

# THE FLOWER OF THE EUROPEAN ORCHID

## FORM AND FUNCTION

*JEAN CLAESSENS JACQUES KLEYNEN*





European orchids are enigmatic flowers, attracting many nature enthusiasts. Many orchid lovers travel long distances to study and photograph wild orchids. The authors of this book were equally attracted by the hidden beauty of the orchids.

Jean Claessens (l) and Jacques Kleynen (r) are nature photographers specialized in extreme macro photography. After an initial period of getting acquainted with the orchids, they got interested in the structure and function of the orchid flower and started studying the flower morphology. The findings of their studies were presented in a series of articles and contributions to various conferences. This book is the result of many years of studying and photographing orchids throughout Europe. It contains numerous, never before published, extremely detailed photographs of the orchid flower. The book presents all aspects of the orchid flower: photographs of the column, microscopic sections, SEM-photos, flower diagrams, pollinators, rosette and fruit set. In the text the relationship between flower and pollinator is emphasized. All European orchid genera are treated. Various appendixes contain supplemental information on pollinators, fruit set, autogamy, seed number and bending time of the caudicles. This book gives an astonishing view of many hidden aspects of the European orchids. The authors hope you will be equally intrigued and fascinated as they have been all these years.

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Photo endpaper: *Megachile willughbiella* with pollinaria of *Serapias cordigera*

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# FOREWORD

Which features make the flower of an orchid (almost) unique? What allows us to distinguish among orchid flowers pollinated by moths, butterflies and bees? How do bee orchids deceive naïve male insects into attempting to mate with their flowers? Answers to these and many other burning questions are provided by this highly informative and lavishly illustrated book, which will fit equally comfortably on the bookshelf of a professional botanist or the coffee table of an enthusiastic novice.

European terrestrial orchids have long attracted a degree of interest that is far greater than the proportion of the overall flora that they represent (somewhere between 2% and 4.5% of native species of flowering plants, depending mainly on the chosen taxonomic treatment of the cute but troublesome bee orchids). For some mainstream botanists, this adulation is a source of annoyance or even poorly concealed jealousy. But those of us who have already succumbed to the allure of terrestrial orchids can easily explain our obsession. Few families of plants have contributed more to our understanding of evolutionary mechanisms ... or generated more controversy regarding formal classification! And no other family of plants can match the orchids for their sheer charisma – a property that mainly reflects their complex flowers and diverse pollination syndromes.

Ever since Charles Darwin published his characteristically thoughtful treatise on *The various contrivances by which orchids are fertilised by insects*, orchid experts have paused periodically to take stock of advances in our knowledge of particular orchidological topics. Some authors have focused on selected aspects of orchid biology or ecology, such as their relationships with pollinators or mycorrhizal fungi. Others have provided either increasingly informative and well-illustrated orchid floras of individual countries within Europe or monographs of particular groups of orchids that span the whole of Europe.

Here, Jean Claessens, Jacques Kleynen and their collaborators have produced a thoroughly researched volume that combines all of these concepts, thereby presenting an unparalleled account of the floral structure and reproductive biology of the orchids of Europe and Asia Minor. The immense amount of fieldwork conducted by the authors has generated a fund of new data – much of it not published elsewhere – that underpins their accounts of the morphology, ecology and biogeography of their orchidaceous subjects. By choosing to focus their comparisons at the genus level rather than the species level, the authors have mitigated the impact of current debates on the most appropriate species concepts to apply to European orchids and, more importantly, they have felt free to focus their attention on whichever species best illustrate particular properties of each genus. A further key decision – to follow the DNA-influenced recircumscriptions of genera presented in the multi-volume monograph *Genera Orchidacearum* – has allowed the authors to limit discussion of the classification of European orchids and thereby to focus on the topics that most excite them – the detailed appearance and pollination biology of the orchid flowers.

Illustration is a key aspect of this book. Aesthetic full-page portraits are followed by innovative composite plates that include vegetative shoots, mounted flowers and various visiting pollinators. Pictorial treatment of the often overlooked sexual organs of the orchids is especially thorough, assisted by excellent light micrographs of anatomical sections by Gregorio Fazzi and scanning electron micrographs of pollinaria and pollen grains provided by Matthias Svojtka. And these fine images are further enhanced by a pleasing, user-friendly layout, together constituting a benchmark volume.

Lastly, this is a book that laudably encourages further thought, by revealing that some major scientific uncertainties remain to further torment us. For example, how many observations, made over what spatial and temporal scales, are needed before the pollination of a particular orchid can be considered adequately characterised? How many different lines of evidence should be pursued before a particular feature of an orchid can confidently be regarded as a long-term adaptation? And can the transient evidence of gene exchange provided by observations of pollinators be successfully resolved with the long-term averaging of evidence of gene exchange that emerges from DNA-based studies? I, for one, would be disappointed if we had satisfactory answers to *all* of our questions – after all, such ongoing uncertainties and controversies help to justify continued exploration of these wonderful plants. Claessens and Kleynen's landmark work will certainly speed us along on this marvellous journey of enlightenment.

Professor Richard Bateman

## Anther

An anther is basically the terminal part of a stamen, forming an oblong structure of two lobes which each contain two sacks in which the pollen matures. During evolution most of the six original anthers changed into sterile structures (auricles, staminodes) or disappeared. In the European orchids *Cypripedium* is the only genus with two fertile anthers. These are the lateral stamens of the inner whorl (Kurzweil 1993). As an adaptation to the pollination mode (sticky pollen is scraped off the anther and deposited on the pollinators' back), the anther contains no dry pollen but produces a sticky substance, the elastoviscin, in which the pollen grains are embedded (Pacini & Hesse 2002). Early in development the quartering of the anther is visible, but later on the subdivision disappears and the anther appears as one mass of viscid matter. In older systematics *Cypripedium* was placed in the sub-family Diandrae, all orchids with two or three anthers.

All other European orchids have only one anther, the median one of the outer whorl and formerly they were grouped in the sub-family Monandrae (Kurzweil 1987b). Form and number of pollinia are determined by the morphology of the anther. The anther is divided into four cells and many (mainly tropical) orchids have four pollinia (as in *Corallorrhiza trifida*). Most European orchids have two pollinia, subdivided into two halves which are juxtaposed and have a flat side. In some genera the pollinia are not juxtaposed but superposed, as in *Hammarbya paludosa*.

Normally in flowering plants (as in the genus *Lilium* or *Tulipa*) the filament of the anther is long but in many European orchids it is no longer visible and the anther is attached at a broad base to the column. Examples of such attachment can be found in *Dactylorhiza*, *Gymnadenia* or *Ophrys*. In some primitive genera however the filament is visible, enabling some movement of the anther as in *Epipactis*. *Limodorum* and *Cephalanthera* have a long filament making the anther hinged so that it can easily be pushed backward. This facilitates attachment and transport of the pollinia by the pollinator. The two anther lobes are connected by tissue of the filament, called the connective. In some cases it can form a beaklike elongation, as in *Ophrys apifera* or *Serapias*.

The position of the anther may change during development. Anther position is an important feature in orchid classification. In most groups it is erect and parallel to the axis of the column, as in *Orchis* or *Himantoglossum*. In most Epidendroideae the anther bends forward during a late developmental stage (Kurzweil 1987a). Due to dorsal growth of the column the anther becomes inflexed, as in *Cephalanthera longifolia* or *C. damasonium* (Rasmussen 1982, 1986).

Growth of the filament can promote autogamy, as the pollinia are pushed into the stigmatic fluid due to the forward movement of the anther (Claessens & Kleynen 1998, Claessens *et al.* 2000). Pollinia and, if present, caudicles grow in the anther. When, in development, the anther opens, the pollinia or caudicles contact the viscidium or viscidia and grow together. However, this does not always take place. In *Epipogium aphyllum* the ribbon-shaped caudicles curl over the viscidium after opening of the anther but do not fuse with it. The anther of *Neottia ovata* has an outgrowth of the connective, partly covering the anther. The function of this is not yet clear. In some species like *Neottia ovata* and *N. nidus-avis* the sides of the anther dehydrate and curl up, freeing the pollinia. In other species, due to the same process of dehydration, the anther opens wide during anthesis. Thus, the pollinia are easily dehisced and may fall onto the stigma below, causing autogamy. Examples of this are found in *Pseudorchis albida* and *Neotinea maculata*.

## Clinandrium

The clinandrium is a cavity on the upper side of the column in which the anther lays and in which the pollinia are deposited. It is made up from the filament and lateral outgrowths of the column. In some genera it is a deep cavity, (as in *Epipogium aphyllum*, whereas in other genera it is only a hollow divided in two by a slightly raised ridge, as in *Epipactis helleborine*. In earlier works the term androclinium was used (Reichenbach 1851) but the term is no longer current.

## Pollen

In seed plant reproduction the pollen grains represent the highly reduced male gametophyte. The outer layer (exine) of the two-layered pollen wall is physically and chemically highly robust and protects the enclosed cellular content from rapid desiccation and overall damage (HESSE *et al.* 2009). The exine surface shows a distinct ornamentation, for example psilate

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Fig. 17: *Phalaenopsis* sp., column with anther, stipes and viscidium

Fig. 18: *Phalaenopsis* sp., inside of the anther

Fig. 19: *Calypso bulbosa*, column

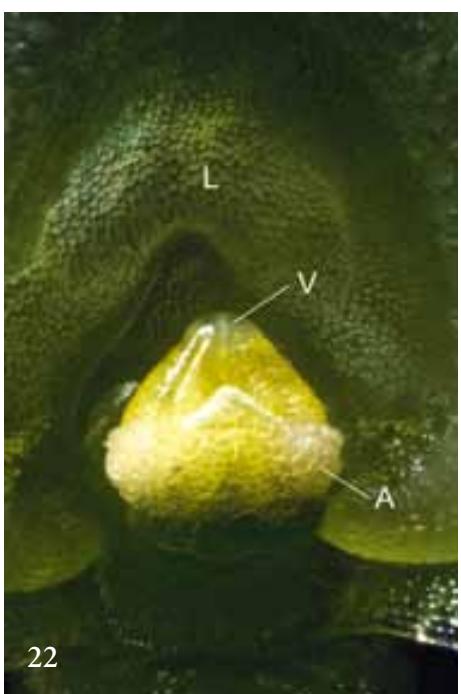
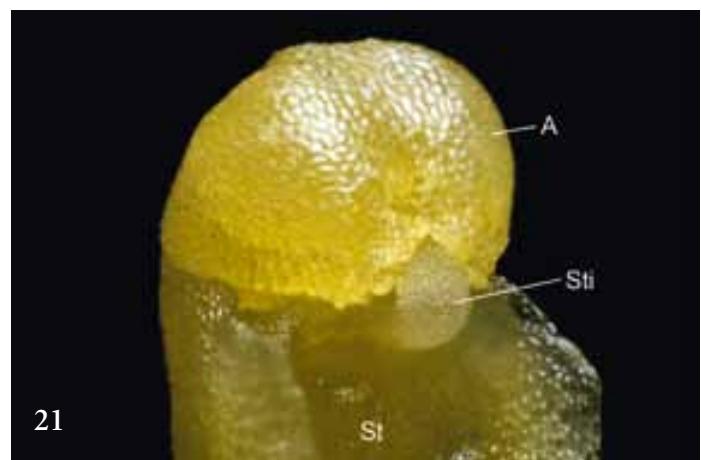
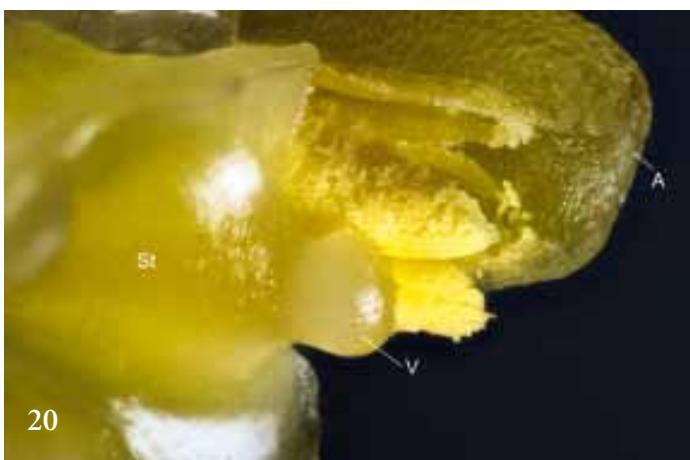
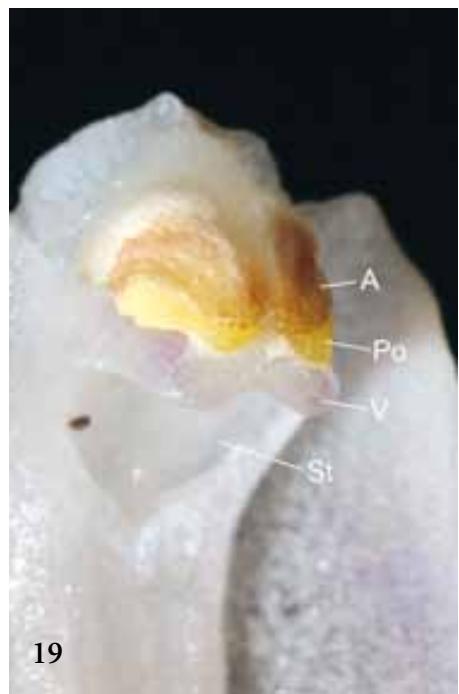
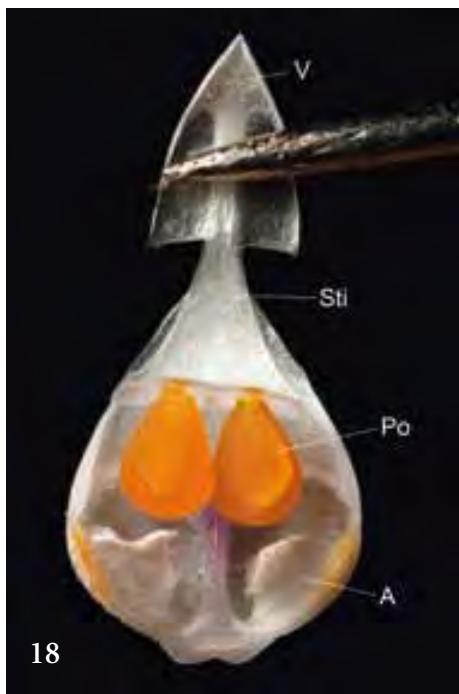
Fig. 20: *Epipactis palustris*, column from below  
with stigma, viscidium and protruding anther with pollinia

Fig. 21: *Corallorrhiza trifida*, column with hook-like stipes

Fig. 22: *Malaxis monophyllos*, column with droplet-like viscidium

Fig. 23: *Platanthera chlorantha*, viscidium covered with scales of a  
visiting moth

Fig. 24: *Himantoglossum metlesicsianum*, pollinarium with common  
viscidium, sticking out of the anther





# CYPRIPEDIUM L. 1753

## DESCRIPTION

The genus *Cypripedium* has its main distribution in North America. The only European representative is *C. calceolus* L. The plant has a thick, creeping **rhizome** and three or four green or brown, broad sheaths at the stem base. The large and stem-embracing vivid green **leaves** are broadly ovate-lanceolate, acute. Their margins and the prominent veins have furrows. The green **stem** is 20 to 60 centimetres high, erect and round. It is glabrous at the base and has short, dense hairs on the upper part. The erect, green **bracts** are leaf-like, broadly lanceolate and larger than the flowers. The green, long, slender **ovary** sits on a straight pedicel and is covered by fine hairs. There are one or two large **flowers** with a yellow lip and a brownish-purple perianth. There are two lanceolate or ovate-lanceolate, slightly bow-shaped, more or less sinuate **sepals**, 3 to 5 cm long. The median sepal is broader and erect. The other sepal, the so-called **synsepalum**, is downward pointing and is formed by the fusion of the two lateral sepals and has a forked tip. The margins are often somewhat reflexed and shortly pubescent with longer hairs at the base. The acute, linear or linear-lanceolate **petals** are twisted, ribbon-like and downy on the inside. The large, bright yellow pouch-shaped **lip** is slipper-shaped and has an oval opening with inwardly curved edges. At the base it ends in two upright lateral, ear-like ridges. On each side it has a small auriculate opening between the lip base and the column. The lip walls show translucent spots, the so-called "windows". On the bottom of the lip are longitudinal veins, covered with red elevations, which are scattered at the apex from the column but get denser towards the lip base. From the elevations rise long translucent hairs that are quite long and get denser underneath the column. No **spur** is present. The scent is fruity.

The yellow-green **column** is massive in size and consists of three lobes which are attached to a short base. The side lobes each carry a lateral, fertile anther. The middle lobe is curved obliquely downward and expands in a shield-like body to form the terminal stigma. The back of the column ends in a large stalk bearing a large, oblong-obovate staminode. The staminode is obtuse, gutter-shaped on top, yellow-whitish with a red punctuation and keeled on the back. The two lateral **anthers** are borne on a thorn-like filament that is longer than the anthers. The **pollen** consists of single pollen grains, called monads and is not powdery but is held a sticky fluid kept in the anther. No **viscidia** are present. The **stigma** is large, triangular with rounded angles and has three lobes. It is convex on the outer side but slightly concave in the centre. The stigma is dry, not sticky and covered with obliquely downward pointing papillae.

Chromosome numbers:  $2n=20, 22$

## Morphological adaptations

For European orchid lovers, *C. calceolus* is the absolute number one species. It has the largest flowers of all the European genera and the yellow lip is quite eye-catching and attractive. The brownish purple perianth forms a strong contrast with the lip and enhances its conspicuousness. The lip is slipper-shaped and has incurved margins. The inner side walls of the lip are covered with an oily secretion. The bottom of the lip is ornamented with red elevations and hairs pointing in the direction of the column. *C. calceolus* is the only representative in Europe of the Diandreae, a group of orchids having two fertile anthers. The anthers are placed left and right of the stigma, partly blocking the auriculate

openings at the lip base. The stigma is large and shield-like. In contrast with all other European orchids, *C. calceolus* has a dry stigma, not covered with stigmatic fluid. The stigmatic surface is covered with minute papillae, pointing downward obliquely. The pollen grains are not mealy but are embedded in a sticky fluid.

## Pollination

Insect visitors land either on the lip margins or on the prominent staminode that is covered with a pattern of crimson dots and stripes. A similar pattern can also be found on the bottom of the lip; those patterns function as false nectar guides. Bees are attracted by the yellow lip and the fruity scent emitted by the

sepals and petals. They land on the staminode or on the lip margins and fall or fly into the lip pouch. Escaping by climbing the walls of the lip or the staminode proves to be impossible for genuine pollinators, that are insects with the right body size. After crawling around excitedly for some time they start searching in the lip for a possible exit and eventually find the two auriculate openings at the lip base. They first have to get past the stigma, which is pointing downwards in the opening of the pouch. The bees have to work hard to crawl up the narrow space between lip tissue and anther. The opening is narrow and when wriggling through the bees get smeared with the sticky anther fluid containing the pollen. If they leave a new flower, the anther smear will be scraped off the insects' back by the downward pointing papillae of the dry stigma.

## Observations

Müller (1883) supposed that the colour and scent of the orchid attracted insects. Daumann (1968) investigated the distant attraction in order to find out if colour, scent or both attracted insects. He observed that *Andrena* females, the genuine pollinators of *C. calceolus*, flew straight towards the flower irrespective of the wind direction. The insects continued to visit the flowers when he cut off the sepals and petals but when the lip was cut off (with sepals and petals remaining) no insect paid attention to the flower. If a flower was placed in a glass tube that was closed at the top but open on the lower side, the insects flew straight to the flower and not to the open lower end of the tube where the easily perceptible scent was released. These tests showed that in distant attraction the yellow lip is a key factor. Nilsson (1979) found that out of 118 bees (Andrenidae and Halictidae) which passed within a metre of a group of flowering *C. calceolus*, 80.5% were attracted and flew towards one of the flowers. When the bees were quite close, they sometimes showed an undulating flight, suggesting a local chemical stimulation, probably due to the somewhat fruity scent.

If the slipper was cut off, scent was still emitted (Ziegenspeck 1936). Daumann (1968) investigated the sites of scent production and concluded that neither column nor lip but only sepals and petals emitted the scent. According to Stoutamire (1967) sepals and lateral petals are the main sources of scent production, whereas the lip produces a weaker scent. The scent is described as fruity, reminiscent of oranges (Wagner 1982) or the coating of apples (Nilsson 1979).

Analyses of the floral fragrance showed that the volatile compounds were found in the flower parts, not in the staminode (Nilsson 1979), supporting Daumann's conclusion about the region of scent production. Octyl and decyl acetates dominate the scent, although other substances common in flower and fruit scents are found in small quantities. The large quantity of acetates is quite unusual. Acetates are also found in the cephalic pheromone secretions of *Andrena* species. The *Andrena* males odour-mark objects in order to attract females and as a side-effect this also attracts and assembles other males. Several of the female bees that visit *C. calceolus* produce alpha-farnesene in the abdominal Dufour glands. The bees scent the soil around the nest entrance, attracting males and females to land near the nest-site. The scent emitted by the flower probably disturbs the normal landing pattern, attracting bees by pheromones and inducing them to land on the lip (Nilsson 1979, Bergström *et al.* 1992).

Influenced by Darwin (1877), many authors thought that the inflected lip margins served as a mechanism for preventing insects from crawling out of the lip (Müller 1868, Summerhayes 1951, Faegri & van der Pijl 1966.) The lip margins and inside

Fig. 01: *C. calceolus*; Ga, La Bâtie 01.06.2008

Fig. 02: *C. calceolus*; Ga, La Bâtie 01.06.2008

Fig. 03: *C. calceolus*; Ga, la Bâtie 01.06.2008

Fig. 04: *C. calceolus*; Ga, la Bâtie 01.06.2008



Fig. a: *C. calceolus*, monads on stigmatic surface with developing pollen tube, SEM-photo M. Svojtka

Fig. b: *C. calceolus*, monads, SEM-photo M. Svojtka

Fig. c: *C. calceolus*, monads, SEM-photo M. Svojtka



01



02



03



04



# EPIPACTIS ZINN 1757

## DESCRIPTION

*Epipactis* species have a horizontal or vertical **rhizome** but no tubers. The **leaves** are very variable in size and shape, sheathing at the bottom but circular to lanceolate higher up. They are more or less spreading and green to more purple, often with marked veins. Often the upper leaves are bract-like. The **stem** is pubescent to glabrous (especially in the autogamous species) and coloured green to purple. The **inflorescence** is more or less unilateral. The lowest **bracts** can be much longer than the ovary and leaf-like whereas further up they usually decrease in size. The **ovary** is clavate and placed on a distinct, twisted pedicel. The **flowers** are spreading or pendulous, often bell-shaped and sometimes cleistogamous. They vary in colour but often are green to brown-purplish. **Sepals** and **petals** are about the same shape, with the sepals generally a bit longer and brighter coloured than the petals. The **lip** consists of two parts: an apical, more or less triangular part, the **epichile** and a cup-shaped basal part, the **hypochile**. The epichile can be covered with bosses or ridges, the so-called **calli** and can be white, green to red-brown. It is connected to the hypochile by means of a narrow part that can be either hinged or immovable. The hypochile is coloured red-brown on the inside and on the bottom nectar can be secreted. A **spur** is absent.

The **column** is short, erect and broader at the apex. The **anther** is erect, ovoid or more oblong-ovoid and connected to the column base by a very short or somewhat longer filament. The anther is divided into two oblong anther cells containing two **pollinia** that consist of pollen tetrads with very different degrees of cohesion. A pollen bed, the **clinandrium**, can be formed on the upper side of the stigma. Left and right of the anther are two more or less prominent staminodes but no auricles. In most allogamous species the **viscidium** is well developed and visible as a round globular mass of viscid fluid, covered by a thin membrane. At its back, a small pointed projection is connected to the pollinia. No caudicles are formed. In the autogamous species, the viscidium is either reduced or completely absent. The **rostellum** is small, one-lobed, forming a small bulge in most allogamous species and a triangular protrusion in most autogamous species; it is rarely completely absent. The **stigma** is three-lobed, transversely oblong or sub-quadrangular and cushion-like, slightly concave in the centre with convex lobes. In most species the median lobe is the largest.

Chromosome numbers:  $2n=16, 18, 32, 36, 38, 40, 52, 60$

## Morphological adaptations

The flowers are green-brownish to purplish with a lighter coloured, more whitish lip. The epichile is triangular or heart-shaped and is decorated with more or less prominent wrinkled bosses or ridges, the calli. The hypochile is cup-shaped, generally red-brownish on the inside. This is where the nectar is secreted, sometimes in large quantities. The transition between epichile and hypochile is generally rigid but is flexible in some species. The column is a robust, forward-projecting structure placed above the hypochile. The anther is divided into two anther chambers in which two powdery pollinia develop. In the allogamous species the coherence of the tetrads composing the pollinium is good, but in the autogamous species the tetrads can be only loosely connected. The upper side of the column is

hollowed out creating a shallow cup, the clinandrium in which the pollinia are deposited when the anther is ripe and opens. The staminodes form the sides of the clinandrium. The viscidium can be a prominent structure, placed at the upper stigmatic rim. At anthesis it is already connected to both pollinia. The viscidium is covered by a minute membrane which bursts when touched. The stigma is backward sloping and concave, presenting maximum surface and optimal shape for receiving pollinia. The broad side-lobes enlarge the stigmatic surface. It is quite sticky, allowing it to hold the pollen grains that are deposited.

## Pollination

Visitors, above all wasps, are attracted by the scent and the dull, olive-green wasp colours. Once they have visited an *Epipactis*

flower, they have learned that in most species the lip contains nectar. Wasps generally show a purposeful behaviour and fly straight towards the *Epipactis* plants. They alight on the lip and take a position on the epichile with their head turned towards the column. The surface structure of the epichile as well as the crenate epichile margin, offers the larger visitors a good hold. In order to reach the nectar offered in the hypochile, the insect has to bend forward. In doing so the insect touches the viscidium which releases a milky adhesive that instantly hardens when exposed to the air. The pollinia are attached either to its head or to the thorax, depending on its size. The pollinia do not seem to hinder the wasps very much, because they show little grooming behaviour and fly or creep from flower to flower. When a new flower is visited, the pollinia are pressed against the stigma. The pollinium does not stick to the stigma as a whole, but loses only small amounts of pollen grains that stick into the stigmatic fluid. This means that multiple flowers can be pollinated with one pollinium. The potentially dangerous all-or-nothing strategy of the allogamous *Epipactis* (losing all its pollen in one action) is compensated for by the ability to pollinate more flowers. Usually *Epipactis* plants show many flowers open at the same time. This

can be profitable, because this enhances the chance of being visited by a pollinator.

## Observations

*E. palustris* (L.) CRANTZ is the most showy and conspicuous orchid of the genus. Together with *E. veratrifolia* BOISS. & HOHEN., it belongs to the section *Arthrocilium* IRMISCH, characterised by a non cup-shaped hypochile with lateral lobes and a hinged lip. The flowers are purplish-white and open wide. The epichile is white and has large calli with a central groove at the lip base. The calli have yellow-orange margins, serving as pseudo-pollen. This is also the place where small amounts of nectar are secreted. They serve as a “taste nectar guide”, helping visitors to attain the right position for pollination (Brantjes 1981a). The hypochile is rather flat with upright, red-striped side-lobes. On the inside there is an irregular pattern of dots forming the nectar secretion zone. The spurless flower with freely accessible nectar is a typical bee-flower (Faegri & van der Pijl 1971). Entering the flower and removal of the pollinia proceed as described above. Nilsson (1978b) investigated scent production but could not detect any emitted compounds. Apparently, scent does not play a role in the attraction of pollinators.

Darwin (1877) studied pollination of *E. palustris* in detail and stated that the hinged lip was crucial in the pollination process. His “springboard” hypothesis, based on observations of the flower morphology, explains the importance of the lip structure. Suppose a small insect visitor alights on the lip. When entering the flower it will press down the epichile. However, in order to

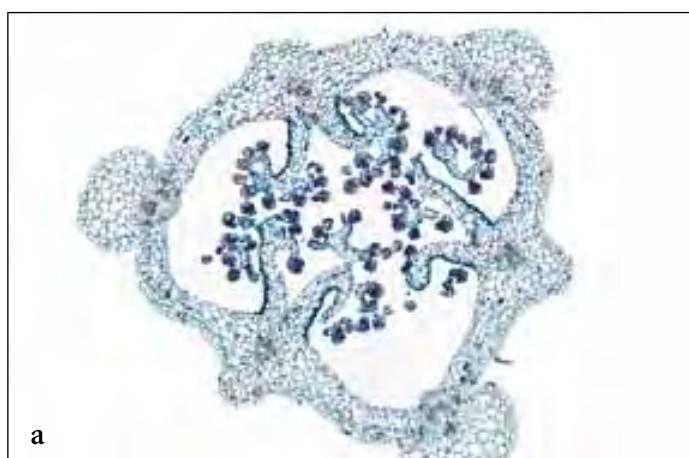


Fig. 01: *E. purpurata*; Ge, Eschweiler 10.08.2010

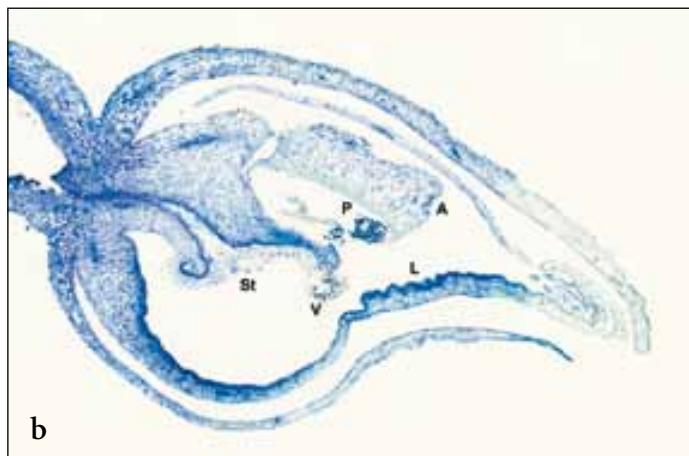


Fig. 02: *E. helleborine*

Fig. 03: *E. purpurata*; Ge, Eschweiler 10.08.2010

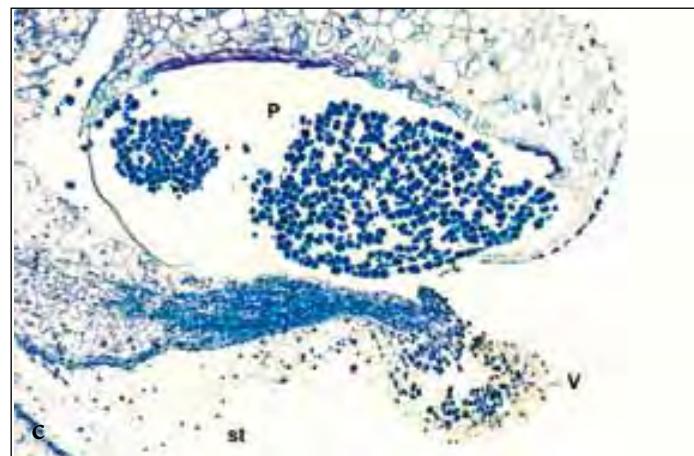
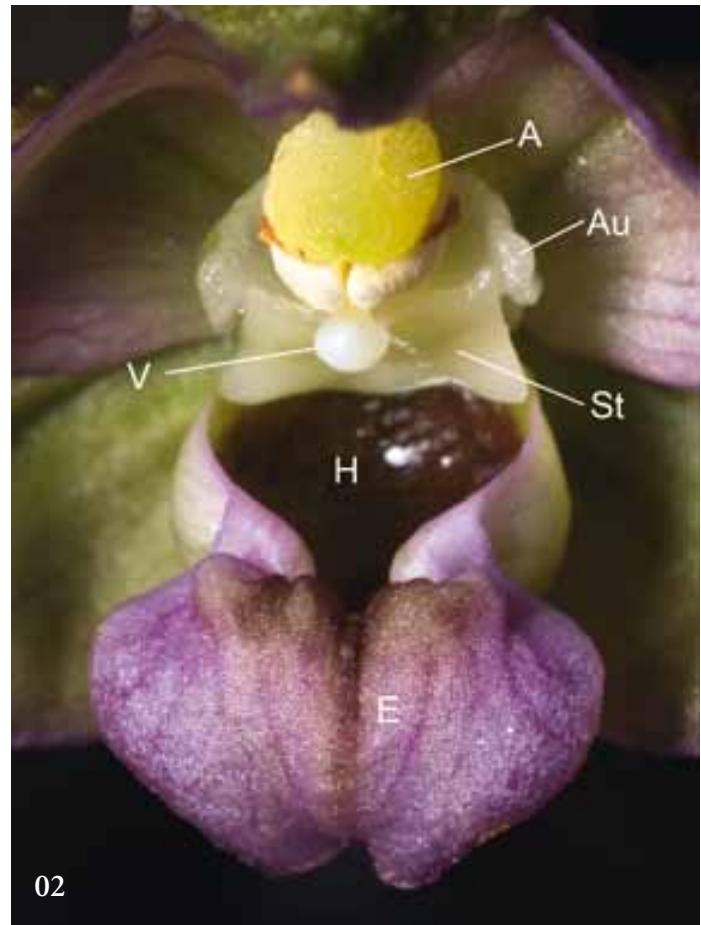


Fig. c: *E. helleborine*, 25x, column with large detachable viscidium, microscopic section by G. E. Fazzi

Fig. a: *E. helleborine*, cross section ovary, 12.5x, microscopic section by G. E. Fazzi

Fig. b: *E. helleborine*, 12.5x, microscopic section by G. E. Fazzi



beginning of the *L. vernalis* flowering season the queens did not pay attention to *O. pallens* but later on they turned regularly to the orchids, where they probed one to four flowers and then returned to *L. vernalis*. When nectar production decreased the queens re-examined the flowers of *O. pallens*. Vöth (1982a) assumed that the scent of *L. vernalis* masked that of the orchid preventing the queens from differentiating nectariferous flowers from deceit flowers.

The effect of scent in the genus *Ophrys* is well documented (e.g. Schiestl *et al.* 1999, 2000, Ayasse *et al.* 2000, Borg-Karlsson *et al.* 2003). It plays a vital role in attracting male bees, encouraging them to copulate with the flower. In *Orchis* however there are hardly any examples of sexual deceit. One possible exception is *Orchis galilea* (BORNM. ET SCHULZE) SCHLTR., which attracts only males of *Halictus marginatus* BRULLÉ. The flowers emit a typical, musk-like scent that is so strong that even humans can easily perceive it. Males show the typical searching behaviour of bees guided by olfactory cues, making a downwind approach. Experiments with covered flowers showed that the bees were attracted by the strong scent (Bino *et al.* 1982). The authors found *H. marginatus* males which carried pollinaria from plants growing at least 200 m. away. Because only males were involved in pollination, Bino *et al.* (1982) suggested that the pollination of *O. galilea* is based on sexual attraction. Further experiments are needed to confirm this hypothesis.

Recently the monospecific genus *Aceras* was transferred to the genus *Orchis* (Pridgeon *et al.* 1997). *O. anthropophora* (L)

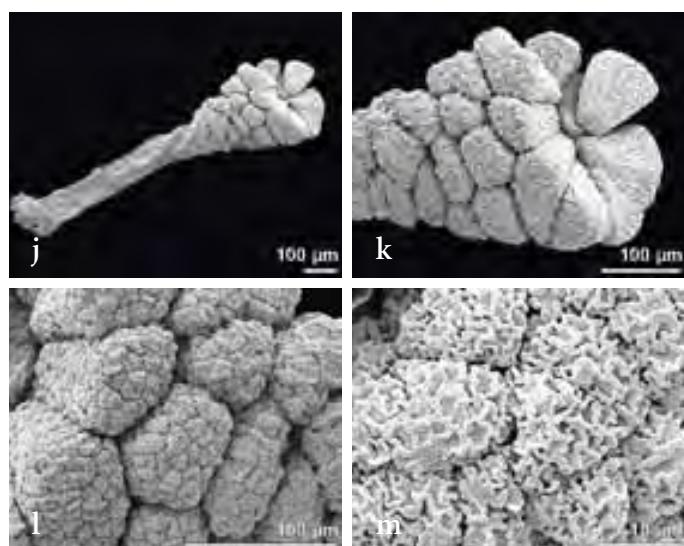


Fig. j: *O. anthropophora*, pollinarium, SEM-photo M. Svojtka

Fig. k: *O. anthropophora*, massulae composing the pollinium, SEM-photo M. Svojtka

Fig. l: *O. anthropophora*, massulae, SEM-photo M. Svojtka

Fig. m: *O. anthropophora*, tetrads in massulae, SEM-photo M. Svojtka

**ALLIONI** is a rather inconspicuous plant due to its yellow-green colours. A close look reveals the strong puppet-like appearance that is reflected in many local names (man orchid, l'homme pendu, Puppenorchis, Ohnhorn). Often, it grows in larger groups, enhancing its attraction. The flowers are closely packed, making it easy for visiting insects to crawl from flower to flower. The plants emit a rather strong, unpleasant scent that serves as a means of long-distance attraction. The lip has a more or less shiny appearance, caused by the large ovoid, protruding, translucent cells covering it. The two white folds at the lip base guide the insect's tongue towards the centre of the bursicle and stigma. The two tiny hollows at the lip base can be considered as the precursors of a spur. Darwin (1877) interpreted them as nectaries, an opinion followed by many authors (Godfrey 1933, Summerhayes 1951, Ziegenspeck 1936, Davies & Huxley 1983, Vöth 1999b, Berger 2003, Lang 2004, Arbeitskreise Heimische Orchideen Hrsg. 2005). Although we examined almost 1,300 flowers, we never observed the presence of nectar. The green hollows at the lip base are dry and do not glisten and we assume that *O. anthropophora* produces no nectar.

Insect visits are quite scarce and generally involve rather small bugs or ichneumoid wasps. Observations, especially of the ichneumoid wasps, are difficult because they are easily disturbed. Due to their size the visitors can enter the flower without difficulty and look for nectar inside the flower. They seem to be attracted by some means for they can stay in the flower for a long time, retreating and entering again several times. In doing so they touch the viscidia and get a pollinarium attached to their head or thorax. Little is known about the pollination of *O. anthropophora*, yet this genus can be quite dominant, especially in the Mediterranean region. In recent literature there are some pictures of insects carrying pollinaria of *O. anthropophora*. Reinhard *et al.* (1991) show a picture of a click beetle (probably *Cidnopus minutus* L.). The beetle carried three pairs of pollinaria, indicating that it must have visited at least three different flowers. Similarly, Presser (2000) depicted a click beetle. Berger (2003) depicts *Cantharis*

Fig. 12: *O. spitzelii*, column

Fig. 13: *O. spitzelii*, column

Fig. 14: *O. simia*, column

Fig. 15: *Bombylius minor* on *O. mascula*; Ga, Gigors-et-Lozeron 03.05.2010

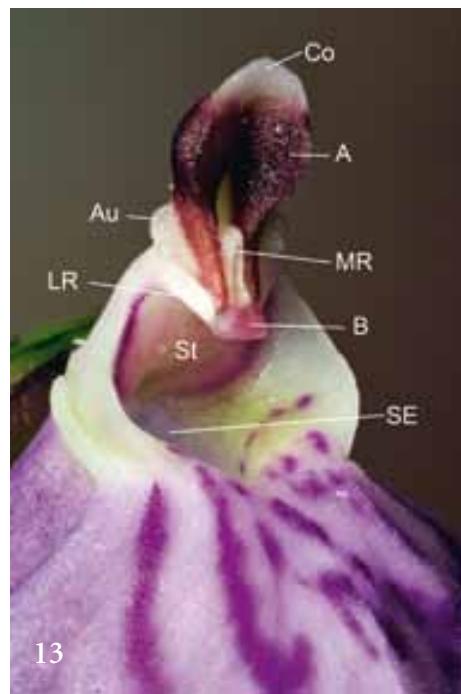
Fig. 16: *O. militaris*, flower diagram

Fig. 17: *O. purpurea* fruit set; Ga, Trésanne 31.05.2009

Fig. 18: *Apis mellifera* pollinating *O. militaris*; Ho, Wijlre 19.05.2007

Fig. 19: *Andrena* sp. pollinating *O. militaris*; Ga, St-Genis 07.05.2010

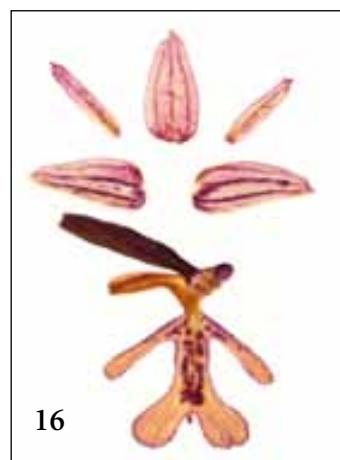
Fig. 20: *Bombus* sp. and *Andrena* sp. on *O. simia*; Ga, St-Genis 07.05.2010



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# APPENDIX I: POLLINATORS

Orchid and insect names are as cited in the reference articles

Pollinator	Order	Reference	Pollinator	Order	Reference
<b>Anacamptis boryi</b>			<b>Anacamptis papilionacea</b>		
<i>Apis mellifera</i> L.	Hymenoptera	Gumbert & Kunze 2001	<i>Anthophora crinipes</i> SMITH	Hymenoptera	Scopece <i>et al.</i> 2009
<i>Bombus</i> sp.	Hymenoptera	Gumbert & Kunze 2001	<i>Anthophora retusa</i> L.	Hymenoptera	Scopece <i>et al.</i> 2009
<b>Anacamptis collina</b>			<i>Apis mellifera</i> L.	Hymenoptera	Vöth 1989
<i>Eucera longicornis</i> L.	Hymenoptera	Cingel, van der 1995	<i>Bombus humilis</i> ILLIGER	Hymenoptera	Cozzolino <i>et al.</i> 2005
<b>Anacamptis coriophora</b>			<i>Eucera bidentata</i> PÉREZ	Hymenoptera	Vöth 1989
<i>Dinoptera collaris</i> L.	Coleoptera	Berger 2006a, 2007b	<i>Eucera caspica</i> MORAWITZ	Hymenoptera	Scopece <i>et al.</i> 2009
<i>Oedemera nobilis</i> SCOP.	Coleoptera	Berger 2004	<i>Eucera longicornis</i> L.	Hymenoptera	Bournéries 1998
<i>Tachina fera</i> L.	Diptera	Bournéries 1998	<i>Eucera nigrescens</i> PÉREZ	Hymenoptera	Cozzolino <i>et al.</i> 2005;
<i>Andrena</i> sp.	Hymenoptera	Reinhard <i>et al.</i> 1991;	<i>Eucera tuberculata</i> FABR.	Hymenoptera	Scopece <i>et al.</i> 2009
<b>Anthidium</b> sp.	Hymenoptera	Dafni & Ivri 1981a	<i>Bombus terrestris</i> L.	Hymenoptera	Vogel 1972
<i>Apis mellifera</i> L.	Hymenoptera	Berger 2004	<i>Megachile parietina</i> GEOFFREY	Hymenoptera	Scopece <i>et al.</i> 2009
<i>Bombus pratorum</i> L.	Hymenoptera	Berger 2004; Schatz <i>et al.</i> 2005	<i>Nomada agrestis</i> FABR.	Hymenoptera	Vöth 1989
<i>Halictus quadricinctus</i> FABR.	Hymenoptera	Bournéries 2005	<i>Nomada basalis</i> HERR.-SCHÄFF.	Hymenoptera	Vöth 1989
<i>Trielis villosa</i> FABR. var. <i>rubra</i> JUR.	Hymenoptera	Vöth 1975	<i>Nomada imperialis</i> SCHMIEDECKN.	Hymenoptera	Vöth 1989
<i>Xylocopa valga</i> GERSTÄCKER	Hymenoptera	Berger 2004	<i>Nomada nobilis</i> HERR.-SCHÄFF.	Hymenoptera	Vöth 1989
<i>Lasioglossum</i> sp.	Hymenoptera	AHO (eds.) 2005	<i>Nomada propinqua</i> HERR.-SCHÄFF.	Hymenoptera	Vöth 1989
<i>Lygaeus saxatilis</i> L.	Hymenoptera	Vöth 1999a; Berger 2007a	<i>Tetralonia berlandi</i> FONSCOLOMBE	Hymenoptera	Vöth 1989
<b>Anacamptis coriophora</b> ssp. <i>fragrans</i>			<i>Osmia sybaita</i> SMITH	Hymenoptera	Vöth 1989
<i>Oedemera nobilis</i> SCOP.	Coleoptera	Berger 2007a, b	<b>Anacamptis pyramidalis</b>		
<i>Apis mellifera</i> L.	Hymenoptera	Peisl 1975; Berger 2003, 2006a	<i>Trichius fasciatus</i> L.	Coleoptera	Démares 2000
<i>Bombus lucorum</i> L.	Hymenoptera	Cingel, van der 1995	<i>Apis mellifera</i> L.	Hymenoptera	Vöth 1999a; Démares 2000
<i>Halictus</i> sp.	Hymenoptera	Peisl 1975	<i>Aporia crataegi</i> L.	Lepidoptera	Lind & Lindeborg 1989; Lind <i>et al.</i> 2007
<i>Lygaeus saxatilis</i> L.	Hymenoptera	Berger 2007b	<i>Adscita staties</i> L.	Lepidoptera	Claessens & Kleynen 2011
<i>Scoliidae</i>	Hymenoptera	Peisl 1975; Kretzschmar <i>et al.</i> 2007	<i>Acontia luctuosa</i> DEN. & SCHIFF.	Lepidoptera	Darwin 1877
<i>Xylocopa violacea</i> L.	Hymenoptera	Peisl 1975; Kretzschmar <i>et al.</i> 2007	<i>Aglais urticae</i> L.	Lepidoptera	Darwin 1877; Démares 2000
<i>Zygaena filipendulae</i> L.	Lepidoptera	Scappaticci 1998	<i>Agrotis catalaea</i> L.	Lepidoptera	Darwin 1877
<b>Anacamptis morio</b>			<i>Anthrocera filipendulae</i> L.	Lepidoptera	Darwin 1877
<i>Apis mellifera</i> L.	Hymenoptera	Darwin 1877; Vöth 1987, 1999a Cozzolino <i>et al.</i> 2005	<i>Anthrocera trifolii</i> ESPER	Lepidoptera	Darwin 1877
<i>Andrena albopunctata</i> ROSSI	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Arge galathea</i> L.	Lepidoptera	Darwin 1877
<i>Andrena ovatula</i> KIRBY	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Brenthis ino</i> ROTTEMBURG	Lepidoptera	Lind & Lindeborg 1989
<i>Anthophora acervorum</i> L.	Hymenoptera	Evans 1934	<i>Caradrina alsines</i> L.	Lepidoptera	Darwin 1877
<i>Apatura rupestris</i> FABR.	Hymenoptera	Godfrey 1918	<i>Caradrina blanda</i> L.	Lepidoptera	Darwin 1877
<i>Bombus agrorum</i> FABR.	Hymenoptera	Vöth 1987	<i>Euclidia glyphica</i> L.	Lepidoptera	Darwin 1877
<i>Bombus confusus</i> SCHENCK	Hymenoptera	Darwin 1877	<i>Eubolia mensuraria</i> L.	Lepidoptera	Darwin 1877
<i>Bombus humilis</i> ILLIGER	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Euphydryas aurinia</i> ROTTEMBURG	Lepidoptera	Lind & Lindeborg 1989
<i>Bombus lapidarius</i> L.	Hymenoptera	Darwin 1877; Cozzolino <i>et al.</i> 2005	<i>Fabriciana adippe</i> DEN. & SCHIFF.	Lepidoptera	Lind & Lindeborg 1989
<i>Bombus lucorum</i> L.	Hymenoptera	Vöth 1987	<i>Glaucopsyche alexis</i> PODA	Lepidoptera	Darwin 1877
<i>Bombus muscorum</i> L.	Hymenoptera	Darwin 1877	<i>Hadena dentina</i> DEN. & SCHIFF.	Lepidoptera	Darwin 1877
<i>Bombus pascuorum</i> L.	Hymenoptera	Vöth 1999a; Schiestl 2005	<i>Hadena monoglypha</i> HUFN.	Lepidoptera	Bournéries 1998
<i>Bombus pratorum</i> L.	Hymenoptera	Darwin 1877	<i>Heliothis marginata</i> MOORE	Lepidoptera	Darwin 1877
<i>Bombus ruderatus</i> FABR.	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Hemaris fuciformis</i> L	Lepidoptera	Démares 2000
<i>Bombus rupestris</i> FABR.	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Hesperia linea</i> ESPER	Lepidoptera	Darwin 1877
<i>Bombus sylvarum</i> L.	Hymenoptera	Darwin 1877; Cozzolino <i>et al.</i> 2005	<i>Hesperia sylvanus</i> FABR.	Lepidoptera	Darwin 1877
<i>Bombus terrestris</i> L.	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Leucania lithargyra</i> ESPER	Lepidoptera	Darwin 1877
<i>Bombus vestalis</i> GEOFF.	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Lithosia complana</i> L.	Lepidoptera	Darwin 1877
<i>Eucera hungarica</i> FRIESE	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Lycanea phlaeas</i> L.	Lepidoptera	Darwin 1877
<i>Eucera longicornis</i> L.	Hymenoptera	Darwin 1877	<i>Lysandra bellargus</i> ROTTEMBURG	Lepidoptera	Bournéries 1998; Démares 2000
<i>Halictus patellatus</i> MORAWITZ	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Maniola jurtina</i> L.	Lepidoptera	Bournéries 1998; Démares 2000
<i>Osmia bicoloris</i> L.	Hymenoptera	Darwin 1877; Cozzolino <i>et al.</i> 2005	<i>Melanargia galathea</i> L.	Lepidoptera	Darwin 1877
<i>Lasioglossum xanthopus</i> KIRBY	Hymenoptera	Cozzolino <i>et al.</i> 2005	<i>Melitaea athalia</i> ROTTEMBURG	Lepidoptera	Lind & Lindeborg 1989
<i>Anthocharis euphenoides</i> STAUDINGER	Lepidoptera	Barile <i>et al.</i> 2006	<i>Melitaea cinxia</i> L.	Lepidoptera	Bournéries 1998; Démares 2000
<i>Cucullia santonici</i> HÜBNER	Lepidoptera	Barile <i>et al.</i> 2006	<i>Melitaea didyma</i> ESP.	Lepidoptera	Reinhard <i>et al.</i> 1991
<i>Hadena plebeja</i> L.	Lepidoptera	Barile <i>et al.</i> 2006	<i>Melitaea parthenoides</i> KEFERSTEIN	Lepidoptera	Claessens & Kleynen 2011
<i>Zygaena lonicerae</i> SCHEVEN	Lepidoptera	Barile <i>et al.</i> 2006	<i>Melitaea phoebe</i> DEN. & SCHIFF.	Lepidoptera	Démares 2000
<b>Anacamptis palustris</b>			<i>Mythimna sicula</i> TREISCHKE	Lepidoptera	Barile <i>et al.</i> 2006
<i>Bombus muscorum</i> L.	Hymenoptera	AHO (eds.) 2005	<i>Cinclidia phoebe</i> DEN. & SCHIFF.	Lepidoptera	Bournéries 1998
			<i>Ochlodes venatus</i> BR. & GREY	Lepidoptera	Bournéries 1998
			<i>Plebejus argus</i> L.	Lepidoptera	Démares 2000
			<i>Polyommatus alexis</i> ROTTENBURG	Lepidoptera	Darwin 1877
			<i>Pyrgus carthami</i> HÜBNER	Lepidoptera	Reinhard <i>et al.</i> 1991
			<i>Pyrgus malvae</i> L.	Lepidoptera	Démares 2000
			<i>Shagacucullia caninæ</i> RAMBUR	Lepidoptera	Barile <i>et al.</i> 2006
			<i>Sonia lineata</i> SCOP.	Lepidoptera	Démares 2000
			<i>Spilodes cinctalis</i> TREITSCHKE	Lepidoptera	Démares 2000
			<i>Spilodes palealis</i> SCHIFF.	Lepidoptera	Darwin 1877

## APPENDIX 2: FRUIT SET

Fruit	Flowers/ set (%)	Date	Country/Location	Observer / Reference	Fruit	Flowers/ set (%)	Date	Country/Location	Observer / Reference
<b><i>Anacamptis boryi</i></b>									
78.5	200 / 157	09.06.2004	Gr, Tripoli	H. Presser	39.8	98 / 39	05.05.2005	Ga, Pierrefeu	M. Démaries
<b><i>Anacamptis collina</i></b>									
25.0	273 / 68	04.1973	Ij, Horshat Tal	Dafni & Ivri 1979	14.3	307 / 44	09.05.2005	Ga, Le Cannet-des-Maures	J. Claessens & J. Kleynen
32.0	243 / 78	04.1974	Ij, Horshat Tal	Dafni & Ivri 1979	25.0	164 / 41	19.05.2004	Sa, Su Taccu	M.P. Grasso
30.0	241 / 72	04.1975	Ij, Horshat Tal	Dafni & Ivri 1979	44.9	78 / 35	13.05.2005	Ga, Cabasson	J. Claessens & J. Kleynen
29.3	41 / 12	02.04.2004	AE, Rhodes	K. & S. Hertel	12.4	412 / 51	08.05.2005	Ga, Le Cannet-des-Maures	J. Claessens & J. Kleynen
37.1	97 / 36	14.03.2006	Gr, Nata	W. van Looken					
28.7	275 / 79	10.04.2006	Cr, Crete	U. Lünsmann					
<b><i>Anacamptis coriophora</i></b>									
88.0	497 / 437	04.1973	Ij, Horshat Tal	Dafni & Ivri 1979	59.1	44 / 26	23.07.1997	Ge, Ichenheim	Baumann in: Sebald <i>et al.</i> 1998
78.0	634 / 495	04.1974	Ij, Horshat Tal	Dafni & Ivri 1979	41.1	231 / 95	23.05.2004	It, Lecce	M. Rackl
95.0	551 / 523	04.1975	Ij, Horshat Tal	Baumann in Sebald 1998					
51.3	596 / 306	20.07.1996	Ge, Augsburg						
96.5	434 / 419	18.08.2004	Ge, Roth						
64.0	670 / 429	06.06.2005	Ga, Massif des Maures	M. Démaries					
<b><i>Anacamptis israelitica</i></b>									
38.1	217 / 83	03.1978	Ij, Mt. Ahim	Dafni & Ivri 1981a	1.8	400 / 7		It, Capri	Knuth in: Ziegenspeck 1936
59.1	296 / 175	03.1979	Ij, Mt. Ahim	Dafni & Ivri 1981a	67.0	109 / 73	10.04.2006	Cr, Crete	U. Lünsmann
2.8	201 / 6	03.1979	Ij, Mt. Ahim	Dafni & Ivri 1981a	64.6	65 / 42	07.04.2006	Cr, Crete	U. Lünsmann
48.6	179 / 87	04.1980	Ij, Mt. Ahim	Dafni & Ivri 1981a	41.4	29 / 12	08.04.2006	Cr, Crete	U. Lünsmann
4.7	227 / 11	04.1980	Ij, Mt. Ahim	Dafni & Ivri 1981a	62.7	134 / 84	08.04.2006	Cr, Crete	U. Lünsmann
					59.5	116 / 69	14.04.2006	Cr, Crete	U. Lünsmann
<b><i>Anacamptis laxiflora</i></b>									
36.0	211 / 76	10.05.2004	AE, Dipi	R. & A. Wielinga	50.0	66 / 33	31.03.2005	Cr, Lipsi Panaghia	W. van den Bussche
17.2	58 / 10	23.05.2004	Ga, Caudebec-les-Elbeuf	M. Démaries					
26.2	65 / 17	09.06.2004	Ga, Saint-Jean-d'Alcas	A. Kampen					
49.3	152 / 75	12.06.2004	Ga, Berville-en-Roumois	M. Démaries					
25.9	112 / 29	11.05.2005	Ga, Le Cannet-des-Maures	J. Claessens & J. Kleynen					
<b><i>Anacamptis morio</i></b>									
4.3	2136 / 92	1976	Su	Nilsson 1984	93.2	118 / 110	1860	Br, Folkestone	Darwin 1877
14.4	450 / 65	1977	Su	Nilsson 1984	39.4	302 / 119	1875	Br	Darwin 1877
20.2	193 / 39	1979	Su	Nilsson 1984	39.5	124 / 49	Ge		Ziegenspeck 1936
30.2	295 / 89	1981	Su	Nilsson 1984	3.6	1038 / 37	09.1988	Br, Leith Hill – Surrey	Waite <i>et al.</i> 1991
24.1	133 / 32	1982	Su	Nilsson 1984	33.5	678 / 227	Br		Neiland & Wilcock 1998
12.1	1470 / 178	23.05.1986	Au, Sparbach	W. Vöth	65.1	1969 / 1282	1993	Su, Öland	Lind <i>et al.</i> 2007
23.6	713 / 168		Lu	Neiland & Wilcock 1998	36.3	1506 / 547	1993	Su, Öland	Lind <i>et al.</i> 2007
27.0	444 / 120	18.06.1996	Ge, Öschingen	Baumann in: Sebald <i>et al.</i> 1998	21.0	2166 / 455	1993	Su, Öland	Lind <i>et al.</i> 2007
35.5	454 / 161	18.06.1996	Ge, Owingen	Baumann in: Sebald <i>et al.</i> 1998	15.6	7155 / 1116	1993	Su, Öland	Lind <i>et al.</i> 2007
27.0	1386 / 385	1997	Cz, Horní Záblatí	J. Jersáková	73.5	536 / 394	1993	Su, Öland	Lind <i>et al.</i> 2007
39.4	5179 / 2039	1997	Cz, Zábrdří	J. Jersáková	26.0	21250 / 5525	1993	Su, Öland	Lind <i>et al.</i> 2007
29.5	1680 / 495	1998	Cz, Zábrdří	J. Jersáková	33.9	694 / 235	30.07.1997	Ge, Schellingen	Baumann in: Sebald <i>et al.</i> 1998
32.1	2131 / 683	1998	Cz, Horní Záblatí	J. Jersáková	54.8	863 / 472	23.07.1997	Ge, Steineneadt	Baumann in: Sebald <i>et al.</i> 1998
36.3	1120 / 406	1998	Cz, Javorník	J. Jersáková	20.9	640 / 134	23.06.2003	Ho, Schin op Geul	J. Claessens & J. Kleynen
44.4	1961 / 870	1999	Cz, Horní Záblatí	J. Jersáková	41.7	676 / 282	12.07.2004	Ga, St. Pierre	M. Démaries
42.9	1330 / 570	1999	Cz, Javorník	J. Jersáková	5.3	1141 / 60	07.08.2005	Ge, Niederehe	J. Claessens & J. Kleynen
44.4	2970 / 1320	1999	Cz, Zábrdří	J. Jersáková	23.6	475 / 112	10.05.2006	Hs, Son Bou	H. Salkowski
35.7	924 / 330	2000	Cz, Javorník	J. Jersáková	8.9	1206 / 107	20.08.2006	Ge, Niederehe	J. Claessens & J. Kleynen
34.0	1940 / 660	2000	Cz, Zábrdří	J. Jersáková					
12.2	2161 / 263	2000	Ho, Sirjansland	J. Jersáková					
22.6	1697 / 384	2000	Ho, Renesse	J. Jersáková					
50.9	1150 / 585	2000	Ho, Wijlre	J. Jersáková					
29.1	1720 / 500	2001	Cz, Zábrdří,	J. Jersáková					
54.4	92 / 50	28.04.2004	AE, Achladeri	R. & A. Wielinga					
49.3	215 / 106	05.06.2004	Ge, Blankenheim	F. Opitz					
23.3	382 / 89	21.07.2004	Ho, Dijkwater	R. Wielinga					
33.7	258 / 87	20.05.2006	Ga, Véronnes	J. Claessens & J. Kleynen					
20.1	284 / 57	21.05.2006	Ga, Barbières	J. Claessens & J. Kleynen					
26.5	476 / 126	05.06.2006	Ho, Wijlre	J. Claessens & J. Kleynen					
18.2	214 / 39	13.05.2007	Ho, Wijlre	H. Jussen					
17.9	296 / 53	15.05.2007	Ga, Barbières	J. Claessens & J. Kleynen					
43.5	462 / 201	20.05.2007	Ga, Beaufort-sur-Gervanne	J. Claessens & J. Kleynen					
40.4	426 / 172	23.06.2009	Ho, Wijlre	J. Claessens & J. Kleynen					
44.6	280 / 125	04.06.2010	Ho, Wijlre	J. Claessens & J. Kleynen					
<b><i>Calypso bulbosa</i></b>									
					6.0	50 / 3		USA, Vermont	Mousley 1924
					22.3	94 / 21	26.05.1968	CAN, Banff Alberta	Mosquin 1970
					10.4	1560 / 160	07.06.1968	CAN, Banff Alberta	Mosquin 1970
					11.0	1273 / 141	1976	USA, California	Ackerman 1981
					7.0	1161 / 82	1978	USA, California	Ackerman 1981
					0.0	57 / 0	1978	USA, California	Ackerman 1981
					30.0	114 / 34	1978	USA, California	Ackerman 1981
					16.0	349 / 56	1978	USA, California	Ackerman 1981
					34.0	137 / 47	1978	USA, California	Ackerman 1981
					33.0	86 / 28	1978	USA, California	Ackerman 1981
					1.2	843 / 10	12.06.1977	CAN, Banff-Alberta	Boyden 1982
					48.0	2176 / 1045	1992	Su	Alexandersson & Ågren 1996
					21.0	1616 / 339	1993	Su	Alexandersson & Ågren 1996
					37.0	2848 / 1054	1994	Su	Alexandersson & Ågren 1996
					54.6	11 / 6	28.06.2006	Su, Brynje	L. & J. Essink
<b><i>Cephalanthera damasonium</i></b>									
					95.5	22 / 21	13.07.1904	Ge, Jena	Detto 1905
					86.9	23 / 20	20.07.1904	Ge, Jena	Detto 1905
					77.3	586 / 453	18.08.1904	He, St. Gallen	Gössnitz in: Detto 1905
					82.4	136 / 112	25.09.1996	Ge, Heimsheim	Baumann in: Sebald <i>et al.</i> 1998
					91.6	71 / 65	19.07.1995	Ge, Hörschwag	Baumann in: Sebald <i>et al.</i> 1998

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