether at home or abroad, and I look forward to meeting as many members as possible at Leeds in September.

Results of HOS Plant Show 2015

Class 1: Three pots native British orchids, distinct varieties

1st Neil Hubbard: *Anacamptis morio*; *Orchis anthropophora*; *Ophrys sphegodes*

Class 2: Three pots native European (not native to Britain) orchids, distinct varieties

1st Barry Tattersall: *Serapias neglecta*; *Ophrys cretensis*; *Anacamptis longicornu*
2nd Mike Powell: *Orchis provincialis*; *Serapias orientalis* × *Serapias neglecta*; *Anacamptis papilionacea*
3rd Neil Hubbard: *Ophrys lutea*; *Serapias lingua*; *Orchis provincialis*

Class 3: Three pots non-European hardy orchids, distinct varieties

1st Barry Tattersall: *Anacamptis morio*; *Serapias levantina*; *Ophrys reinholdii*
2nd Mike Powell: *Calanthe tricarinata*; *Calanthe striata*; *Calanthe* Kozu Orange

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

1st Barry Tattersall: *Ophrys picta*; *Anacamptis boryi*; *Serapias bergonii*
2nd Malcolm Brownsword: *Pleione* Tongariro 'Krakatoa'; *Pleione* Tongariro; *Pleione* Taal 'Red Tailed Hawk'
3rd Mike Powell: *Orchis anthropophora*; *Serapias cordigera*; *Calanthe* Takane

Class 5: One pot native British orchid

1st Neil Hubbard: *Anacamptis morio*
2nd Mike Powell: *Orchis anthropophora*
3rd Barry Tattersall: *Anacamptis laxiflora*

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

1st Barry Tattersall: *Ophrys vernixia*
2nd Mike Powell: *Serapias cordigera*
3rd Andrew McDougall: *Orchis provincialis*

Class 7: One pot non-European orchid

1st Mike Powell: *Disa sagittalis*
2nd Barry Tattersall: *Serapias carica*
3rd Malcolm Brownsword: *Pleione formosana* × *Pleione* Leda

Class 9: One pot *Orchis*, *Anacamptis* or *Neotinea*
1st Andrew Bannister: *Orchis italica*
2nd Mike Powell: *Anacamptis laxiflora*
3rd Malcolm Brownsword: *Anacamptis morio* × *longicornu*

Class 10: One pot *Ophrys*
1st Barry Tattersall: *Ophrys picta*

Class 11: One pot *Serapias*
1st Mike Powell: *Serapias lingua* white form
2nd Barry Tattersall: *Serapias neglecta*

Class 12: One pot *Cypripedium*
1st Mike Powell: *Cypripedium* Hank Small (*C. parviflorum* × *henryi*)

Class 13: One pot *Calanthe*
1st Mike Powell: *Calanthe tricarinata*
2nd Malcolm Brownsword: *Calanthe brevicornu*

Class 14: One pot *Pleione*
1st Malcolm Brownsword: *Pleione formosana* Snowcap

Class 15: One plant or pan of plants raised from seed by the grower
1st Andrew Bannister: *Orchis olbiensis* × *pauciflora*
(Sown 27-06-11 on modified Meijer YE media; replated on 30-11-11; deflasked on 13-09-12; 2nd flowering.)

There were no further entries in classes where only 1st or 1st & 2nd places are recorded. There were no entries in Class 8 and Class 16.

Winner of Best in Show Trophy: Neil Hubbard for *Anacamptis morio* in Class 1
Winner of Chairman's Trophy: Barry Tattersall for *Ophrys vernixia* in Class 6
Winner of RHS Banksian Medal: Barry Tattersall
Most Points: Mike Powell (29) won Banksian Medal last year & not eligible 2015
Thanks to Brian Walker for judging the Plant Show

Some Winning Entries in the 2015 HOS Plant Show

Fig. 1a: *Anacamptis morio* by Neil Hubbard in Class 1 (Best in Show)
Fig. 2b: *Ophrys cretensis* by Barry Tattersall in Class 2
Fig. 2a: *Serapias neglecta* by Barry Tattersall in Class 2
Photos by Mike Gasson


1a


2b


2a


4a


6


10


12

Some Winning Entries in the 2015 HOS Plant Show

Fig. 4a: Ophrys picta by Barry Tattersall in Class 4
Fig. 6: Ophrys vernixia by Barry Tattersall in Class 6 (Chairman's Trophy)
Fig. 10: Ophrys picta by Barry Tattersall in Class 10
Fig. 12: Cypripedium Hank Small by Mike Powell in Class 12
Photos by Mike Gasson

HOS Photographic Competition 2015

Entry details for the competition at Kidlington, November 15th 2015

E-mail digital entries by 12th October 2015 to Neil Evans at neilfevans@btinternet.com Send notification of entries for print classes to Steve Pickersgill by 2nd November 2015 at steve_pickersgill@btinternet.com. For entrants who are unable to attend the meeting Steve will accept postal entries by the same date, with SAE if return of pictures is required. Please email Steve for the address for postal entries. The Schedule of Classes and Rules have been amended and can be found on the HOS website:
http://www.hardyorchidsociety.org.uk/HOS%201012/PhotoCompIntro.html

Earth, Wind, Fire and Ice: Orchid hunting in Iceland

Richard Bateman & Paula Rudall

Most HOS members will be aware that we have spent many years pursuing the genus *Platanthera* across Europe and the Mediterranean, eventually tracking it down to its comparatively species-rich but previously under-researched lair in the Azorean archipelago (Bateman *et al*., 2012, 2013, 2014). But how could we possibly trump the Azores for remote austere landscapes and impoverished orchid floras? It soon became clear that two frigid refugia remained to be explored in 'Greater Europe': that of *Platanthera* (*Lysiella*) *oligantha* in North Norway, and that of *Platanthera* (*Limnorchis*) *hyperborea* in Iceland. Given that both of these Nordic objectives appeared eye-wateringly expensive to visit (a situation only partly alleviated by a small fieldwork grant generously provided by the Botanical Research Fund), the choice between them boiled down to likely benefits in terms of (a) scientific returns and (b) intrinsic interest for natural history and archaeology – a conundrum that yielded an easy win for Iceland.

The island

Further research soon made clear that botanical exploration of Iceland has thus far been surprisingly rudimentary. The best guide to the island's flora is Kristinsson (2010), who lists 365 species of vascular plant. Of these, only seven are orchids (Table 1). The distribution maps provided by Kristinsson are minimalistic; a marginally better sense of plant distributions on the island can be gained by consulting the Global Biodiversity Information Facility website (GBIF, 2015). Nonetheless, we arrived at Reykjavik airport on 3rd July 2014 knowing that during our week-long field trip we would have to operate essentially blind. Even flowering times are hard to predict, given the vagaries of Iceland's notoriously challenging climate.

In fact, the strategy that we had devised proved close to ideal, other than the fact that a relatively early season had rendered our visit about ten days later than would have been optimal. We had decided to limit our activities to the southwest quadrant of the

Table 1. The seven orchid species presently found on Iceland

Platanthera hyperborea (L.) Lindley
Pseudorchis straminea (Fernald) Soó
Dactylorhiza viridis (L.) R.M. Bateman, Pridgeon & M.W. Chase
Dactylorhiza maculata (L.) Soó ?subsp. *islandica* (A. Löve & D. Löve) Soó
Neottia cordata (L.) L.C.M. Richard
Neottia ovata (L.) Bluff & Fingerhuth
Corallorhiza trifida Chatelain

island east of Reykjavik (Fig. 1) – the only part of the island that benefits from metalled roads extending inland from the 1330 km-long, slow, two-lane road that encircles the whole of Iceland as a kind of vehicular noose. The inland metalling allows tour buses to link all of the main tourist attractions in the so-called Golden Triangle (Figs. 2, 3), thereby permitting feverish day-trips from Reykjavik as far inland as the stunning Gulfoss waterfall (fortunately, the summer days are long in Iceland). More importantly from our viewpoint, the presence of asphalt meant that we could risk hiring an extremely expensive 2WD hatchback rather than a phenomenally expensive 4WD Chelsea tractor. Either way, one faces a bewildering array of vehicle insurance options – options that, among other unique features, formally recognize three different categories of grit. The most expensive of the three grit-inspired tariffs is designed to negate occasional wind-storms so violent that they are supposedly capable of sand-blasting away every fragment of a vehicle's paintwork.

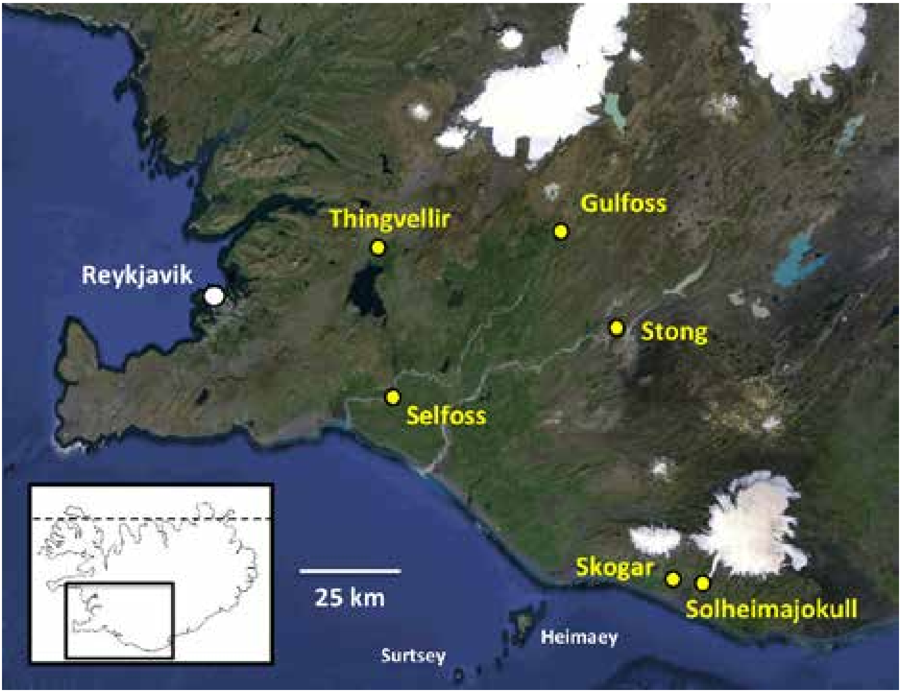

Fig.1 (above): The southwest quadrant of Iceland explored by the authors. Fig. 1 of Bateman *et al*. (2015), built on a base map derived from Google Earth.

Representative orchid habitats on Iceland
Fig 2 (opposite top): Geysir hot springs
Fig 3 (opposite bottom): Gulfoss waterfall

Photos by Richard Bateman


The chosen hatchback proved to be just about sufficient for our purposes, forcing us to abort only one attempted journey along a rough gravel track … though one particularly challenging journey led to a lively debate between a navigator desperate to see the only potentially accessible tongue of rapidly receding glacial ice (at Solheimajökull) and a driver keen to preserve the integrity of her vehicle. Although technically challenging, the interior of the island is visually spectacular and virtually uninhabited; lower altitudes are dominated by almost unvegetated tracts of lava and ash exuded by the only terrestrial manifestation of the mid-Atlantic ridge, whereas higher altitudes support four ice-caps, each gradually diminishing in extent as a result of global warming and periodic sub-glacial volcanic activity – as epitomised by the infamous 2010 eruption of Eyjafjallajökull (pronounced Chumley).

With regard to accommodation, the slow roads encourage a tour schedule based on one-night stands in sequential bed and breakfast outlets, but such havens are few and far between and require booking well in advance. Their quality is typically reasonably good, and they can offer unexpected perks – for example, hot-tubs heated naturally through groundwater are often provided. However, a Full English is an improbable luxury (in Richard's case, leading to the occasional traumatic mirage), and in the land of the midnight sun, the thickness of the bedroom curtains becomes a critical factor for potential somnambulists. The alternative, comparatively frugal 'survivalist' option is camping, though repeatedly witnessing the slug-like emergence of bedraggled campers from saturated, wind-torn tents curtailed any latent envy on our part. Cafes and restaurants are likewise both sparse and expensive. Although wilderness areas in most cold-temperate regions of the globe are populated primarily by sheep, they are almost absent from Iceland, poaching by their feet having rightly been deemed too destructive to such fragile habitats. The localised lowland grasslands, most developed on glacial outwash, are more often grazed by herds of stocky Shetland pony-style horses, whose cheerfully frisky demeanour conceals the fact that their primary role in the Icelandic economy is culinary rather than equestrian.

The orchids

So much for the practicalities of the island; what about its flora? Well, general botanists will soon realise that plant species that in the UK can be seen only via a pilgrimage to the top of Ben Lawers make up the bulk of the background flora in Iceland. A similar situation characterises the orchid flora; six of the seven orchids native to Iceland are boreal specialists that together are reminiscent of the orchid flora of the Scottish Highlands (Table 1). Amusingly, the one exception – a much-prized rarity on Iceland known from few scattered localities – is the Common Twayblade, *Neottia* (*Listera*) *ovata*! This species, together with its close relative *Neottia* (*Listera*) *cordata* and much more distant relative *Corallorhiza trifida*, eluded us for the entire week we spent on the island, leaving us able to report only on the four remaining orchid species. Fortunately, they are the four most interesting.

Dactylorhiza (*Coeloglossum*) *viridis* vies with *Platanthera hyperborea* for the title of Iceland's commonest orchid. Examine any patch of heathland that features *Thymus praecox* and *Prunella vulgaris* and you have a reasonable chance of also encountering Frog Orchids (Fig. 6). They vary considerably in plant size and flower colour (from pallid green to wine purple), typically occur in substantial numbers, and bear flowers that appear comparatively short-lived, suggesting that they may self-pollinate.

The best clue to the likely presence of *Dactylorhiza maculata islandica* (Fig. 7) is to first find patches of low-growing *Salix*-dominated scrub that are rich in the striking purple herb *Geranium sylvaticum*. The likelihood is that some of the pale pink to medium-purple flowers present in the habitat will prove not to be geraniums but rather spotted-orchids – often very heavily spotted orchids. It is several years since we demonstrated that the supposedly endemic *D. 'islandica'* shares its genetics with other northwest European forms of *D. maculata* (Pillon *et al*., 2007). In terms of morphology, the growth architecture and flower shape of these Icelandic plants are reminiscent of certain populations of *D. maculata* in western Scotland (including the taxonomically contentious populations resident on Rum), and Richard looks forward to testing this hypothesis of similarity when he and Ian Denholm finally synthesise their three decades worth of morphometric data on *Dactylorhiza*. We suspect that the reliable association with the *Geranium* reflects food deceit, allowing the orchid to capitalise on the comparatively small numbers of bees attracted by the geranium's nectar on this pollinator-deficient island. The best display of spotted-orchids that we encountered stretched along the small road (initially metalled) that extends northward from the Thingvellir Park visitor centre along the tectonic plate boundary and toward Iceland's rugged interior.

Next up is the most challenging of our research targets, *Pseudorchis straminea* (Fig. 5). This species particularly interested us because there exists an ongoing debate regarding whether this plant is best viewed as an infraspecific taxon of the British native *Ps. albida* or a species in its own right, as has been suggested by both morphometric studies (Reinhammar, 1995) and rather crude molecular studies (Reinhammar & Hedrén, 1998) previously conducted in Sweden. Certainly, the flowers of *Ps. straminea* are considerably larger and their labella more deeply three-lobed (Fig. 5) than those that characterise *Ps. albida*, though we have yet to obtain molecular results using more modern DNA-based techniques. Despite intensive searching, we found only three small populations of this taxon, the last a nondescript piece of heathland near the junctions of Routes 41 and 425 that we spotted during our return journey to the airport. This orchid appeared to prefer disturbed soils, including recently exposed glacial outwash. Small numbers of plants were found below the Solheimajökull glacial tongue and adjacent to the Skogarfoss waterfall.


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Lastly, we should consider our primary target – the Iceland Butterfly-orchid, *Platanthera hyperborea* (Fig. 4). All parts of the plant are such a vibrant lime green in colour that populations are comparatively easily spotted from a moving vehicle. Any suitably moist piece of heathland, moorland, rough grassland or *Salix* scrub appeared capable of supporting this orchid, often in considerable numbers. Plants in exposed locations remained comparatively small, whereas those distributed among light scrub could reach 30 cm with 40 flowers, and two roadside plants observed under trees (the latter a great Icelandic rarity!) near Reykjavik exceeded 45 cm. It is a species that one could get to know well simply by joining up the many aquatically-inspired tourist attractions. Iceland offers a particularly fine line in spectacular waterfalls, and each reliably supports *Platanthera* populations, as do hot springs and geysirs; indeed, at Geysir itself, one need venture no further than the car park before tripping over butterfly-orchids.

We studied morphometrically several of these *Platanthera* populations, also sampling them for scanning electron microscopy and DNA studies. Rapid progress in this research project means that it has already been published (Bateman *et al*., 2015). Our major conclusions include the fact that, unlike the remaining Icelandic orchids, *P. hyperborea* reached Iceland by migrating from North America, probably via Greenland and possibly more than once. Its flowers have been miniaturised during evolution, thereby mirroring those of two of the three *Platanthera* species previously studied by us on the Azorean archipelago (Bateman *et al*., 2013, 2014). The Icelandic plants reliably proved to be not only autogamous (self-pollinating) but also cleistogamous (self-pollinating while still in bud) – a sensible precaution in a land so sparsely populated with potential pollinators. Pollination is achieved through friable pollen shaken by high winds falling onto a chewing-gum-like plug exuded by unique papillae on the underlying stigma (Fig. 8). The midges that were thought by some previous observers to pollinate the flowers can do so only in their death-throes, as they immediately become firmly affixed to the adhesive plug; every flower on some spikes contained the corpse of an attendant midge. In short, *P. hyperborea* provided us with a valuable case-study in learning how an orchid can best become ecologically successful in a boreal-arctic environment.

Four Icelandic orchids

Fig.4: *Platanthera hyperborea*, Thingvellir
Fig 5: *Pseudorchis straminea*, Skogarfoss
Fig 6: *Dactylorhiza viridis* (plus *Lathyrus japonica*), Hjalparfoss (Thjorsa)
Fig 7: *Dactylorhiza maculata* ?subsp. *islandica*, Kerith Crater (Selfoss)

Photos by Richard Bateman

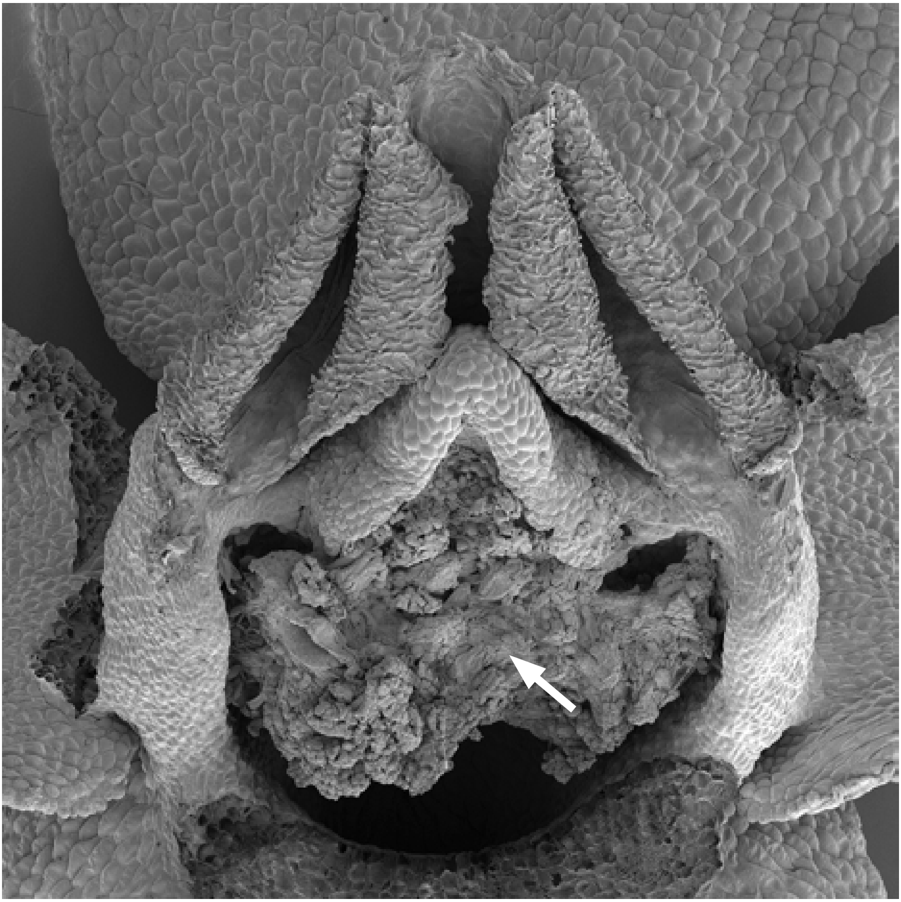

Fig. 8: Scanning electron micrograph of the stigmatic 'plug' (arrowed) that aids self-pollination in the buds of *Platanthera hyperborea*.

Image by Paula Rudall

We are uncertain whether our description of Iceland's orchidological highlights will be sufficient to encourage other HOS members to undertake this relatively challenging pilgrimage. Visitors to the island are guaranteed to see plants of interest, albeit at a significant financial outlay. To get the best out of Iceland's natural history it helps to have supplementary interests in ubiquitous volcanology, spectacular waterfalls and ever-changing cloud formations, while viewing the acquisition of a sun-tan as an optional extra. In truth, the Icelandic weather bears comparison with that of the Outer Hebrides, and when placed under particular duress, the coastal bird-watching at Vik, Folk Museum at Skogar, and National (Historical) Museum in Reykjavik constitute pleasant refugia for weather-beaten botanists.

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Dactylorhiza maculata ?subsp. *islandica* sheltering in the lee of a volcanic crater, Kerith, near Selfoss, Iceland.

Photo by Richard Bateman

Some Observations of Pollen Vectors in Two *Epipactis* Orchids

Nick & Frankie Owens

Marsh Helleborine *Epipactis palustris*

In July 2014 my wife and I toured the Jura region of France in our motor home. Taking a walk round the lake at Clairveaux les Lacs we were pleased to find a nice stand of Marsh Helleborine orchids. The sun had just emerged after rain and insects were becoming active. We noticed a hoverfly visiting one of the flowers and hastened to get the camera ready, as we were keen to observe the pollination mechanism proposed by Darwin. As readers will know, Darwin surmised that the lower lip or epichile of this orchid helps to project an insect upwards and into the flower, assisting in causing the insect to touch the viscidium and extract the pollinia. The epichile is hinged and moves up and down with the weight of an insect.

The literature

Since Darwin's day, there has been much discussion about how the so-called springboard mechanism works and which pollinators are involved. Some examples from the literature show the variety of descriptions and explanations:

Darwin (1877) did not himself observe insects visiting Marsh Helleborine orchids but deduced how the epichile might work from the structure of the flower: '*Reflecting on the structure of the flower, it occurred to me that an insect entering one in order to suck the nectar, would depress the distal portion of the labellum, and consequently would not touch the rostellum; but that, when within the flower, it would be almost compelled, from the springing up of this distal half of the labellum, to rise a little upwards and back out parallel to the stigma'*. Darwin's son William reported his observations of honeybees visiting this orchid in the Isle of Wight to his father. Charles Darwin realised that honeybees were able to acquire pollinia without entering the flower, and states that '*the upward movement (of the epichile) may not be so necessary in all cases as I had supposed'*.

Nilsson (1978) observed 431 insect visitors to Marsh Helleborines across 12 sites in southern Sweden and found that most visitors were hymenoptera or diptera. Small hoverflies did not depress the epichile but *Eumenes* wasps did so and had the highest rate of pollinium attachment (though were quite rare). As *Eumenes pedunculatus* depressed the epichile, the wasp was seen to curl its abdomen under the flower. It then moved forwards, allowing the epichile to move upwards. As it backed out of the flower the epichile moved downwards again, causing the wasp to '*partially lose its balance and tip backwards'*, causing the pollinia to attach to its head. Nilsson found that smaller insects carried the pollinia farther back on their bodies than did larger ones, usually on the thorax rather than the head.

Brantjes (1981) found that ants, smaller hoverflies and honeybees were the main pollen vectors at a site in the Netherlands. Agreeing with Nilssen, he notes that the main hoverfly pollen vectors, *Syritta pipiens* and *Lejogaster mettalina*, did not depress the epichile. Larger hoverflies depressed the epichile but did not obtain pollinia. His summary reads *'The epichile bent down under heavy insects, and worked as a 'springboard' for light hymenopterans'*. In fact the epichile was seen to move upwards on two occasions when the flowers were visited by small hymenoptera, potentially assisting pollen transfer, but in neither case were pollinia attached.

Jacquemyn *et al.* (2014) provide a literature review of all aspects of the biology of Marsh Helleborine, including pollination. They list 10 coleoptera, 45 diptera and 55 hymenoptera species recorded visiting the flowers of the orchid by various authors. They relate the doubt of some authors about the validity of Darwin's springboard mechanism and say that '*it may be more plausible that when the insect backs out of the flower, both depression of the epichile and maintenance of the insect's foothold on the outside of the hypochile .. induce a stretching of its body that brings its head into contact with the rostellum'*.

Wilcox (2010) gives an account of almost 50 visitors to Marsh Helleborine flowers in the Vendée sand dunes of France. The main pollen vectors were *Polistes* wasps, *Oedemera nobilis* beetles, halictid bees, ants and tachinid flies. Hoverflies sometimes depressed the epichile, triggering the springboard mechanism. Some were able to avoid rupturing the viscidium and ingested pollen, whereas others acted as pollen vectors.

Claessens & Kleynen (2011) state '*our observations underline the importance of the upward movement of the epichile when returning to its original position. The visitors are pushed towards the anther, just as Darwin (1877) described it'*. They present sequential images (p. 107) of a soldier fly (Stratiomyidae) entering a Marsh Helleborine flower and eliciting the springboard action of the epichile. Their list of all pollinators identified to species in the literature comprises 10 coleoptera, 46 diptera and 57 hymenoptera.

Our own observations

A male *Sphaerophoria scripta,* a small and light hoverfly species, was seen landing on the epichile. It then moved forwards, presumably seeking nectar under the base of the column. As its weight was transferred partly onto the hypochile, the epichile was seen to hinge up and down several times (Figs. 1, 2 & 3). The insect emerged almost immediately with pollinia attached to its thorax. Over the next 15 minutes the hoverfly rested on the petals and pedicel of the flower and attempted to groom off the pollen using its legs, but was unable to do so (Fig. 4).

Fig.1 (left): Epichile hinged down Fig 2 (right): Epichile hinged up
Photos by Nick Owens

Fig 3: Hoverfly with weight partly transferred to the hypochile: epichile hinged up. The insect's middle legs are inserted round the front edge of the epichile, perhaps assisting the forward and upward projection of the insect as the epichile hinges upwards.
Photos by Nick Owens

Fig 4: The hoverfly attempts to groom pollinia from its thorax, but is unable to do so

Photo by Nick Owens

Fig 5: The hoverfly emerges with pollinia on its head. The epichile is hinged down again by weight of insect.

Photo by Nick Owens

A visit by a second hoverfly, a female *Sphaerophoria sp.,* followed a similar pattern, except that the epichile hinged upwards just once, suddenly, pitching the hoverfly into the flower. The insect immediately emerged with pollinia on its head, partly covering its eyes (Fig 5). It was able to groom these off almost completely, though it did enter a second flower before all the pollen had been removed, potentially pollinating it.

Conclusions

From the author's observations and those of other observers, the springboard mechanism appears to have validity, and apparently functions as Darwin proposed when suitable insects visit the flower. The most effective pollen vectors seem to be insects of intermediate size, including hoverflies, soldier flies, smaller solitary wasps and solitary bees. Insects of suitable size land on the lower part of the epichile and take nectar from the yellow callus. They are enticed into the flower by the channel of nectar just above the callus. The pink converging lines inside the hypochile lead the insect to the base of the column where there is more nectar. As it enters, the epichile hinges up (or up and down repeatedly). This springboard mechanism nudges the insect upwards and forwards towards the pollinia. The attachment of pollinia when the viscidium ruptures appears to disturb the insect, causing it to retreat from the flower. Pollinia may be attached to the head or thorax of the insect vector, or in some cases the abdomen. Pollinia on the head area or legs may be at least partially removed by grooming. Larger insect visitors, such as honeybees, may strike the viscidium as they leave the flower, and a somewhat different role for the springboard mechanism has been claimed based on insects 'losing their balance' or being propelled upwards or stretched as they take off.

Appeal for information

It is surprising that the precise mechanism of this orchid is still in some doubt so long after Darwin's treatise was written, and the HOS is well placed to put this right! It is very likely that the authors of this article are ignorant of other significant observations and descriptions of this orchid. However, in our minds, the following questions still need answering:

- Which insects trigger the springboard mechanism of the epichile?
- Are pollinia attached as an insect enters the flower or as it leaves? Does this differ according to the insect involved?
- Is the springboard mechanism important in the placing of pollen on the stigma as well as its removal from the pollinaria?
- To what extent are pollinia groomed off after attachment?

Images and video recordings of the process could help to clarify what happens. Readers may already have such recordings, and if not, it could be something to attempt in the coming season. It may be necessary to wait some time for insect visitors to arrive! The mornings and/or sunny periods after rain are probably the best times. The authors would be very interested to hear about any relevant observations.

Broad-leaved Helleborine *Epipactis helleborine*

Broad-leaved Helleborines show characteristics of so-called 'wasp flowers' which also include some Figworts *Scrophularia spp.* and *Cotoneaster spp.,* being (usually) a dull purple-brown colour. The flower colour of Broad-leaved Helleborine is, however, quite variable, and newly opened flowers still holding pollinia are paler. The epichile is rigid, unlike that of the Marsh Helleborine. The orchid is pollinated almost exclusively by social wasps and attracts very few other species of insect. It therefore contrasts with the Marsh Helleborine, which may attract 50 or more potential pollinator species at one site.

Manfred Ayasse and his team at the University of Ulm, Germany, have demonstrated that Broad-leaved Helleborine flowers release chemicals which mimic the scents produced when phytophagous insects, such as caterpillars, chew leaves. These chemicals are called green leaf volatiles (GLVs). By releasing chemicals mimicking GLVs, the orchids are thought to trick worker wasps, which are seeking prey, into visiting them. The wasps then discover the nectar in the orchids and act as pollinators. The antennae of captive worker *Vespula* wasps produced electrophysiological responses to GLVs, and the wasps also turned preferentially towards GLVs in a Y-maze.

In August 2012 the authors were shown some Broad-leaved Helleborine orchids flowering by the edge of a ride in Swanton Novers Great Wood, Norfolk. Almost immediately it was apparent that the flowers were being visited by social wasps. Photographs of the wasps were obtained, all of which were *Dolichovespula saxonica* or *D. sylvestris*. All but one of the wasps was male, and most had one or more orchid pollinia attached to their clypeus (Figs 6-8). Further observations were made in 2013 and 2014: only one worker wasp was observed at the orchids over three seasons (the one in Fig 7), but at least 21 different males were seen visiting the flowers. These observations of a preponderance of male wasps visiting the orchids in Swanton Novers Great Wood were unexpected, since male wasps do not seek prey, and probably would not therefore be attracted to GLVs.

Female (worker) social wasps certainly do visit Broad-leaved Helleborine flowers. However Claessens & Kleynen (2011) report observations by Veenendaal (2010) at Epe in the Netherlands who recorded 37 pollinators of *E. helleborine*, all of which were *D. saxonica,* comprising 33 males and 4 females. Their own observations at Wijlre comprised 4 male *D. saxonica*, 3 male *D. sylvestris* and one female *V. vulgaris*.

Fig 6 (top): *Dolichovespula sylvestris* male taking nectar from Broad-leaved Helleborine.
Fig 7 (bottom): *Dolichovespula sylvestris* worker leaving Broad-leaved Helleborine flower with pollinia attached to its clypeus.
Photos by Nick Owens

Fig 8: *Dolichovespula sp*. male with multiple pollinia on its clypeus. Note the long antennae of the male. (Figs 6-8 from Swanton Novers Great Wood, 6th August 2012)

Photo by Nick Owens

Appeal for information

The authors would be interested to see any images of insect visitors to Broad-leaved Helleborine orchids. Images of wasps should ideally show the antennae and/or the whole abdomen in order to determine whether they are males or females.

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[A more detailed article on this topic, with a fuller review of the literature, has been submitted for publication in Transactions of the Norfolk and Norwich Naturalists' Society. Contact Nick Owens by email at owensnw7@gmail.com]


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Bushfires and Orchids in Australia: The Fire-dependent Species

George Tiong and Jim Cootes

Fire is an integral part of the Australian landscape. Throughout the drier south-eastern and south-western areas of the continent, bushfires are a regular occurrence during the hot and dry summer months (December to February). Following the years where there has been significant build-up of dry vegetation, these fires often have a devastating impact on humans and wildlife alike. The state of Victoria, in particular, has experienced many of the deadliest bushfires, most notably the 2009 Black Saturday fires, which killed 173 people and destroyed about 2000 homes.

The impact of bushfires on flora can produce a variety of responses. At one extreme, the intense heat can kill trees, while at the other end of the spectrum, a quick-moving fire may trickle through to remove only the litter layer and spare many plants. The majority of Australian flora, including the dominant eucalypts, has evolved with fire, developing characteristics which help them to withstand or adapt to fire. It is now known that the ash from a fire contains chemicals which promote new growth while the smoke stimulates flowering and regeneration of some species.

The response of orchids to fire is likewise highly varied. Some species are killed outright when exposed to a bushfire, either because they are evergreen epiphytes or lithophytes which are simply burnt by the intense heat, or they are small terrestrial species with tubers in the leaf and bark litter or in the shallow top few centimetres of soil which get scorched. A number of terrestrial orchid species are inhibited by summer bushfire, rather than killed, surviving because they flower in autumn or winter. Other species, which flower in spring, may not be affected at all by fire. On the other hand, a large number of terrestrial orchid species are stimulated to flower, often in great abundance, after a fire. These plants are dormant during the summer months and are often found in habitats which become overgrown with competing vegetation. A fire clears the ground cover, enabling light to reach the ground, while the mineral-rich ash bed provides increased nutrients. Finally, there are several orchid species which are totally dependent on fire in order to flower. These species have evolved to flower only in the year (or rarely a few years) following a bushfire. It is believed that the ethylene gas released during the passing of a fire front is the main factor that stimulates mass flowering. Ethylene is known to induce flowering and fruit ripening in other plants, as well as stimulate flowering in numerous orchid species.

Fig. 1: Typical orchid habitat after a fire
Fig. 2: Typical orchid habitat after a fire – *Xanthorrhoea australis* blooming in response to fire.

Photos by Colin & Mischa Rowan

This last group of orchid species, which are dependent on fire to flower, are of interest to the authors and are the focus of this article. Many orchid habitats in the south-eastern and south-western states of Australia are regularly burnt, some as often as every two years. While many orchids have adopted fire into their life cycle by flowering more profusely during the spring following the fire, at least four species are known to take it to the extreme by flowering only in the season (or rarely for a few years) after the fire.

Probably the most well-known terrestrial orchid species in this category is *Burnettia cuneata* Lindl. This is a most unusual and fascinating orchid that is rarely seen, as it spends most of its life cycle underground as a small dormant tuber. During this period, which may last for many decades, it is probably dependent upon a mycorrhizal fungus as a source of nutrients. However, this pattern changes following a bushfire, when the period of dormancy is broken and plants are stimulated to flower *en masse* during the following spring. Above the ground, the plant consists of a purplish brown coloured basal bract and a stout fleshy brittle stem, reaching up to 13 cm in height, with up to 7 (usually fewer) small white (sometimes pink) fleshy flowers, and red longitudinal stripes on the labellum underside and the dorsal sepal. Each flower measures no more than 2 cm across, opening widely for a period of 1-2 days only during warm humid days, although it may remain partly open for longer. Plants die after flowering, with reproduction entirely from seed. The seeds germinate and develop into tubers, and then lie dormant underground for the next fire to arrive. This species is distributed in Victoria, Tasmania and New South Wales, where it is highly localised to peaty soils and margins of shrubby swamps containing Scented Paperbark (*Melaleuca squarrosa*), with the areas under water during winter but just damp during the flowering period. Other than an odd flower or two in subsequent seasons, flowering generally does not occur again until after another fire. Following the 2009 Victorian bushfires, mass flowering of *Burnettia cuneata* was observed at many sites with damp, peaty soils associated with *Melaleuca squarrosa* swamps. Hundreds of short, fleshy, dark reddish brown stems with white flowers could be seen emerging from the charred soil. Within a few days, the flowers had disappeared and the plants withered rapidly.

The genus *Pyrorchis* contains two species of terrestrial orchids, one of which is widespread across southern and eastern Australia, while the other is confined to Western Australia. As indicated by the generic name, fire is needed to induce flowering in these plants. Unlike *Burnettia cuneata*, these species grow in extensive colonies and produce large ground-hugging leaves.

Fig. 3: *Burnettia cuneata*
Fig. 4: Typical habitat for *Burnettia cuneata*

Photos by Colin & Mischa Rowan

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Pyrorchis nigricans (R.Br.) D.L.Jones & M.A.Clem. has a single, large, thick, fleshy, ovate or heart-shaped, ground-hugging leaf, dark green in colour, measuring 3-13 cm by 4-8 cm. In most years, only these large leaves, commonly called ‘elephant’s ears’, are found scattered in various habitats, including open forest, woodland and heath, and often in extensive colonies. Following a summer bushfire, a dramatic transformation occurs as the plants burst into flower. The flower stem is fleshy, with 2-3 loose stem bracts, and can reach 25 cm in height. There are up to 10 white coloured flowers with red stripes and markings. The flower is nodding, measures 2-3 cm across, and has a broad hooded dorsal sepal and narrow spreading petals and lateral sepals. The labellum is curved and prominently fringed. The flower turns black as it ages, earning it the nickname of “Undertaker orchid”. This species is widespread and abundant, being found in Western Australia and the eastern states of New South Wales, Victoria, South Australia and Tasmania, where the large vegetative colonies of rounded fleshy leaves of the non-flowering plants are easily identified.

In contrast, *Pyrorchis forrestii* (F.Muell.) D.L.Jones & M.A.Clem. is found only in the south-west corner of Western Australia, frequenting winter-wet swamp margins and creek lines. This attractive plant was first collected by John Forrest in 1882. There are 2-3 overlapping leaves which are arranged in a tight rosette, and are ovate in shape, but less fleshy and more elongated than that of *Pyrorchis nigricans*. The flower stem reaches 10-30 cm in height, and carries up to 7 flowers. Each flower measures up to 3 cm across, is pink and white in colour, with the segments roughly obovate in shape, while the labellum has distinctive red bars. Although the plant can be locally common, forming dense vegetative colonies, the dense habitat in black peaty soil makes it difficult to find in unburnt areas. The flowers appear in large numbers only after hot summer fires and are sweetly scented.

The final species covered in this article, *Leptoceras menziesii* (R.Br.) Lindl., is one of the most common and widespread orchids, occurring throughout the southern regions of the continent, from Western Australia to the eastern states as far north as New South Wales. Although relatively small, this plant is often found in dense colonies, and is easily recognised by the solitary, shiny, bright green, ovate-lanceolate leaf. In the absence of fire, these plants reproduce vegetatively by forming new tubers and rarely flower. However, a dramatic mass flowering response occurs in the spring following summer fires. The flower stem can reach 25 cm tall, with a small bract towards the base, and has up to 3 highly distinctive flowers. Each flower measures 2 cm long, and is coloured white and reddish. Due to the prominent erect ear-like petals, which are coloured dark-red, this plant is commonly called “Rabbit orchid”. The dorsal sepal is incurved, while the labellum is white and is adorned with yellow coloured calli. This species grows in a wide variety of habitats, stretching from the coast to inland areas, in heath and open forest to granite outcrops and swamp margins.

Figs. 5 & 6: *Pyrorchis nigricans*

Photos by Colin & Mischa Rowan

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Fig. 7: *Leptoceras menziesii*

Photo by
Colin & Mischa Rowan

Many Australian terrestrial orchids have evolved by adopting fire into their life cycle, and are stimulated to flower following summer bushfires. Such plants typically produce robust growth in the burnt habitat due to increased light reaching the ground and the presence of nutrients in the mineral-rich ash-bed. A number of species have become dependent on fire and will flower only in the year following a bushfire. The ethylene gas released during a fire is thought to stimulate mass flowering, in the same manner that the enclosing of a ripened banana in a plastic bag elicits a flowering response in dormant orchid tubers. Such dramatic, massed floral displays of bright colour on brand-new growth, set against a stark and blackened landscape, make for some of the most impressive sights that the orchid enthusiast would wish to see.

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Fig. 8: *Pyrorchis forrestii*
Fig. 9: Wildflowers blooming two springs after fire.
Back Cover: *Pyrorchis nigricans* (white variant)

Photos by Colin & Mischa Rowan


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