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The Hardy Orchid Society Committee

Cover Photographs

Front Cover: Yellow form of *Dactylorhiza sambucina* in the Bernese Oberland by Rosemary Webb. (see article on page 124)

Back Cover: *H. hircinum* (Bagnols-en-Forêt, France, 9-5-2008) by Jean Claessens & Jacques Kleynen (see article on page 114)

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.

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Editorial Note

This edition of *JHOS* includes another beautifully illustrated pollination article from Jean Claessens and Jacques Kleynen. There is a second instalment of Rosie Webb's historical travel series, as well as another thoughtful piece from David Trudgill, this time on orchid longevity. I have included two field trip reports that are informative articles in their own right: a Darwinian overview from Irene Palmer and some insights into the conservation of Lady's-slipper Orchid from Charlie Philpotts.

A quick word is due about our printer Anglia Print. They are a small East Anglian company who do a good job for us but are noteworthy as one of the few printers in the UK to pioneer eco-friendly technologies. They are powered by 100% renewable energy, have zero waste to landfill and use waterless printing presses and vegetable oil based inks. All very appropriate for HOS as a conservation-minded society. Their efforts were rewarded in 2016 with a Queen's Award for Enterprise in the category for sustainable development.

Chairman's Note

John Wallington

At the end of my piece for the July Journal I expressed my hope that you were all having a good "plant hunting" season. I hope you all did and I hope you all heeded the request to be careful when photographing or just inspecting the orchids and did not damage other plants.

This year Anne and I went to Albania for a month, in part to look for the Spring flowers of the Balkans, including the orchids. We saw quite a good cross section of the orchids known to flower there but (and there is always a but) the roads in the rural parts of Albania are not good – without a 4x4 the mountains are inaccessible. Even then access to the higher pastures is only possible by foot and horse or donkey.

By mid April, when we arrived, the local shepherds and goatherds had moved their animals up from their winter pastures into the mountains. There are a very large number of sheep and goats in Albania, also cattle. The animals graze along the roadsides and over the hillsides and it can be very difficult to find any flowers as the goats, particularly, eat everything. Grazing animals are not allowed onto the historical sites, of which there are many, or into the national parks. However, there appears to be very little enforcement.

So there is a conflict and it was perhaps summed up by the shepherd who was totally perplexed as he watched me photographing a white *Neotinia tridentata*. To me it was a rare flower and worthy of recording even if it was going over. To him it was just another flower on the hillside and sooner or later it would end up eaten by one of his sheep or goats. Albania is a very poor country with an almost entirely rural economy. The more animals you can graze and sell the better you are able to look after yourself and your family. A few orchids are of little importance in that context – so a dilemma. In spite of the legions of goats we did manage to find many species of orchid, even if in quite small numbers.

There were however exceptions. On lower hillsides, after the goats had moved on, there were fields full of *Anacamptis morio* or *A. picta*, and in some areas thousands of *Serapias vomeracea* / *S. bergonii*. In the lowlands, even beside the one main road, from Tirana to Shkroder, there were damp/wet meadows full of *Anacamptis laxiflora* and a good sprinkling of *A. fragrans* and *A. coriophora*; also colonies of *Ophrys apifera*. The *Anacamptis laxiflora* can also be found in big bunches for sale on the streets of Tirana. So a great month, the scenery and people are wonderful, but it was rather mixed as far as the orchids were concerned. A holiday which illustrated rather well the tensions between sustaining rural livelihoods and protecting rare, or not so rare, plants.

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The Pollination of European Orchids
Part 5: *Himantoglossum* and *Anacamptis*, Two Examples of Deceptive Pollination

Jean Claessens & Jacques Kleynen

Introduction

Many orchids produce nectar in order to attract insects. However, in the European orchids there are a considerable number of orchids which produce no nectar. Why would an orchid shift from reward to no reward, as this pollination mode clearly attracts less insects? We will discuss this on the basis of two non-rewarding orchid genera, *Himantoglossum* and *Anacamptis*.

Many orchids provide some kind of reward for their visitors like nectar, pollen or oil. European orchids only present nectar to their visitors. A number of orchids do not present any reward at all; they are called rewardless or deceptive orchids. The best known forms of deception are: food deception, shelter imitation (in the genus *Serapias*) and sexual deception, well known from the genus *Ophrys*. In this article we will only discuss food deception, where a plant attracts pollinators despite the fact that it does not present a food reward.

Himantoglossum

Because the Lizard Orchid (*H. hircinum*) is the only species of the genus growing in Great Britain, we will use this species to illustrate the pollination biology. The plants are 30-80 cm high, carrying 15-80 flowers (photo on back cover). The leaves appear in September, and by the time the flowers are in full bloom the rosette has withered. The orchid's name refers to the flowers with the long, twisted lip, reminiscent of a lizard. A feature you remember, once you have seen this orchid, is its pungent, goat-like smell. In most European countries it is therefore called "goat orchid". The sepals and petals form a hood and the upright, large column is readily accessible to visiting insects. The long, brownish, strap-shaped lip has a white basal part with purplish tufts of hairs, acting as honey guides (Fig. 1). They are also said to be osmophores, emitting an attractive scent. The lip forms a short, downward curved spur which contains no nectar. The anther contains two pollinia which are connected to a common viscidium by two long, curved caudicles. The viscidium is stored in a bursicle, a protective membrane. The large stigma is oblong to oval and concave.

Fig. 1: *H. hircinum*; lip with tufts of purple hairs (Selogney, France 12-5-2007).
Fig. 2: *H. hircinum*, longitudinal section showing the protruding bursicle (red arrow).
Fig. 3: Honeybee (*Apis mellifera*) pollinating *H. hircinum* (Gilsdorf, Germany, 1-6-2012).
Photos by Jean Claessens & Jacques Kleynen


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Insects encounter two obstacles when visiting the flower. The viscidium protrudes and, when searching for nectar in the spur, an insect will most certainly bump its head against it (Fig. 2). The vertical, narrow spur entrance is reduced by two rows of long, white hairs, narrowing the entrance considerably. This causes the pollinators to bend well forward. In doing this they touch the protective bursicle, which is pushed backwards and then touch the viscidium, which is generally attached to the forehead. If they already have pollinaria attached (Fig. 3), the pollinium is pushed against the stigma, and the massulae (the packages of pollen composing the pollinium) stick into the stigmatic fluid.

In the literature a variety of pollinators is mentioned like hoverflies, various bees, wasps, ants, beetles, butterflies and moths. However, our observations supplemented with other data clearly show that bees, above all the genus *Andrena*, are the legitimate pollinators of *H. hircinum* (Figs. 4 and 5). All other European *Himantoglossum* species like *H. robertianum* or *H. adriaticum* are also exclusively pollinated by various Hymenoptera.

Anacamptis

Two main flower types are recognised in species of the genus *Anacamptis*, each adapted to specific pollinators. We will discuss the Pyramidal Orchid (*A. pyramidalis*) and the Green-winged Orchid (*A. morio*) as representatives of those types.

Fig. 4: *Andrena* cf. *carantonica* pollinating *H. hircinum* (Gilsdorf, Germany, 3-6-2009).
Fig. 5: *Andrena* sp. grooming; the worn pollinaria indicate that it has visited several other flowers and deposited fragments of pollen (St. Paul-en-Forêt France, 2-5-2008.)

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Fig. 6: *A. pyramidalis* (Treffort, France, 15-6-2015).
Fig. 7: *A. pyramidalis* (Barbières, France, 14-5-2007).
Fig. 8: *A. pyramidalis*, close-up of the lip with guide plates and narrow spur entrance.
Fig. 9: *A. pyramidalis*, pollinaria; the viscidium is curled around the tip of a needle.
Fig. 10: Small tortoiseshell (*Aglais urticae*) with pollinaria attached to its proboscis (Eys, Netherlands, 2-6-2014).
Fig. 11: Meadow fritillary (*Melitaea parthenoides*) with pollinaria of *A. pyramidalis* (Barbières, France, 29-5-2008).

Photos by Jean Claessens & Jacques Kleynen


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Fig. 12: *Zygaena filipendulae*, a regular pollinator of *A. pyramidalis* (Seyssinet-Pariset, France, 16-6-2015)
Photo by Jean Claessens & Jacques Kleynen

A. pyramidalis is 10-25 cm high and has a pyramidal-shaped inflorescence with closely packed, pink to purple flowers (Figs. 6 and 7). Dorsal sepal and petals form a loose hood; the lateral sepals are spreading. The three-lobed lip has two prominent upright guide-plates at its base, leading to the long, slender spur (Fig. 8). The anther is erect and contains two pollinia attached by yellow caudicles to a common, saddle-shaped viscidium, covered by a bursicle of the same form. The stigma is not placed under the column but instead is composed of two stigmatic lobes, placed on each side of the column.

A. pyramidalis is pollinated by a wide variety of butterflies. Various *Zygaena* species are regular pollinators. Flower morphology is well adapted to butterflies: the guide-plates lead the proboscis towards the narrow spur entrance. The long spur (containing no nectar) and the narrow entrance incite the pollinator to stick its head deep into the flower, where it touches and pushes the bursicle backwards. The saddle-shaped viscidium is a beautiful adaptation to the butterfly tongue: when touched it curls around the proboscis, firmly securing the pollinaria which bend sidewards due to the curling movement of the viscidium (Fig. 9). At the same time, they bend forward, bringing the pollinia to the exact position for touching the two stigmatic lobes left and right of the column base. This process takes about 30 seconds, and when the butterfly visits another flower, it will certainly push the pollinia onto the two stigmatic lobes. Butterflies often use the inflorescence as a landing platform from which they start probing the flowers for nectar (Figs. 10, 11 & 12). It does not matter that they insert the proboscis upside down; the spur entrance is so narrow that the pollinia reach the stigma in whatever position the butterfly has adopted.

Fig. 13: *A. morio* (Padalu, France, 8-4-2013).
Fig. 15: Solitary bee pollinating *A. morio* (Fayence, France 1-5-2008).
Fig. 14: Honeybee (*Apis mellifera*) inspecting the flowers of *A. morio* subsp. *picta* (Bois du Rouquan, France, 5-5-2008).
Photos by Jean Claessens & Jacques Kleynen


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With some exceptions all other species of the genus *Anacamptis* are deceit-flowers, that is they do not have any nectar. The pollination of *A. morio* is similar to the process as described in Part 1 for *Orchis*. The broad, slightly three-lobed, violet-purple lip has a lighter, more whitish centre with violet-purple spots creating the the honey-guides (Fig. 13). The spur is long and upward-curving. Darwin (1877) supposed that the insects pierced the inner spur wall to suck the fluid stored between the membranes of inner and outer spur wall, however this assumption was proved to be false. Pollinators are newly emerged, naïve bees who still have to learn which flowers are good food sources (Fig. 14 and 15). They soon learn that the orchids provide no food whatsoever and then avoid the orchids. The early flowering period of *A. morio* is advantageous, because there are few nectar producing plants and the bees have not yet established a fixed food plant preference.

Deceptive orchids are recognisable by the irregular seed set: a bee visits some flowers and then finds out it is deceived and leaves. Often fruit set of the lower half is higher than the upper half, illustrating the learning process of the inexperienced bees. Deception is a widespread strategy among orchids. Production of nectar costs much energy, which in deceit species can be invested in the formation of the fruit. Another advantage is the improvement of the "fitness "of the plants. Orchids with nectar are visited for a longer time and insects tend to creep longer from one flower to another on the same flower spike, causing a much higher degree of geitonogamy. In deceptive orchids the insects visit few flowers and fly much faster to the next plant, thereby promoting cross-pollination, bringing about a higher gene exchange. This is important for maintaining a healthy population.

We would like to thank Mike Gasson again for his great help in improving the manuscript. For more information see our book "The flower of the European orchid – Form and function" or visit our website www.europeanorchids. com.

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I Will Have to Come Back Next Year
2: Bernese Oberland – Wengenalp

Rosemary Webb

The first time that I visited the Bernese Oberland in Switzerland, I was able to be there for only one week. I was very fortunate because the weather was wonderful. The sun and blue sky showed-off the huge mountains to perfection and I had magical days hunting for plants. On my last day, I took the train up from Lauterbrunnen to Kleine Scheidegg. It chugs very slowly and one can spot plants from the train. We reached Wengen and then on, up through a landscape of meadows and woodland with a deep, dark valley below. As the train got ever nearer to the Jungfrau Massif, the mountains towered above the scene, monumental and silent with a considerable amount of snow this year. Arriving at Kleine Scheidegg, I checked and discovered that the last train down, back to Lauterbrunnen, was at 4.30 in the afternoon. There are so many paths and meadows to explore. I would have to make sure that I gave myself good time to get back to the station.

I had a lovely time. There were many alpine flowers that I had not seen before. There were several species of gentian, which are much more magnificent than in pictures. There were sheets of *Crocus vernus* ssp. *albiflorus* in both white and purple, stretching away towards the Eiger amongst considerable patches of lying snow. Sadly, it was too early for orchids at this height. I was told that spring was late this year. Eventually I did find a few *Orchis mascula*, mostly in bud but some with good flowers in more sheltered places. All too soon I had to make my way back on the last train down – it is a long, steep way to Lauterbrunnen on foot! I sat on the left hand side so that I could keep the Jungfrau Massif in sight for as long as possible. The late afternoon sun picked-out the surface texture and the contours, casting blue shadows on the brilliant snow. I had never seen mountains like these before. I longed for more time.

The train made its way slowly down. Many passengers were taking photographs of the mountain-view. We began to slow down even more as we were approaching Wengenalp station. There is a low bank beside the railway, separating the line from the path down to Wixi and eventually to Biglenalp. I noticed some good plants of *Orchis mascula* on the bank and then I saw something that was a complete surprise. There was a fully open spike of a lovely pale, yellow orchid. What could it be?

Fig. 1: Sheets of *Crocus vernus* ssp. *albiflorus* in the Alps
Fig. 2: *Orchis mascula*
Figs. 3 & 4: Yellow form of *Dactylorhiza sambucina*

Photos by Rosemary Webb




I was unaware of yellow orchids in this part of Switzerland. I was excited and deeply disappointed all at the same time. It was the last train on my last day – I go home tomorrow. There was no possibility of getting out and going back to look at it, even though it was only a few metres away from the platform. My decision was made – I will have to come back next year!

This is exactly what I did. I based myself in Wengen where one can get the train, or from which it is a pleasant but steep, longish walk up to Wengenalp. I wanted time to explore the area. I could hardly hide my excitement on my first morning as I boarded the train and we started on the uphill climb. I was so lucky. It was a lovely, fresh, warm, sunny day and the mountains were clear and massive above us.

We arrived at Wengenalp station. Just a few people got off here, most were going on up to Kleine Scheidegg and perhaps on to the Jungfraujoch. I tried not to look too excited. I walked quickly but tried not to run, I tried to keep a little dignity! I walked the short distance towards the site where I saw the single, yellow orchid last year. Would it be there again? At the end of the low platform there is a track which goes under the railway, through a gate and joins the path down into the valley beyond. It was on this side of the railway where the orchid would be if it was here this year.

I turned the corner, looked up onto the bank and there it was! A wonderful, open spike of soft yellow flowers, picked out in the brilliant spring sunshine. I climbed up to it, set up my camera and looked at it closely. There were little red spots on the labellum and I realised that I was looking at the yellow form of *Dactylorhiza sambucina*. I looked around but could not see any others. I had never seen this orchid before although I knew what it was. I set about photographing it. It was in a wonderful position. I could photograph it and get the Massif in the background to show exactly where it was. There are few places that could provide a better backdrop to a beautiful orchid. I had my plant in perfect flower with the Jungfrau/Silberhorns as an icy, snowy background. I am so glad that I had to come back this year. I have revisited this place many times since I saw this orchid – it has never appeared again to my knowledge.

Longevity – A Key Factor in Orchid Population Dynamics

David Trudgill

Reproductive life-span and rates of establishment of new, mature plants are key factors determining the survival and success of individual plant populations. De Witte & Stocklin (2010) comment that ‘a species life-history and population dynamics are strongly shaped by the longevity of individuals, but life span is one of the least accessible demographic traits’. It is clear that a population will flourish and increase when the rate at which mature plants become established exceeds that at which they die, but will decline and eventually disappear when death rates consistently

exceed those of establishment. The longer plants live and flower, the greater the total amount of seed they produce and, as most orchid seed is deposited near its source, the more they will contribute to the establishment of new plants and an increase in the population (Hutchings 2010). But, although of prime importance, reproductive life-span has been little studied in our British hardy orchids. Hence, until recently both Early-purple Orchids (*Orchis mascula*) and Bee Orchids (*Ophrys apifera*) were thought normally to be monocarpic (flowering once and then dying – Lang 2004) whereas the opposite is true and both are 'relatively long-lived' (Harrap & Harrap 2009). Bee Orchids may flower several times and live for more than 20 years (half-life 11.2 years after first appearing – Wells & Cox 1991) and Early-purple Orchids have been recorded living 13 years after the first appearance of leaves (Harrap & Harrap 2009).

Although probably most British orchids are potentially long-lived there is little information on the life-spans of many species. Harrap & Harrap (2009) provided life-span information for only 20 of the 56 species they described, and reported half-lives (the half-life is the time from first emergence/flowering, to when 50% of plants have died) varied greatly. Three species were recorded as generally being short-lived e.g. Frog Orchids (*Dactylorhiza viridis*) are described as having a half-life (from flowering) of 1.5 years, whereas 17 species were described as relatively long-lived (half-life of >6 years). Lady's-slipper Orchids (*Cypripedium calceolus*) are the most long-lived; in a study of three populations of Lady's-slipper Orchid in Poland the estimated mean longevity ranged from 110 to 350 years (Nicol *et al.* 2005).

Because of their method of perennation, this wide range in orchid longevity is unexpected. Each year, our native orchids produce replacement tuber(s) or rhizome, with their associated bud(s) from which will grow next year's leaves and/or flowers. This provides the potential for a new flowering plant to develop in every subsequent year. Therefore, British orchids would seem to be potentially immortal and one has to wonder why mature orchids sometimes disappear, even in apparently favourable locations and conditions. Of particular interest are reports of very large differences in longevity between individuals within a population. For example, in a long-term study, Early Spider-orchids (*Ophrys sphegodes*) had a half-life of 2.25 years but some plants lived for more than 20 years (Hutchings 2010). Frog Orchids are mostly monocarpic (half-life 1.5 years) but some plants live much longer (up to 7 years – Harrap & Harrap 2009). These observations suggests that, rather than dying of old age, many orchid plants disappear because external factors/agents have induced/caused their death.

We seem to accept that it is natural for a proportion of the plants in a population to die each year, often for no clear reason, but identifying the factors involved may help us with orchid conservation. Do wild orchids mostly die because they are 'old', or

are many dying when they are still relatively 'young'? As most orchids disappear between periods of vegetative growth there is little information on the causes of this 'sudden' orchid death. Unfavourable weather is likely to be a factor weakening or killing orchids. In a study of a population of Lizard Orchids (*Himantoglossum hircinum*) in Germany, numbers varied greatly, but increased after warm winters (Pfeifer *et. al.* 2006). Annual recruitment and mortality of Early Spider-orchids was positively correlated with temperatures in the previous year (Hutchings 2010). Drought in the summer of 1976 was associated with a sharp decline in the numbers of Autumn Lady's-tresses (*Spiranthes spiralis*) on chalk downland at Knocking Hoe in Bedfordshire (Walker *et. al*. 2015). Bill Temple (*pers. comm.*) records the changes in the numbers of Bee Orchids growing on lawns in Oxfordshire and found that numbers varied from 877 in 2007 to 4525 in 2015. Drought (three weeks without rain) during April resulted in many plants going dormant or having smaller rosettes in the following year. However, drought during the flowering period killed many plants. *Dactylorhiza* species were also killed by a drought in May.

The health of the mother tuber/rhizome is critical if the dormant bud is to develop into a plant. Species that are generally short-lived, such as Early Spider-orchids and Frog Orchids, mostly die after flowering only once or twice, possibly because flowering diverts resources from new tuber production. Disease must sometimes be a factor: I have observed dying *Dactylorhiza* species with brown, dead leaves, probably caused by the orchid-specific fungal pathogen, *Cladosporium orchidis.* It has killed many plants in our meadow (Trudgill 2015a) and I have seen plants with similar symptoms of infection in wild populations in Stirlingshire, South Harris, Perthshire, and Fife. An unidentified leaf miner is another problem that can kill *Dactylorhiza* species (Trudgill 2015a). Occasionally, I have observed previously vigorous *Dactylorhiza* species looking stunted with brown leaf mid-veins. Further examination showed that the mother tuber had rotted. In July 2015 a plant of Greater Butterfly-orchid (*Platanthera chlorantha*) in our meadow appeared to have disappeared but closer inspection showed that the leaves and the aborted flower stalk had rotted away – again cause unknown but several bacteria and fungi can cause such problems. Also, two adjacent plants of Lesser Butterfly-orchid (*P. bifolia*) had yellowed leaves (Fig. 1). Tests in which sap from these plants was rubbed onto the leaves of virus-sensitive indicator plants confirmed that these plants were infected with a virus (S. MacFarlane *pers. comm.*). The virus involved was not identified but may have been 'soil-borne' e.g. tobacco rattle virus that is transmitted by Trichodorid nematodes and is capable of infecting a wide range of plant species.

In some species plants may become dormant when conditions become less favourable and re-appear when conditions improve (Shefferson 2002). During a long-term study of the dynamics of Autumn Lady's-tresses 42% of plants spent at least one year entirely underground with a few recorded as missing for up to 9 years (Walker *et*

Fig. 1: Lesser Butterfly-orchid (*P. bifolia*) with yellowed leaves due to infection with a virus.

Photo by David Trudgill

al. 2015). Sue Parker (*pers. comm*.) observed that when a wood near her home was clear-felled many thousands of Broad-leaved Helleborine (*Epipactis helleborine*) appeared where previously there had been only a few. Next season, none appeared. Clearly, dormancy is a complication when trying to determine longevity.

Detailed studies on orchid populations and their longevity are rare. A 32 year demographic study by Hutchings (2010) of Early Spider-orchids showed that most were short-lived (half-life of 2.25 years), but a few plants lived much longer. In Canada two studies of the population dynamics of Case's Lady's-tresses (*Spiranthes casei* var. *casei*) showed that flowering was decreased following damp cloudy weather during the autumn, by drought mid-summer and by feeding damage from slugs and deer (Reddoch & Reddoch 2009). In a similar 24-year study of Autumn Lady's-tresses in the Netherlands, life spans ranged from 1.33 to 9 years, and browsing was suggested as a factor involved in plants disappearing (Jacquemyn 2007). Grazing by rabbits was considered responsible for a decline in the numbers of Autumn Lady's-tresses in Bedfordshire (Walker *et.al.* 2015) and grazing during

the spring and summer was found to be a significant cause of death in a study of *Dactylorhiza sambucina* in Denmark (Sonne & Hauser 2014). Physical damage due to soil disturbance/compression is also a factor: Hutchings (2010) found that Early Spider-orchids decreased in numbers when grazed in the autumn and winter by cattle, but increased when grazed by sheep.

Competition from other plants, especially grasses, and excessive shading is responsible for the decline of populations of many species of orchids. Silvertown *et al*. (1994) observed that fertiliser application decreased the numbers of flowering Green-winged Orchids (*Orchis morio*) due to increased competition from grasses and other herbs. Phosphate fertilizer appeared to be directly toxic as its effect was much greater than could be explained from competition alone. The number and proportion of newly emergent plants of the Military Orchid (*Orchis militaris*) increased following the removal of Yew trees that had been shading the site coupled with intensive management of the herb layer (Hutchings *et al*. 2008). Mowing increased seedling establishment of Lapland Marsh-orchids (*Dactylorhiza lapponica*) compared with unmown plots (Sletvold *et al*. 2010). The re-introduction of regular mowing to abandoned grass plots resulted in an exponential increase in the numbers of *D. incarnata* (Schrautzer *et al.* 2011). Wotavova *et al*. (2004) correlated the occurrence of Western Marsh-orchid (*D. majalis*) with field management at 50 historical sites over a 3-year period. At sites from which it had disappeared the reasons for its extinction were all associated with increased competition. These included an absence of mowing, intensive application of fertilizer and leaching of fertilizer from adjacent fields. At sites where it was still present but declining, competition from grasses was an adverse factor.

If we are to better understand the demographic processes within populations of orchids longer-term, detailed studies involving marked or otherwise identified plants are needed. Large and apparently healthy populations of orchids may have quite different dynamics. Sletvold *et al*. (2010) found that two populations of Lapland Marsh-orchid were characterised by long-lived individuals and high seedling mortality. Populations of other species of orchids, especially those where the plants tend to have a short life-span, are likely to have high death rates that are compensated for by high rates of recruitment.

How do we determine life-span potential if we assume that orchids in wild populations are often killed before they achieve their true potential? One option is to study orchids growing in a relatively protected environment. My wife and I have a small orchid meadow in which the orchids are pampered (Trudgill 2015b). We apply no fertiliser and mow/scythe the field in early September (after the orchid seed has dispersed), removing all the cuttings. The meadow is protected from rabbits and is not grazed. Eight species of orchid are currently growing in our meadow,

including Lesser Butterfly-orchid (LBO) grown from seed that was first spread by hand in 2002 (Trudgill 2015b). One plant of LBO first flowered in 2006 and it was still present in 2015, having flowered each year since 2006. Numbers of LBO have progressively increased to 66 in 2015. Between 2006 and 2015 only two mature plants disappeared, both killed by an unidentified, and probably non-specific rot. Almost every LBO plant has flowered each year following its first year of flowering and, as far as I know, none has gone dormant. Except in 2015 (a year with a cold, wet spring and summer), most plants have increased in size relative to when they first flowered and some of the older plants have multiplied vegetatively (i.e. they form a clump) so that in 2014 there were more than 60 flower stalks. Everything points to LBO being relatively long-lived – given the chance. In practice, the essence of orchid conservations is about managing 'probabilities' i.e. trying to increase the probability that a seed will produce a mature plant, and decrease the probability that, in any one year, that mature plant will die.

We need more information regarding potential orchid longevity if we are to judge the extent to which their (early) death is due to external causes, and to identify the agents/factors involved. I suspect that some of this information is available from members of the HOS – some of you probably have a favourite orchid that you visit year after year to check whether it is still there! Or you know why particular orchids have disappeared. Let me know (davetrudgill@googlemail.com) and I will try to provide a synthesis of your reports in a future JHOS.

Update – 2016

This article was written in 2015, but publication was delayed, allowing me to update it in June 2016. In 2016 our LBO did less well, probably because of the weather over the preceding 12 months. I could not find several LBO plants including the oldest plant that first flowered in 2006. Another died shortly after emergence because the leaves turned black and rotted, and yet another developed similar symptoms early in June 2016. There were only 52 flower heads as several plants that flowered in 2015 did not do so in 2016, or their flowers aborted. One of the two plants that showed virus symptoms in 2015 (that shown in Fig. 1) flowered in 2016, despite still showing symptoms of virus infection. One Greater Butterfly-orchid plant did not emerge in 2016 despite appearing healthy in 2015 and, by early June, the mid veins of the leaves of many dozens of *Dactylorhiza* species had turned brown due to a neck/tuber rot and a few plants appeared to have died.

These problems are almost certainly related to the weather over the previous year. A poor summer in 2015 was followed by a mild winter with record amounts of rain (a total of >50cm over November, December and January) when the lower third of the meadow was flooded for several days. April 2016 was cold (average 5.8°C compared with 7.6°C in 2015) and there was a sharp frost on two nights at the end of April.

Following this frost many plants showed signs of frost damage with the exposed parts of leaves taking on a silver appearance and the tips blackened. The cold April was followed by a drought in May and early June (15mm rain between 1st May and 7th June). Despite these challenges, numbers of all species in our meadow appear to have remained stable or increased. No single factor could be identified to account for some LBO dying between 2015 and 2016 but those that did tended to be amongst the weakest in 2015, in the wetter areas and/or where competition was greatest.

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HOS Visit to Downe 8th June 2016

Irene Palmer

This was the society's second visit to Down House in Kent, Charles Darwin's home for the last 40 years of his life (1842-1882). Today the house is owned by English Heritage. Its key features have been restored, including Darwin's former study. The group spent the morning exploring the house and then the garden, where I joined them. Emma's ornamental garden, the orchard, kitchen garden and Darwin's experimental beds have been replanted with the plants he studied. His greenhouse has been similarly restocked with a collection of carnivorous plants and climbers, as well as tropical orchids, such as the famous Madagascar Comet Orchid (*Angraecum sesquipedale*).

At the far end of the garden a gravel path leads to Darwin's Sandwalk, known nowadays as his 'thinking path,' where he walked most days. Several Violet Helleborine (*Epipactis purpurata*) plants have appeared since Darwin's time and flower there in late summer. Curiously, the Broad-leaved Helleborine (*Epipactis*

helleborine) appeared in a path in his garden, not long after he published his first orchid book but it disappeared long ago. A few plants of the Green-winged Orchid (*Anacamptis morio*) also grew in his garden; it was the most common orchid in the area in Darwin's time but it is extinct locally today. Its loss is almost certainly due to weedkillers and fertilisers used to 'improve' the meadows. A similar number of different species still grow in the area, although they have changed a little since Darwin's time and are mostly restricted nowadays to local nature reserves.

Darwin published his most famous book *On the Origin of Species* in November 1859. It was just a summary of a much larger book which he had been working on called *Natural Selection.* It was only partially written when he was forced to put it aside to defend his theory of natural selection because Alfred Russel Wallace had come up with a similar idea. The *Origin* was criticised because it lacked facts. In order to defend his case, Darwin embarked upon an expanded version of *Natural Selection* in 1860 but as spring turned into summer he suddenly changed course and began studying orchids, although this was not part of his plan originally. This project led to the publication of his orchid book in 1862. It had a lengthy title, which was typical of the times: *On the various contrivances by which British and Foreign orchids are fertilised by insects.* He published an expanded and updated second edition in 1877. Although he shortened its title on the second occasion, it is generally referred to as *Fertilisation of Orchids* and in some instances is known simply as *Orchids.*

The reason for Darwin's change of mind resulted from a sudden moment of insight. He had been tempted into the countryside where the meadows were full of cowslips. He was studying how they were adapted to be cross-fertilised by insects. Growing amongst them were the contrasting spikes of some Early-purple Orchids. Kneeling down to examine their flowers, he decided to mimic an insect probing for nectar and inserted a pencil into a flower. When he withdrew it, he was surprised to see that the orchid's pollinia were firmly attached by a small sticky pad at the base of each stalk. Then, as he watched, the pollinia slowly tilted forward though an angle of about 90° and splayed slightly apart. The movement took approximately 30 seconds and each time he tested a flower, exactly the same thing happened. He could see that the movement had placed the pollinia in the correct position to deposit pollen on the stigma of the next orchid flower. In fact, since insects were disturbed by these two little clubs sticking onto their heads they tended to fly off to another plant, rather than moving to another flower on the same spike. His discovery of this precision movement was a pivotal moment for Darwin.

Fig. 1: Christopher and Bridget Robbie being filmed in the roles of Charles and Emma Darwin at Downe Bank.
Fig. 2: HOS Down House field trip.
Photos by Irene Palmer

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Sexual reproduction was a major theme in the *Origin of Species*. Darwin realised it was an important factor in shaping natural selection. He had become aware of its importance while studying how animal breeders had speeded up natural selection. By selecting particular traits, they had changed the appearance of domestic stock so dramatically that they no longer bore any resemblance to their ancestors. Some plants, such as dates and wheat, had also been improved by human selection since ancient times. In Europe, the idea that plants reproduced sexually was highly controversial. It was widely believed that flowers fertilised themselves and the honey that the bees produced was part of God's bounty. Attempting to breed plants was considered interfering with the work of God, who had created flowers and fruits for our pleasure. Few dared to interfere with the work of the Creator. Despite this, Darwin realised that plants provided ideal experimental material and devoted countless hours quietly studying the role that insects played, diplomatically calling the bees "marriage priests."

Plants have to overcome a basic disadvantage because they are unable to move around to find a mate. In the course of his studies, Darwin learned that bi-laterally symmetrical flowers were pollinated by specialised insects. He even called them orchidaceous flowers because they resembled small orchids, so he knew that orchids themselves were probably pollinated by specialised insects. As he delved into the orchid world, he realised that this large and diverse family would provide convincing evidence to support his theory of natural selection. Even though he rarely saw insects visiting orchids himself, he was able to deduce that they had evolved a lock and key

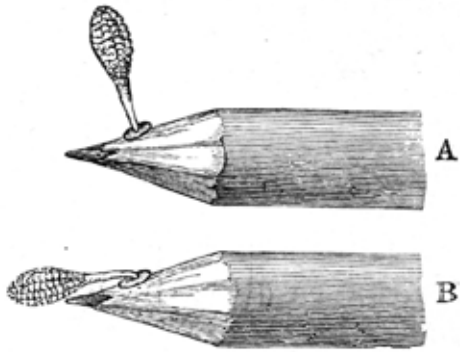

Fig. 3 (above): Darwin's drawings of Early Purple-orchid (*Orchis mascula*) pollinia on pencil. "A. pollen-mass of *O. mascula* when first attached | B. pollen mass of *O. mascula* after the act of depression."

Fig. 4: Bee Orchid (image stack) Fig. 5: Pyramidal Orchid
Fig. 6: Man Orchid (image stack) Fig. 7: Fly Orchid (image stack)
Photos by Alan Bousfield (Figs. 4, 6 & 7) & John Palmer (Fig. 5)


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relationship with their insect pollinators. After his orchid book was published it was said that if he had published his orchid book first, the *Origin of Species* would have received far less criticism.

Darwin had dissected the flower of the Green-winged Orchid while a student at Cambridge with Professor Henslow. He collected only six species during the *Beagle* expedition. His interest was aroused in this group of plants by Robert Brown. Darwin met Brown while he was living in London, after the Beagle expedition had ended. Brown had published a paper about the reproductive organs of orchids and milkweeds. It was also Brown who suggested that Darwin should read a book written by Christian Konrad Sprengel, 'The Secret of Nature Displayed.' Sprengel had made detailed studies of the way flowers were adapted to be pollinated by insects. Sprengel's work was controversial in his lifetime and eventually he became a recluse. He even recorded some of the insects that pollinated orchids but he didn't understand how orchid flowers were adapted for cross-fertilisation.

Darwin was critical of some aspects of Sprengel's work, particularly his idea that some orchids were nectarless deceivers. Darwin believed that insects obtained a sweet substance by piercing the cell walls of the nectar tubes of orchids that lacked nectar. He found it impossible to believe that insects would visit a flower unless they could obtain a reward. We now know that about a third of the world's orchids are nectarless deceivers. Some species appear to offer food, while others appear to offer sex to naïve male insects that attempt to mate with them.

After completing the garden tour, we drove about half a mile along narrow, winding lanes and parked in a field adjacent to Downe Bank. Ron and Lynne Wimpress, the owners of the field, kindly allowed us to picnic there and allowed us the privilege of using their garden loo.

Downe Bank is the Kent Wildlife Trust's oldest nature reserve. It is part of a much larger Site of Special Scientific Interest (SSSI), which includes the High Elms Estate, where Darwin's protégé John Lubbock, the first Lord Avebury lived. Experts believe that Downe Bank was the "entangled bank" that inspired Darwin's poetic last paragraph of the *Origin of Species*. It was there he described the complex interrelationships between living organisms. The passage became the first expression of an important scientific idea (the web-of-life) that underpins our work to conserve and enhance biodiversity today. It can be interpreted as a metaphor, because anyone can gain similar insights from a small patch of land anywhere in the world. The majority of the orchids grow in two chalky slopes within a woodland clearing. We saw a total of eight different species: Common-spotted Orchid, Common Twayblade, Pyramidal Orchid, Bee Orchid, Fly Orchid, White Helleborine and Fragrant Orchid. Downe Bank is the only local site for the Fragrant Orchid. Leaves of the Broad-

leaved Helleborine were just showing. The Man Orchid is seen occasionally but is difficult to detect amongst 2,000 twayblades. Sadly there was no sign of the tiny digger wasps *Argogorytes mystaceus* that pseudocopulate with the Fly Orchid. A couple of members managed to photograph them in action last year, shortly after I had filmed them with the entomologist George McGavin for The One Show. He had always wanted to see this event and said afterwards that it was one of the highlights of his life.

After making a circuit of the main part of the reserve, we drove to the High Elms Estate and the northern part of the SSSI. After parking in the Cuckoo Woods car park, we walked through a wooded part of the High Elms Estate. It is a country park today and is owned by the London Borough of Bromley. The path took us into another clearing with a beautiful orchid meadow, where we added the Man Orchid to our list. The plants were in excellent condition but we were disappointed that we were unable to add the Bird's-nest Orchid to our list, which had been flowering the previous year. Admittedly, the storm clouds overhead made the woodland very dark. Neither site can compete with some of the UK's major orchid sites but for anyone with a sense of history, there is a special pleasure to be gained from walking where Charles Darwin once walked and gained inspiration.

When the Kent Naturalists' Trust, as they were known at the time, bought Downe Bank, there were rumours that it was Darwin's "Orchis Bank". Research has since proved that they are the owners of a very historic site, which has become a place of pilgrimage for orchid and Darwin enthusiasts. The importance of Darwin's work led to his former home and the surrounding countryside being nominated as a World Heritage Site (Darwin's Landscape Laboratory). In the process of making the application, a great deal of research was done. Many improvements were carried out to sites of wildlife interest within the area and the interconnecting footpaths and bridle paths. Unfortunately the nomination was deferred for bureaucratic reasons. It seems unlikely that this will be concluded successfully, in view of the economic situation. This isn't necessarily a bad thing. There are pros and cons about World Heritage Sites and in the case of Downe there were concerns about attracting large numbers of people to such an intimately rural area. However, those of us involved with the area are very anxious about the future of the Greenbelt. Discussions are underway about the possibility of making the Downe countryside part of the County Wildlife Trusts' 'Living Landscape' initiative, linking parts of Kent, Greater London and Surrey.

Few people realise that there are more references from Downe in the *Origin of Species,* than from anywhere else Darwin visited. It was the weight of evidence from his work on plants that largely provided the evidence he needed to counter critics of his theory of natural selection. Darwin's orchid studies were of crucial importance.

Gait Barrows Field Trip
Charlie Philpotts

A group of 12 people were met by Rob Petley Jones, the Senior Reserves Manager, and Ian Taylor, Natural England's senior specialist (vascular plants). Ian gave a fascinating talk about the wider work of the Cypripedium Committee. This included how the work was carried out, the problems encountered and the genealogy of the slipper orchids. This was particularly interesting since there are various stories about the provenance of the orchids planted out. There are five release sites of which four have been proved with DNA sampling to be of true English parentage. The fifth which is Gait Barrows has been shown to have some European stock in it. Care has been taken to ensure this type is not planted out at other sites. Rob told us that the nearby Silverdale plant appears to have been vandalised, now being on its last legs with only two shoots remaining. We were shown around the site and saw where one plant had been dug up over the winter. The flowering plants were in an excellent state, the colour and form being very striking partly due to the judicious use of slug pellets. Rob does not like to use these but around one third suffered mollusc damage last year. Many other visitors were coming and going around the reserve showing how popular this site is. The weather was dull which was good for photographs, which everyone enjoyed taking, but it did prevent the many species of butterflies taking to the air. This site has a wealth of wildlife on it and there are designated routes around the site to enjoy the rich diversity.

After enjoying this site four of us went to The Lots nature reserve at Silverdale. A walk along the beach took us into the fields where Early-purple Orchids and Green-winged Orchids were to be seen in abundance. These were just past their best but still gave a stunning display growing amongst the other wild flowers set against the backdrop of the local countryside. Two of us continued on to Warton Crag which is a huge limestone cliff left by quarrying. Several birdwatchers were enjoying the birds whilst I found more Early-purple Orchids. This area has many fantastic reserves and I can recommend visiting the area and spending quality time here. The Cumbria Wildlife Trust and Natural England websites are good places to look up the reserves. I also recommend using motorways as much as possible to avoid being caught up in local traffic as I was on the way up!

Fig. 1 (above): Notice about stolen Lady's-slipper Orchid
Fig. 2: Lady's-slipper Orchid Gait Barrows.
Fig. 3: HOS members at Gait Barrows.
Photos by Charlie Philpots

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Saaremaa – Wild Orchid Paradise

The Saaremaa 5th Orchid Festival 2017
Promoting the native orchids of Saaremaa island, Estonia, and based in Vilsandi National Park. Combining nature and cultural heritage with lectures and guided tours, also classical music concerts and art classes. Guided tours by leading Estonian orchid expert Tarmo Pikner, author of the endemic Saaremaa Marsh Orchid *Dactylorhiza osiliensis* (see photo).

The Orchid Festival covers four independent weekends from late May to early July to allow the widest variety of orchids to be seen.

For more details contact:
Maarika Naagel - maarika.naagel@gmail.com -
general programme manager, travel, concerts
Tarmo Pikner - tarmopikner@gmail.com - all orchid information
Simon Tarrant - tarrant.simon@outlook.com - contact in UK
web: orhideefestival.eu