

Originally on: <http://www.reallywildflowers.co.uk/>

## THE USE OF SOME NATIVE ORCHIDS IN LANDSCAPING AND HABITAT CREATION

BY SHEENA MCKENDRICK (SHEFFIELD UNIVERSITY), GRAHAME DIXIE (H.V. HORTICULTURE) AND NORMAN HEYWOOD (HARDY ORCHIDS LTD.)

### NATIVE ORCHIDS

Because of ground breaking research work on orchid propagation techniques some native orchids are now being raised commercially. The number of plants available increases annually and they are now being used in small numbers in landscaping and habitat re-construction projects. The seed is hand harvested from native orchid populations, mainly from private land after the necessary written permissions are obtained. In a laminar airflow cabinet the seed is sown onto an agar based medium, normally containing a specific symbiotic fungus. There after the plantlets are replated, potted on, weaned and grown on in a nursery. The process takes three to five years to produce to a flowering plant. The plants are dispatched in P9 pots complete with compost containing the symbiotic fungus (if grown symbiotically) The first native orchids to be available in numbers were the Heath Spotted Orchid (*Dactylorhiza maculata*) and the Marsh Helleborine (*Epipactis palustris*). The next tranche of orchid species to be available commercially included the Common Spotted Orchid (*Dactylorhiza fuchsii*), the Early Purple Orchid (*Orchis mascula*) and the Green Winged Orchid (*Orchis morio*). Within the next few seasons the species range will increase to include the Pyramidal Orchid (*Anacamptis pyramidalis*), the Southern Marsh Orchid (*Dactylorhiza praetermissa*), the Bee Orchid (*Ophrys apifera*) and the Fly Orchid (*Ophrys insectifera*). In this paper we have attempted to summarise the best practices for establishing some British Orchids, based primarily on the researches of Sheena McKendrick whilst obtaining her PhD at the University of Cambridge and the field experiences of H.V. Horticulture and Hardy Orchids.

The key factors in successful orchid establishment involve checking that the site provides the basic requirements for native orchids, selecting appropriate species, providing the necessary care whilst the young plants establish themselves and the subsequent maintenance.

### Site Requirements

Orchids generally thrive in nutrient-poor conditions, such as in unimproved chalk grasslands and species-rich meadows. A few species, e.g. the Green-winged Orchid, *Orchis morio*, can be found in moderately fertile conditions, but in general if the fertility of the soil is raised, the orchids will decrease. On soils high in fertility, and in particular those high in Phosphate (P), orchids are likely to be quickly out-competed by the more vigorous grasses; P may also have a toxic effect on the orchids. P is relatively immobile in the soil, and so may persist for a long time after application. Acceptable levels of P have not been quantified but our experience from establishing wildflower meadows would suggest P readings of below 15ppm (i.e. MAFF index of 1 and below) when the soil is analysed.

There has been shown to be a very close correlation between the application of fertiliser and the decline in orchid numbers. Application of phosphate has the longest term and most devastating impact. Orchid populations disappear within 3-4 years of fertiliser being applied. When fertilising is stopped the reappearance of orchids appears to be linked to the amount of phosphate applied, but can take over a decade on sites which have received high phosphate applications. (Silvertown 1994, Dijk & Olf 1994, During & Willems 1984 and H.H. Willems pers.comm.) Orchids can re-invade sites which have not been fertilised but which have been regularly mown.

## **SPECIES SELECTION**

Clues as to the suitability of specific species for the individual site are provided by reference to local floras and by assessing the National Vegetation Classification (NVC) of the site. (ref J.S Rodwell) Table 1 provides a brief summary of suitable environmental conditions for orchids and lists the NVC plant communities where each species is most often found. This table is only a brief guide to these tolerances. More detail on the individual orchid species is set out below. These are drawn from observations of natural populations and plantings.

With the exception of the Marsh Helleborine, all the orchids in this article annually grow new tubers. The tuber needs to be around 10cm x 5 cm to flower. The tuber feeds the flowering plant, during the season the plant will produce normally one and sometimes two tubers, while the old tuber dies away. Often the effect is to create a clump of separate orchids.

**Table 1. Summary of Environmental Conditions and Flowering Characteristics suitable for some British Orchids**

Latin Name	Common Name	Shade Tolerance	Soil pH	Soil Moisture	Height (cm)	Flowering Time	Flower Colour	NVC
<i>Anacamptis pyramidalis</i>	Pyramidal Orchid	L/M	N/A1	D	20-60	June-August	Pink	W3, CG1,3,4,5,6
<i>Dactylorhiza fuchsii</i>	Common Spotted Orchid	H	Ac/N/A1	M	15-45	May-July	Pale pink, pale purple or white	MG 3,9, CG2,3, M9,10,13, 22,24
<i>Dactylorhiza maculata</i>	Heath Spotted Orchid	M	Ac	D/M/W	10-25	May-August	Pale pink, pale purple or white	W18, M15,16,23,24,25, H514,15,21
<i>Dactylorhiza praetermissa</i>	Southern Marsh Orchid	L	Ac/N/A1	M/W	20-70	June-July	Rose/purple	M13
<i>Epipactis palustris</i>	Marsh Helleborine	L	N/A1	M/W	20-60	June-Aug	White lips, sepals: greenish/reddish bracts, petals: whitish/reddish	M13,22,24
<i>Ophrys apifera</i>	Bee Orchid	L/M	N/A1	D/M	15-60	July	Brown lip, green sepals and pink petals	CG2,3,5
<i>Ophrys insectifera</i>	Fly Orchid	H	N/A1	D	15-60	May-July	Brown lip, green sepals	M13
<i>Orchis mascula</i>	Early Purple Orchid	M/H	Ac/N/A1	D/M	15-60	April-June	Purple	W8, MG3, CG13,U17
<i>Orchis morio</i>	Green-winged Orchid	L	Ac/N/A1	M	6-15	April-June	Purple, pink or white	MG5

Shade Tolerance - L: Low, M: Medium, H: High                      Soil Moisture - D: Dry, M: Moist, W: Wet  
 Soil pH - AC: Acid (pH < 6.5), N: Neutral (pH 6.5-7.5), Al: (pH > 7.5)

The National Vegetation Classification system has three basic grassland types, Mesotrophic grasslands (MG) with pH 4.5-6.5, moderate to high fertility and drought free, Calcicolous grasslands (CG) where the soils are alkaline, often derived from chalk or limestone. The Califugous grasslands are acidic grasslands (U) Wood land and scrub sites are all prefixed with W.

Mire communities (M) are those where the soils are permanently, or periodically waterlogged . . Heaths (H) are vegetation s where the sub-shrubs such as heathers play a dominant role.

.All species but *Dactylorhiza maculata* are calcicoles - requiring free calcium carbonate in the soil and not usually found in soils with pH of less than 4.

### **Pyramidal Orchid (*Anacamptis pyramidalis*)**

The Pyramidal Orchid is an exacting calcicole, requiring free lime in the soil and a pH of no less than 6. Dry soil is a necessity for this species, and as such it thrives on chalk downs and limestone grasslands, and on calcareous sand-dunes. It usually grows amongst tall grasses such as Erect Brome Grass (*Bromus erectus*) or False Oats (*Arrhenatherum elatius*), though can also grow in shorter turf. Pyramidal Orchids can withstand light shade, and can be found amongst scrub and in open grassy woods. They are robust plants, persistent after establishment. Flowering of this species is from the middle of June to mid August, peaking at the end of June to the first few weeks in July.

### **Common spotted orchid (*Dactylorhiza fuchsii*)**

The common Spotted Orchid grows on a wide variety of soils, but particularly those which are humus-rich or loamy. It is most common on calcareous soils (pH>7.5), though also occurs on neutral (pH6.5-7.5) and even moderately acidic (pH 5.0-6.5) soils. Common Spotted Orchids occur on well-drained ground, and in moderately wet places, though rarely in permanently waterlogged sites. They are equally common in grasslands and woodlands, and also in former quarries, clay pits, railway embankments and roadside verges. These orchids flower from June to August, and should flower within one or two years of planting as an eighteen-month-old plant. Flowering can occur each year under the right conditions, and the number of flowering spikes per plant increases.

### **Heath spotted orchid (*Dactylorhiza maculata ssp. ericetorum*)**

The Heath Spotted Orchid is a calcifuge, and is rarely found in a pH of more than 6.5 in the wild. It most commonly grows in moors and acid heaths, from dry heaths and moors alongside Cross-leaved Heath (*Erica tetralix*) and Purple Moor Grass (*Molinia caerulea*), to comparatively damp, marshy places with some Sphagnum moss, though it will grow on deep peat. The Heath Spotted Orchid can withstand light shade, and can be found in open woods of birch and pine or at the edge of scrub, but it is never a truly woodland plant like the common spotted orchid.

This tuberous hardy orchid flowers in the late spring to early summer on tall stems of up to 40cm. The flower colour includes various shades of pink. The leaves can be spotted or plain. In practice Heath Spotted Orchid have been established on a wide range of soil pH's, but not in highly acidic or very alkali noses. The orchid should be planted in a moist soil or at the very least kept well watered for the first 6 weeks after planting.

### **Southern Marsh Orchid (*Dactylorhiza praetermissa*)**

The Southern Marsh Orchid grows in a great variety of places where the soil is wet or damp and base-rich. It is found in very acidic soils, but can sometimes grow in soil with a pH as low as 4.4 (McKendrick, 1995). Southern Marsh Orchids grow in a wide variety of wet places, including damp meadows, water meadows amongst rushes, marshes, fens, at the margin of reed swamps and in marshes among sand-dunes. (Plantings at the Royal Botanical Gardens at Wakehurst Place demonstrated the highest success rates in areas of intermediate dampness in grasslands with a high level of species diversity i.e. over 15 species per 1/4 m<sup>2</sup>. These areas occurred between dense patches of rush (*Juncus articulatus*) and the drier grassy areas (McKendrick, 1995)). In fens, and in marshes among sand-dunes Southern Marsh Orchids are often accompanied by Marsh Helleborines. Southern Marsh Orchids flower from June to July.

### **Marsh Helleborine (*Epipactis palustris*)**

The Marsh Helleborine is said to be an exacting calcicole, thriving in damp or wet areas with free lime in the water. Marsh Helleborines can occasionally be found on chalk downs, but these may be relict populations. They are most common in wet dune-slacks, though plants here are smaller than those growing in more marshy areas among, for example, the Common Reed (*Phragmites australis*). The Marsh Helleborine is a plant of sun and will tolerate some shade. Flowering can occur from late June to early September, but is usually at its peak from mid-July to mid-September. The leaves are plain.

In practice Marsh Helleborine successfully establishes best in moist soil in dappled shade and should be planted with at least 5cm on soil above the growing tip. The orchid has a rhizomatous root structure and, given the right conditions, will multiple vegetatively.

### **Bee Orchid (*Ophrys apifera*)**

The Bee Orchid is found only on calcareous soils. It grows best on chalk downs, limestone hills, clayey soils and marls, and on the moist margins of calcareous dune-slacks or sandy soils. It mostly grows in the open, but can thrive under beech and ash on chalk, and occasionally beneath bushes. Bee Orchids are 'weedy' plants, and are found in turf which is not more than about 50mm in height and in sites where there are numerous patches of bare ground. Ideal

locations are short, chalk turf, short, mown calcareous clay, or chalk quarries, embankments, soil heaps and railway verges where the soil is poor and has been recently disturbed. Bee orchids flower from June to July. They are notoriously fluctuating in flowering numbers, though these fluctuations do not necessarily reflect fluctuations in the population as a whole (Wells & Cox, 1991). Flowering is normally interspersed with one or more years as a non-flowering plant, though some individuals are able to flower for two or three consecutive years (Wells & Cox, 1991).

### **Fly Orchid (*Ophrys insectifera*)**

The Fly Orchid is an exacting calcicole, only growing in dry, alkaline soil. It is most commonly found in woodlands in both light and densely shaded areas, though can also grow in short chalk grasslands, spoil slopes and in abandoned chalk quarries. It is most common in beech woods on chalk, and under mixed oak and ash woods on limestone's. Flowering can occur from early May to June or July, but is usually between late May and early June.

### **Early Purple Orchid (*Orchis mascula*)**

The Early Purple Orchid is a widespread orchid, able to grow on a wide variety of soils except those that are very acid or very wet. It prefers calcareous soils, but can also be found on sandy soils. The turf on which it grows can be short (e.g. on sand-dunes, down land, particularly with cowslips, or on cliffs), or comparatively tall, particularly on chalk or limestone. It is an ideal plant for banks and road verges. Early Purple Orchids can also be found abundantly in some woods and copses, where it is often associated with Bluebells (*Hyacinthoides non-scriptus*) or Dog's Mercury (*Mercurialis perennis*). Flowering of Early Purple Orchids is from April to mid June.

### **Green-winged Orchid (*Orchis morio*)**

The Green-winged Orchid can grow on a wide variety of soils from pH 4.6 - pH 8, though it prefers calcareous soils with a high proportion of clay. It tends to favour damp, sheltered meadows, but can be found on dry hills and slopes. Green-winged orchids are common plants of species-rich meadows and usually in short turf, though they can also be found on lawns and in churchyards on chalk. They are usually found in open, sometimes in the partial shade of bushes and scrub but, unlike Early Purple Orchids, never in permanent woodland. Green-winged Orchids often grow alongside cowslips (*Primula veris*). They flower from May to June.

## **Planting Times**

Late autumn is the best time to plant orchids, when the plants are dormant (Stewart, 1993). Establishment can then take place during the winter before the period of maximum growth of the surrounding vegetation. Winter plantings may also be successful with summer-green species, for example, in the Southern Marsh Orchid, which established well from seedlings planted at the end of January in either rainy or frosty weather (McKendrick, 1994; 1995). Summer plantings are generally not recommended. Particular care must be taken when planting the winter green *Ophrys* (Bee and Fly orchid) plants. These are more difficult to transplant successfully than either *Orchis* or *Dactylorhiza*. *Ophrys* should only be planted when dormant in autumn.

## **Planting and Post Planting Care**

Most hardy orchids like a growing position which provides light dappled shade and particularly that the base of the plant is shaded. When planting into grass clear an area of at least 15cm in diameter of grass, but not greater than 30cm, either with a scuttion (a winged auger-like tool) or by undercutting and removing the turf using a spade.

Water the plant thoroughly the day before planting. When planting out, knock the plant out of the pot gently, as the root structure is such that most of the soil will fall away from the fleshy roots. Place the plant in the prepared hole and fill in around the fleshy roots with the soil from the pot. Some well rotted vegetable matter can be added. The compost has been inoculated with the specified symbiotic fungi that is critical to successful establishment. In really dry weather during the establishment phase the seedling can be watered fortnightly, ideally with rainwater. Spot irrigation should be carried out. Avoid getting water on the leaves in bright sunny weather. The water can contain a weakish emulsion or seaweed fertiliser at a quarter rate. The grass around the young plant can be allowed to grow up to 15-20cm, so as to provide light shade to the young plant, but it should not be allowed to swamp the orchid.

## **Planting Densities**

Work has not been carried out on optimal planting densities. Results from experiments with other wildflowers planted into grassland and woodland have shown that it is generally preferable to plant small areas relatively densely

than to plant thinly across a site. Not only is the visual impact greater, but more importantly the high densities facilitate cross pollination and therefore seed production and second generation propagation.

Plants like Pyramidal Orchids should not have less than 100cm<sup>2</sup> around them, whereas slender orchids such as the Fly Orchid could be planted more densely. Common Spotted and Southern Marsh Orchids may produce a second tuber within a year or two of planting and under the right condition will produce quite large groups of plants, and can be planted a little further apart (say, 20cm or more). Experimental plantings of Southern Marsh Orchids at Wakehurst Place were carried out at 20 plants per m<sup>2</sup>, which proved adequate. Green-winged Orchids and Early Purple Orchids could be planted within, say 20cm of each other, but Marsh Helleborines may benefit from a greater distance between plants as it spreads by rhizomes underground.

The table below gives some suggestions for planting densities for orchids in landscaping situation.

<b>Possible Planting Densities Per M<sup>2</sup></b>		
	High	Suggested
Pyramidal Orchid	25	8
Common Spotted Orchid	8	4
Heath Spotted Orchid	8	4
Southern Marsh Orchid	8	4
Fly Orchid	30	10
Early Purple Orchid	8	4
Green Winged Orchid	8	4

## **Pest Control**

The amount of protection provided to the orchids will vary from site to site, depending on the herbivores present. Insect damage to the leaves of the orchid, where present, is usually light and no application of insecticide is necessary. Damage from molluscs (slugs and snails) can vary considerably from month to month, e.g. in the Southern Marsh Orchid (McKendrick, 1994) and the Bee Orchid (Wells & Cox, 1989), and from site to site. Mollusc damage is usually light (Hutchings, 1987; McKendrick, 1994; Wells & Cox, 1989) but can occasionally be considerable. Monthly applications of molluscicide is not always effective in controlling such damage (McKendrick, 1994), and is not recommended except in extreme cases. A more environmentally sound method is the use of the biological control in the form of parasite nematodes, in products like Nemaslug, which provide about 6 weeks protection from each application.

Grazing by small mammals and deer may be a problem in some areas (e.g. Wells & Cox, 1989). Fencing against small mammals might be necessary, at least in the first year, to allow the orchids to establish. In a 3-year study the effects of herbivores on planted Southern Marsh Orchids, most fatalities caused by herbivores occurred in the first few months after planting (February - April). Most of these fatalities occurred before leaf expansion and were caused by small mammals digging up and pheasants pulling up the seedlings (McKendrick, 1994). Fencing plots with 1.5m wire fencing (1.7cm mesh) pushed a few cm underground or creating pyramids of chicken wire are effective in eliminating the digging up of seedlings by mammals. In a further planting, making the seedlings less visible through replacing a little of the soil and vegetation removed on planting was effective in eliminating digging/pulling up by both mammals and pheasants.

In practice, in locations where there is a low rabbit and small mammal population the most cost effective prevention of damage is by 'disguising' the young seedlings. However, when the rabbit population is high the seedlings should be fenced off, or cages of chicken wire covering the young plants, whilst they establish themselves.

## **Maintenance Programmes**

Orchid habitats represent a particular stage in ecological succession. Management is needed to keep the habitat stable. This has to be an on-going process involving grazing, or cutting and some scrub clearnace. On no account must sites where orchids are introduced be fertilised. Some management will be necessary to keep down competing species and open up new areas for colonisation from seed. In general, cutting regimes should take into account the life-cycle of the species to be encouraged, in particular not cutting the sward until the orchids have set seed, which is late August, except in the case of the Green Winged and Early Purple orchids. The management regime employed will depend much on the type of habitat, soil fertility, orchid species and availability of equipment.

Some suitable management regimes are listed below:-

### *Low fertility calcareous grasslands*

In a study of orchids on the chalk grasslands of southern England, most orchids found in closed (continuous) turf were in grasslands with a species-richness of greater than 15 species per 50 x 50cm area (McKendrick, 1994). Grazing is the principle method of maintaining species-richness in chalk grasslands. If grazing is employed then it should cease during the time of maximum growth, flowering and seed set of the orchids in order to encourage their establishment and regeneration. Winter grazing can be particularly effective though late summer grazing may also be valuable. Overgrazing should be avoided.

Where grazing is not possible an alternative management regime may be the creation of orchid lawns or meadows (Cribb & Bailes, 1989). In these, winter-green orchids are encouraged by mowing as usual until October, then not cutting the grass again until the orchids have set seed (late July-early August); the clippings must always be removed to avoid fertilising the soil. Orchid lawns must never be fertilised, treated with moss-killer or herbicide (Cribb & Bailes, 1989). In some sites with low levels of fertility it may be possible to cut only once in late July (e.g. Wells & Cox, 1989), but this will depend much on the fertility of the soil and the presence of natural grazers such as rabbits or deer.

Orchid lawns have been successfully established with Bee Orchids in Oxford (Cribb & Bailes, 1989) and on calcareous clay in Cambridgeshire (Warner, 1982), and with Green-winged Orchids in Sussex (Cribb & Bailes, 1989). Pyramidal Orchids can also grow on lawns in calcareous areas (Cribb & Bailes, 1989). Early Purple Orchids are probably suitable for establishment in orchid lawns (though their smell *en masse* might be slightly off-putting!), and attractive lawns may be possible by interplanting Early Purple Orchids or Green-winged Orchids with Cowslips (*Primula veris*).

### *Neutral grasslands*

The Green-winged Orchid is the classic orchid of old, species-rich neutral grassland. The optimum management of this species on such grasslands is to mow for hay in late July after the flowers have set seed, then have the aftermath grazed by cattle or sheep until the end of the growing season (Crofts & Jefferson, 1994; Frazer, 1992). Early Purple Orchids would also benefit from this management regime, though they can also grow in rougher grasslands.

Damp neutral grasslands containing Common Spotted Orchids and Southern Marsh Orchids should be mown annually in September, and the clippings removed (e.g. McKendrick, 1995).

### *Woodland*

Woodland management will depend very much on what species are to be encouraged, and the type of woodland being managed. Common Spotted Orchids and Early Purple Orchids benefit from coppicing of the trees to let more light in. Bee Orchids and Fly Orchids can be found in quite dense shade under beech and ash on chalk, but can also be found on woodland margin, and may benefit from the clearance of woodland rides. Open-ness is also important for Heath Spotted Orchids, which will only thrive in open woods, and on the edge of scrub.

### *Quarries/clay pits/spoil heaps/sand dunes*

Disturbed ground, particularly if the soil is calcareous, is often an ideal habitat for orchids of many types. Pyramidal Orchids, Bee Orchids and Common Spotted Orchids are all classic invaders of disturbed, calcareous soil and should quickly build up and spread. The planting of Fly Orchids may also be successful in dry chalk quarries, provided the vegetation is kept discontinuous. Little management of such sites should be needed in the first few years after establishment, except, perhaps, fencing against rabbits in the first few months should local populations be high. Later on as the vegetation becomes more rank some sort of cutting, grazing or disturbance-making mechanism should be employed to maintain bare patches of soil for re-colonisation by orchids, and scrub clearance carried out.

## **Bibliography**

- Beryle, H., Penningsfield, F. & Hock, B. (1991).** The role of nitrogen concentration in determining the outcome of interaction between *Dactylorhiza incarnata* (L.) Soo and *Rhizoctonia* sp. *New Phytologist*, **117**, 665-672.
- Clapham, A.R.; Tutin, T.G. & Warnburg, E.F. (1964).** *Excursion Flora of the British Isles*. Cambridge University Press, Cambridge.
- Cribb, P. & Bailes, C. (1989).** *Hardy Orchids*. Christopher Helm, London.

- Cofts, A. & Jefferson, R.G. (1994).** *The Lowland Grassland Management Handbook*. English Nature/The Wildlife Trusts.
- Dijk, E. (1989).** Effects of mycorrhizal fungus on in-vitro responses of juvenile orchids. *Agriculture, Ecosystems and Environment*, **29**,91-97.
- Dijk, E. & Olf, H. (1994).** Effects of nitrogen, phosphorous and potassium fertilisation on field performance of *Dactylorhiza majalis*. *Acta Botanica Neerlandica*, **43 (4)**, 383-392.
- During, H.J. & Willems, J.H. (1984).** Diversity models applied to a chalk grassland. *Vegetatio*, **57**,103-115
- Edees, E.S. (1972).** *Flora of Staffordshire*. David and Charles, Newton Abbot.
- Ellenberg, H. (1988).** *Vegetation Ecology of Central Europe*. Cambridge University Press, Cambridge.
- Fraser, A.J.L. (1992).** *Managing Wild Grasslands: A Guide for Landowners*. Worcestershire Nature Conservation Trust.
- Jenkinson, M.N. (1991).** *Wild Orchids of Dorset*. Orchid Sundries Ltd.
- Jenkinson, M.N. (1995).** *Wild Orchids of Hampshire & Isle of Wight*. Orchid Sundries Ltd.
- Landwehr, J. (1993).** *Les Orchidees Sauvages de Suisse et D'Europe I & II*. Piantanida, Lausanne.
- Lang, D. (1980).** *Orchids of Britain*. Oxford University Press, Oxford.
- McKendrick, S.L. (1994).** *The Ecology and Ecophysiology of some British Orchid Species*. PhD Thesis, University of Cambridge, Cambridge.
- McKendrick, S.L. (1995).** The effects of herbivory and vegetation on laboratory-raised *Dactylorhiza praetermissa* (Orchidaceae) planted into grassland in southern England. *Biological Conservation*, **73**, 215-220.
- Oberdorfer, E. (1979).** *Pflanzensoziologische Exkursionsflora*. Verlag Eugen Ulmer, Stuttgart.
- Primavesi, A.L. & Evans, P.A. (1988).** *Flora of Leicestershire*. Leicestershire Museums, Leicester.
- Rodwell J.S. (1992)** *British Plant Communities*, Three Volumes, Cambridge University Press
- Silvertown, J.Wells, D.A. Gillman M. Dodd, M.E. Robertson, H. & Lakhani, J.K. (1994).** Short-term effects and long-term after effects of fertiliser application on the flowering population of Green-winged Orchid *Orchis morio*. *Biological Conservation*, **69 (2)**, 191-197.
- Sinker, C.A. Packman, J.R.; Trueman, I.;Oswald, P.H.; Perring, F.H. & Prestwood, W.V. (1985).** *Ecological Flora of the Shropshire Region*. Shropshire Trust for Nature Conservation, Shropshire.
- Stewart, J. (1993).** The Sainsbury Orchid Conservation Project: The First Ten Years. *The Kew Magazine*, **10**, 38-43.
- Summerhayes, V.S. (1951).** *Wild orchids of Britain*. Collins, London.
- Warner, N. (1982).** A tale of Bee Orchids. *Nature in Cambridgeshire*, **25**, 50-58.
- Wells, T.C.E. & Cox, R. (1991).** Demographic and biological studies on *Ophrys apifera*; some results from a 10 year study. *Population ecology of terrestrial orchids* (Ed. by T.C.E. Wells & J.H. Willems), pp 7-61. SPB Academic Publishing, The Hague.