

## The current status of Military (*Orchis militaris*) and Monkey (*Orchis simia*) Orchids in the Chilterns

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### ABSTRACT

The past and current status of the two populations of Military orchid (*Orchis militaris*) and one population of Monkey orchid (*O. simia*) in the Chilterns is discussed. All three of these extant populations reached nadirs twenty or more years ago, but have since increased substantially, especially in the last five years, and are now considered relatively healthy. Preliminary results from re-introduction attempts are given. The possible causes of the population increases are discussed.

KEYWORDS: Orchidaceae, conservation, re-introduction, artificial propagation.

### INTRODUCTION

Both Military (*Orchis militaris* L.) and Monkey (*O. simia* Lamarck) orchids are considered to have once been relatively common in the Chilterns and surrounding area (Summerhayes 1951; Lang 1980; Farrell 1985), to the extent that advice on how to cultivate them (presumably after removal from the wild) was provided (Webster 1898). However, even 100 years ago, concern was expressed (Webster 1898) over the possible loss of some orchid species, including *O. militaris* (at that time *O. simia* was considered a sub-species, *O. militaris tephrosanthos*, of the Military or Soldier orchid), Webster writing that *O. militaris* had “suffered almost complete extermination at the hands of collectors and dealers”. By 1925, the situation was worse. Tahourdin (1925) wrote that the *O. militaris* was “now so rare that only a few privileged persons know where, if at all, it can be found” and *O. simia* (now considered a distinct species) occurred “only in South-Eastern England, and probably near extinction even there”. Around that time *O. militaris* was thought to have become extinct in the U.K. (Summerhayes 1951), and *O. simia* became confined to one site

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in Oxfordshire (Godfery 1933), leading Brooke (1950) to suggest that for both species “this excessive rarity appears to be due to the fact that the flowers are very seldom fertilized in this country”. However, he also noted regarding *O. militaris*, that “the builder and the farmer have laid waste many of its former haunts, and probably it has suffered more than most orchids from those who should be its best friends – the botanists”. Probably the same was true for *O. simia* (Summerhayes 1951)

This depressing situation took an unexpected twist when, in 1947, J. E. Lousley discovered, by chance, a colony of *O. militaris* growing at Homefield Wood in Buckinghamshire, a locality from which it had not previously been reported, although within its past distribution area (Summerhayes 1951; Farrell 1985). An even greater surprise was the discovery in 1954 of a large colony of *O. militaris* in Suffolk, well outside of the area normally considered its previous stronghold within the U.K. In contrast, *O. simia* was not considered to have become extinct (but see Preston *et al.* 2002, for a different opinion), although for many years it is thought to have existed on only one site (Hartslock) in the Chilterns, until the discovery of a single plant on a site in Kent in 1955, where the species thrived in subsequent years, possibly helped by hand pollination (Lang 1980).

The current situation is that both species remain very rare plants in the U.K. (Preston *et al.* 2002). *O. militaris* is confined primarily to the sizeable colony in Suffolk and two populations in the Chilterns, and *O. simia* is confined to two populations in Kent (one an introduction from the other) and one in Oxfordshire. It is recent changes in the numbers of these two species in Oxfordshire and Buckinghamshire (the Chilterns) which form the basis of this report. One of the populations of *O. militaris*, that at Homefield Wood, has been well studied for a long time, and earlier papers report on changes in the number of plants (Farrell 1985, 1991; Hutchings *et al.* 1998) and the population biology (Hutchings *et al.* 1998). These show that although the persistence of *O. militaris* at this site for the last 55 years suggests very considerable resilience, the population remained small (always less than 50 flowering plants), and hence very vulnerable. We are unaware of any reports in the open literature on the status of *O. militaris* at the other current site in the Chilterns, or of *O. simia* in the Chilterns.

#### THE SITES

There are presently two extant sites for native (not introduced) *O. militaris* in the Chilterns. One is Homefield Wood (SU814867), a mixed woodland with areas of open grassland. It has been owned by the Forestry Commission since 1955. A small portion of it, the area containing *O. militaris*, has been managed by the Berkshire, Buckinghamshire, and Oxfordshire Wildlife Trust (B.B.O.W.T.), under agreement, since 1969. In 1984 it was notified as a S.S.S.I. Further information about the site, since the discovery of *O. militaris* there in 1947, can be found in Farrell (1985 and 1991) and Hutchings *et al.* (1998). Recently, the area of habitat considered suitable for *O. militaris* has been increased by the removal of plantation trees planted in the early 1960s, and this has led to an expansion of the range of *O. militaris* at Homefield Wood. There are presently three distinct areas considered suitable for the species (see Fig. 1). When originally found (in 1947), the plants were located in the area here called ‘The Enclosure’, due to the fact that in 1968 a fence was erected around the remaining plants (Hutchings *et al.* 1998). In 1985, an adjacent grassland area was created by the clear felling of plantation trees: this area is referred to as the ‘1985 Clearing’. *O. militaris* have also appeared in ‘The Meadow’, which is separated from the other areas by trees and scrub (Fig. 1).

The other *O. militaris* site is privately owned, and there is no public access. It holds a relatively small population. For these reasons, we have chosen to refer to this site as Site X, rather than name and locate it. It is also managed by B.B.O.W.T. under an agreement with the owner.

Recent genetic fingerprinting studies (Qamaruz-Zaman *et al.* 2002) have suggested that the three extant native populations of this species (two in the Chilterns, one in Suffolk) are all distinct and probably represent independent colonisations from the continent (the U.K. populations are at the very north-west edge of the geographical range of *O. militaris* (Farrell 1985). The populations at the two Chiltern sites are probably the remnants of older, previously more extensive, populations (Qamaruz-Zaman *et al.* 2002).

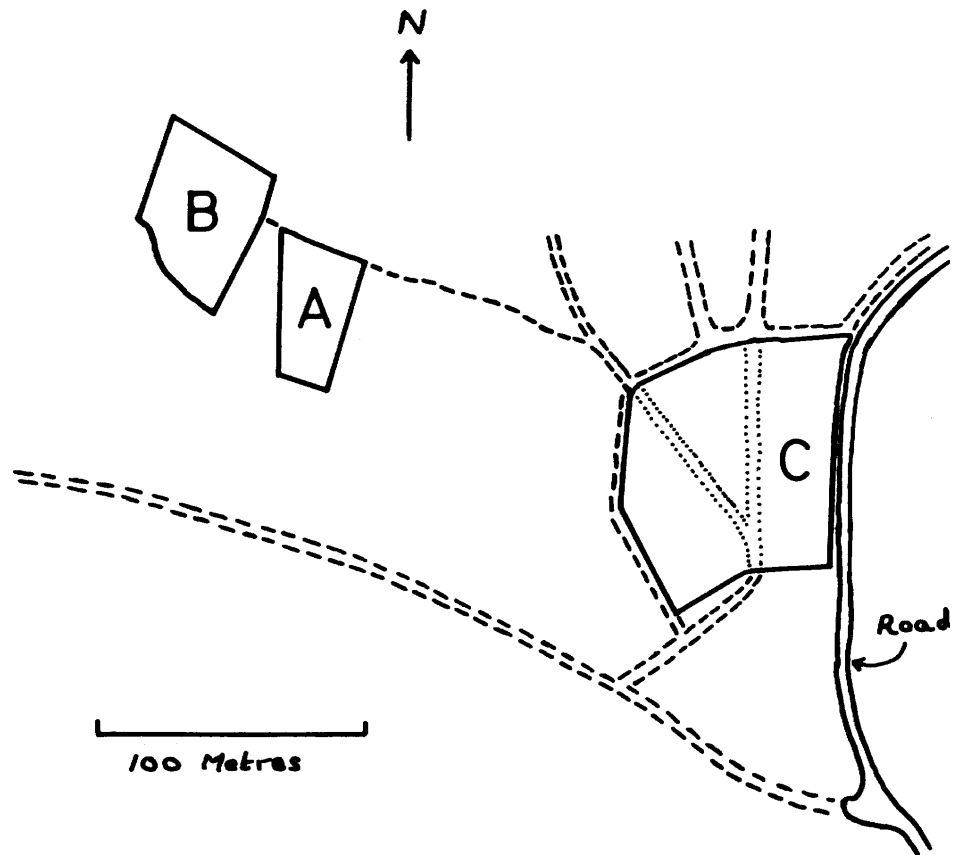


FIGURE 1. Simplified map of Homefield Wood S.S.S.I. in Buckinghamshire. *Orchis militaris* was originally found growing in the area now known as 'The Enclosure' (A). They now also grow in 'The 1985 Clearing' (B) and 'The Meadow' (C)

The only known extant site in the Chilterns for *O. simia* is Hartslock, Oxfordshire (SU616796). It is an area of 4.4 ha of species-rich chalk grassland, purchased by the B.B.O.W.T. in 1975. It is part of a larger S.S.S.I. The history of the existence of *O. simia* at this site can be found in Paul (1965) and Lang (1980). In brief, in the 1920s and 1930s there were more than one hundred *O. simia* plants at Hartslock. The whole slope on which the orchids grew was ploughed in 1950, after which the orchid led a very precarious existence at the site. Over the next 15 years, up until 1965, the number of flowering plants each year was very low, usually between one and five (Paul 1965).

#### DATA COLLECTION

All three sites have been managed for many years by volunteers (including the authors), under the direction of B.B.O.W.T. staff. Most of the data were collected by these volunteers. Additional data were obtained from records maintained by the B.B.O.W.T. In general, the data are considered very reliable. All three sites are relatively small, and the flowering spikes of both species are showy, and hence easily seen. Although various types of data (such as flowering dates, the frequency of flowering of individual plants, the size of each flower spike, the number of flowers per spike, number of seed pods per flower spike, etc) have been collected from all three sites, this paper concentrates only on the numbers of plants, although it includes data on both the numbers of

flowering plants and the total numbers of plants (vegetative plus flowering), hence conveying population trends. Accurate counts of vegetative plants are difficult, partly because these non-flowering plants are less obvious, and partly because small plants can be difficult to find. Thus, it is likely that the numbers given for all plants (vegetative and flowering) represent under-estimates of the true picture. Information on other aspects of the population biology of *O. militaris* at Homefield can be found in Farrell (1985, 1991) and Hutchings *et al.* (1998).

## POPULATION CHANGES

*ORCHIS MILITARIS**Homefield Wood*

When Lousley discovered *O. militaris* at Homefield in 1947, there were 18 flowering plants (Lang 1980). From then until 1995, the number of flowering plants fluctuated considerably (Farrell 1985, 1991; Hutchings *et al.* 1998), but was always low, reaching 45 in 1995, a 7-fold increase over the number in 1977 (Hutchings *et al.* 1998). However, there has recently been a very marked increase in the number of flowering plants, the number passing 100 for the first time in 2002 (Fig. 2). This increase in number has occurred unevenly in the three areas of the site (Fig. 3). The number of plants in 'The Enclosure' has remained relatively constant for the last 15 years. *O. militaris* first flowered in 'The Meadow' in 1983, but the number remained very low (five or less) until 1996, after which there was a steady, sustained increase (Fig. 3). The first flowering plants in 'The 1985 Clearing' were observed in 1995, when two flowered. Since then, there has been a dramatic increase in the number of flowering plants in this part of the reserve (Fig. 3). Hence, most (over 80%) of the increase in the total number of flowering *O. militaris* that has occurred in the last 10 years has been due to the appearance of plants in 'The 1985 Clearing'.

Fig. 2 also presents data covering the total numbers (vegetative and flowering) of *O. militaris* at Homefield Wood, over the last 27 years. The number remained fairly stable, around 50 plants, until 1990, before increasing steadily, and then markedly, in the last 8 years. Presently there are over 200 *O. militaris* plants at Homefield Wood. As can be deduced from Fig. 2, although the proportion of plants flowering fluctuates, it has been fairly consistent recently. For example, in the last ten years (1994 to 2003 inclusive) the percent flowering has ranged from 31.7 to 58.6 (mean  $\pm$  SEM:  $47.6 \pm 2.69\%$ ).

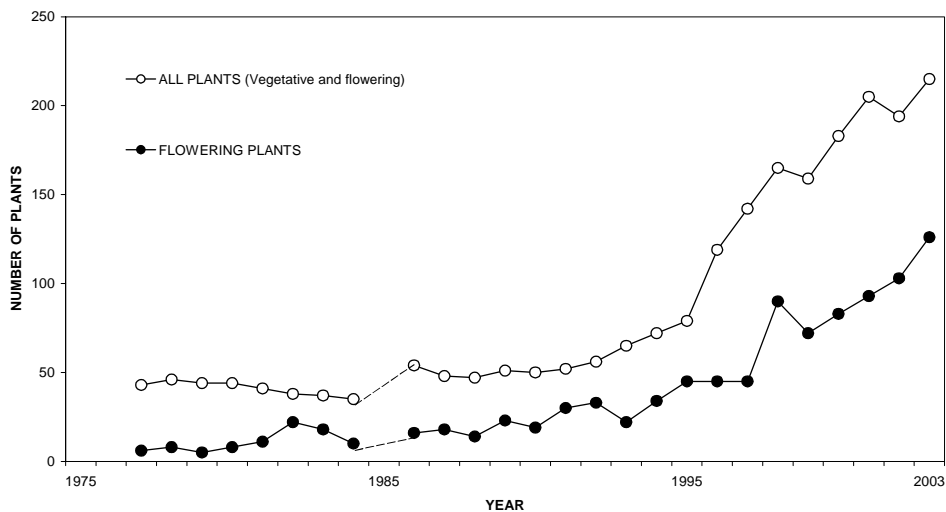


FIGURE 2. Changes in the number of flowering and total (vegetative and flowering) *Orchis militaris* at Homefield Wood, Buckinghamshire in the last 27 years.

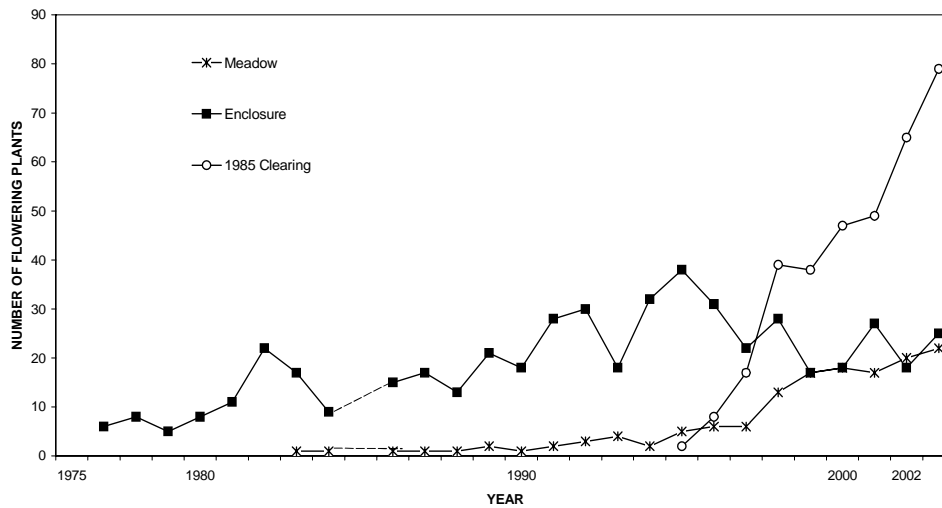


FIGURE 3. Changes in the number of flowering plants of *Orchis militaris* in the three different areas of Homefield Wood, Buckinghamshire in the last 27 years.

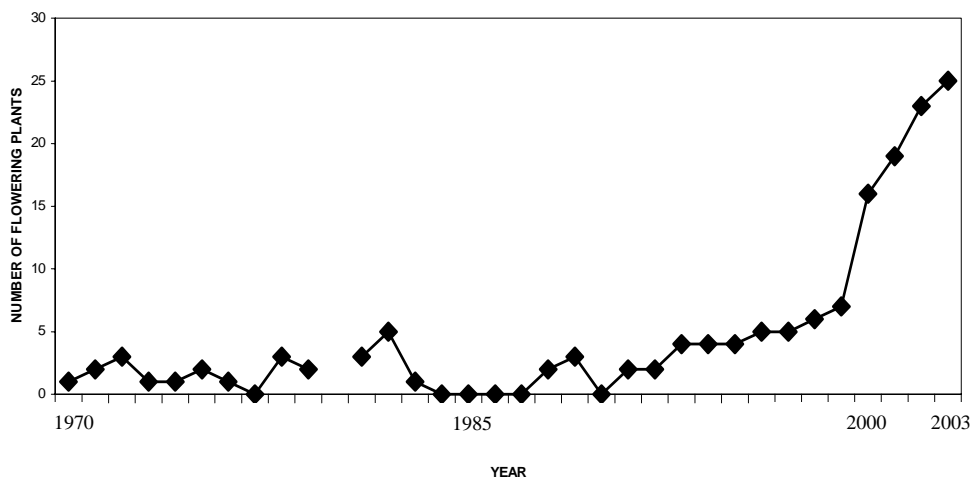


FIGURE 4. Change in the number of flowering plants of *Orchis militaris* plants at site x since its discovery in 1970.

*Site X*

*O. militaris* were first discovered at Site X, we believe by Lord Glendevon and Humphrey Bowen, in 1970. For the next 20 years, numbers remained very low, to the extent that in some years there were no flowering plants (Fig. 4), including for four consecutive years (1984 to 1987 inclusive). However, there has been a very pronounced increase in the number of flowering plants in the last 5 years, the total reaching 25 in 2003 (Fig. 4). Twenty five vegetative *O. militaris* plants were also present in 2003, making a total population of at least 50 plants. This was by far the highest number of plants that there has ever been at the site.

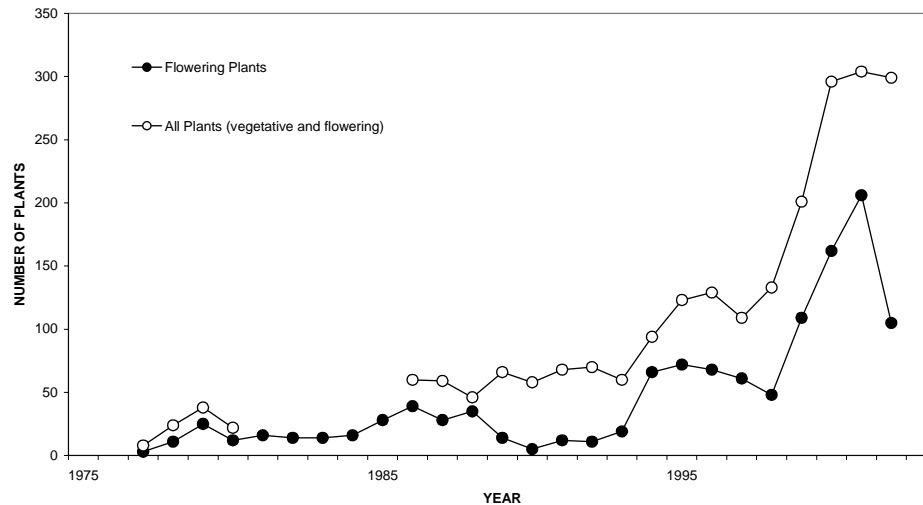


FIGURE 5. Changes in the numbers of flowering and total (vegetative and flowering) plants of *Orchis simia* at Hartslock, Oxfordshire since 1977.

#### ORCHIS SIMIA

Numbers of flowering plants every year for the last 26 years are shown in Fig. 5. The number fluctuated considerably for the first 15 years (from 1977 to 1992), being as low as five in one year. However, numbers have increased markedly since then, and reached over 200 flowering plants in 2001 (Fig. 5), before falling significantly in 2002, although still remaining very high in comparison to historical records.

Fig. 5 also shows the change in the total number (flowering and vegetative) of *O. simia* at Hartslock during the last 26 years (unfortunately, accurate data for 2003 are not available, but the situation appeared similar to that of the previous year). As occurred with *O. militaris* at Homefield Wood, after a slow but steady increase in the number of plants during the 1980s and early 1990s, thereafter there was a very marked increase, and since 2000 there have been around 300 identifiable *O. simia* plants at Hartslock. The proportion of plants flowering has, as with *O. militaris*, been reasonably consistent, especially recently. For example, in the ten years between 1993 and 2002, between 31.7 and 67.8 percent of plants flowered (mean  $\pm$  SEM:  $51.7 \pm 4.0\%$ ).

#### ARTIFICIAL PROPAGATION OF *O. MILITARIS* AND TRANSPLANTATION OF THESE PLANTS INTO THE WILD

*O. militaris* seed collected over the years from Homefield Wood plants was supplied by The Royal Botanic Gardens, Kew, to Mr Svante Malgrem in Sweden, under a CITES licence. He raised plants aseptically (i.e. without any associated fungus). Two hundred and thirty one tubers, a mixture of one and two-year old plants, were planted at Homefield Wood (in 'The 1985 Clearing') and Warburg Nature Reserve (SU720879) in early July, 1996, and their subsequent progress monitored. In general, the plants did not fare well, at either location (Table 1). Even in the first year after transplantation, only a minority of plants showed above ground, and this proportion decreased steadily in the following years, such that very few plants now survive. However, a few plants have survived and grown enough to flower: the first artificially-propagated plants flowered at Homefield Wood in 2000, and five flowered in 2002, when the first plant (of the very few remaining) flowered at Warburg Nature Reserve (Table 1). In 2003, six plants, out of the ten that showed at Homefield Wood, flowered, but none flowered at Warburg.

Three other points of interest have emerged from this experiment. Firstly, that the tubers that were two years old when planted out into the wild survived better than those that were only one year old. This point is well illustrated by survival rates at Warburg Nature Reserve: in 1998, 23 out of 50 (46%) two year old plants showed above ground, whereas only 7 out of 70 (10%) one year

TABLE 1. NUMBERS OF VEGETATIVE PLANTS ARISING FROM MIXED ONE AND TWO YEAR-OLD MILITARY ORCHID TUBERS TRANSPLANTED IN 1996. THE NUMBERS OF FLOWERING PLANTS ARE SHOWN IN BRACKETS

SITE	YEAR							
	1996	1997	1998	1999	2000	2001	2002	2003
HOMEFIELD WOOD	111	31(0)	27 (0)	20 (0)	16 (2)	17 (7)	ND (5)	10 (6)
WARBURG RESERVE	120	18 (0)	30 (0)	16 (0)	11 (0)	8 (0)	4 (1)	4 (0)

ND = Not Determined

The data for Warburg in 1997 were not adequate, because we did not look early enough in the year, and hence the figure of 18 is a minimum.

old plants did. Secondly, that although survival was somewhat better at Homefield Wood (an established site for the species) than at Warburg Nature Reserve (where, as far as we are aware, *O. militaris* had never been common, although a herbarium specimen dating from 1862 was collected approximately 400 m from where the young tubers were planted), the difference in rate of survival was not great (Table 1). Thirdly, most of the plants which showed above ground for one or more years at Homefield Wood were ones placed in amongst existing plants. In contrast, tubers planted away from other, established plants fared much less well (data not shown).

#### REINTRODUCTION OF *ORCHIS MILITARIS*

As part of the Species Recovery Programme for *O. militaris*, twelve plants were removed (with the agreement of English Nature) from Homefield Wood in 2000 and introduced to a National Trust site considered suitable for the species. This site is approximately 25 km from Homefield Wood, and lies within the previous distribution range of *O. militaris* (Farrell 1985). The tubers were all of plants which flowered in the year they were relocated, or in the previous year. They were much larger than those used in the experiment (discussed above) based on the artificially propagated tubers.

In the following year, eight out of the twelve plants flowered. Five of these had flower spikes bearing seed pods when next observed in August, and it appeared that 33.5% of the flowers on these five flower spikes had set seed. In 2002, ten plants showed, eight of which were in bud when observed in early May. When observed next, in August, it appeared that six plants had flowered. These had between zero and sixteen seed pods per flower spike, suggesting relatively poor pollination. In 2003, nine plants showed, of which seven flowered, one aborted a flower spike, and one was vegetative.

#### DISCUSSION

The most obvious feature of the populations of both *O. militaris* and *O. simia* orchids in the Chilterns is the very pronounced increase in numbers of both flowering and vegetative plants at all sites in the last five years. These simultaneous increases might suggest a common cause, of which the most likely might be climate change. In England, both species are at the very north-western limit of their European distributions (Farrell 1985). They are considered to grow best where the spring and summer are warm (Farrell 1985), and therefore their U.K. populations might be expected to prosper with global warming. To date, there appears to be relatively little evidence that global warming has yet made a great difference to the distributions of most British plants (Preston *et al.* 2002). In contrast, there is good evidence that climate changes has led to the northward spread of some species of butterfly in Britain, Ireland, and mainland Europe (Parmesan *et al.* 2001). Hence, we cannot conclude presently whether or not climate change has had a significant positive effect on the *O. militaris* and *O. simia* in the Chilterns. However, results from a long-term study of another outlier population of *O. simia*, in the Netherlands, may be relevant to the situation in the U.K. In this population, there is evidence to suggest that both population size and the proportion of plants flowering can be strongly influenced by weather conditions (Willems & Bik

1991); low temperatures when plants appear above ground (January–February) resulting in death of a significant proportion of established plants. In contrast, mild winters led to higher numbers of plants flowering (Willems & Bik 1991). Hence, if climate change leads to warmer winters (as has occurred recently in the U.K.), over-winter survival of plants at the northern extremities of their ranges, such as *O. militaris* and *O. simia*, may be enhanced.

Another factor that is likely to have contributed to the increase in numbers of both species is appropriate management of the sites. However, definitively linking particular management strategies with changes in numbers of orchids is difficult because of the time lag between seeds setting and plants flowering. The precise length of this time interval is unknown for both species under consideration here, but may well be between 5 and 10 years (Summerhayes 1951; Farrell 1985; Hutchings *et al.* 1998). Hence, it is quite possible that management practices in the late 1980s and early 1990s were responsible for the increased numbers of plants that occurred in the last five years, but proving (or refuting) this link will be extremely difficult, if not impossible.

The general management strategy at all three sites was similar; it involved fencing the areas containing the orchids, grazing with sheep in autumn/winter, and scrub management. The deer and rabbit-proof fencing is designed to eliminate (or at least greatly reduce) the loss of plants and/or flower spikes to these grazers, which otherwise can do considerable damage. Fencing also allows controlled autumn/winter grazing with sheep, with the sheep preferably being removed before the orchids appear above ground, which can occur as early as November, although is usually January or February.

Besides these general management practices common to all three sites, site-specific actions may have contributed to the success of the orchids. In the case of Homefield Wood, the creation (by clear felling of plantation trees) of the '1985 Clearing' undoubtedly contributed very significantly to the overall increase in number of *O. militaris* at this site; in 2003, well over half of all flowering plants occurred in this clearing, despite the fact that the first plant flowered in this clearing only eight years earlier. Hence, the creation of more suitable habitat was indisputably a key factor. The fact that it took 10 years after creation of the clearing for the first *O. militaris* plant to flower there suggests that a considerable time needs to elapse before the success (or otherwise) of such a management practice can be gauged. This regular creation of additional areas suitable for orchids provides a dynamic environment into which new plants can colonise. Over time, established, but often relatively small, areas (such as 'The Enclosure' in the case of Homefield Wood) can become invaded by scrub, or change in character in other ways (perhaps imperceptibly), and become less suitable for orchids. Small, isolated populations may be more vulnerable than larger ones spread over larger areas. Therefore, a management strategy that regularly provides new areas ecologically suitable for the orchids, while maintaining established areas in appropriate condition, seems sensible.

Hand pollination is another management practice that might have played a significant role in the expansion of the populations of both orchids. According to the literature, natural pollination rates are very low; for example, Farrell (1985) summarizes the information available for *O. militaris* at that time by writing "it thus seems likely that poor seed set has been characteristic of British populations for at least 150 years". Various authors report that the proportion of flowers producing seed is around 5%, perhaps due to lack of suitable insect pollinators (e.g. Summerhayes 1951). Some degree of hand pollination of the orchids has occurred at all three sites, probably starting in the late 1980s or early 1990s. At Site X, after a number of years of no sign of the presence of *O. militaris*, two plants flowered regularly in the late 1980s. Given the precarious hold of this species at the site, the decision was taken to hand pollinate as many flowers as possible, to maximise seed production, even though there was concern that this might weaken the plants and shorten their lives. This achieved almost 100% successful pollination. The same two plants were heavily hand pollinated for the following 10 years, during which time seed production was (presumably) high. Thus, artificial pollination each year did not seem to have a deleterious effect on these two plants, a fact we have confirmed by hand pollination of other plants more recently.

At Homefield Wood, some hand pollination (up to 20% of available flowers) was carried out from 1986 to 1998, but none has occurred since. Overall, the percentage of flowers pollinated (some by hand, but the majority naturally), and which set seed, fluctuated between 21 and 59% (mean 38.7%) over this period, figures much higher than those reported earlier by other authors (e.g. Summerhayes 1951; Farrell 1985). No hand pollination was carried out in 1999 and 2000, when 40 and 24%, respectively, of flowers were pollinated and produced seed pods. We do not

know why the degree of pollination appears much higher now than it did to earlier authors. Similarly, hand pollination of *O. simia* has ceased, because natural pollination and seed production appears high.

The degree of success of the first stage of the re-introduction programme for *O. militaris* is difficult to gauge presently. Despite the success of raising *O. militaris* aymbiotically from seed, the young (1 and 2-year old) plants have not fared well, although a few have survived and flowered (and may continue to do so in subsequent years). The reason(s) why most plants failed is unknown. In contrast, the much larger (and presumably older) tubers transplanted from Homefield Wood to a new site have fared much better, and most have flowered, or at least attempted to flower, in the two years following their translocation. These plants must have produced a new tuber each year, suggesting that the conditions were favourable. Further, some natural pollination occurred, suggesting the presence at the site of at least one species of pollinating insect, although the overall degree of pollination has been quite poor. However, data for pollination success of the re-introduced plants are not very good presently, and hence we are cautious of drawing any firm conclusions as yet. It will probably be many years before it is known if this re-introduction has been successful; it will require the appearance locally of new plants, the offspring of the transplanted 'parents'. Using modern genetic techniques (Qamaruz-Saman *et al.* 2002) it would be possible to establish whether any new plants were indeed offspring of the transplanted plants, as opposed to natural spread from other plants at other sites.

## ACKNOWLEDGMENTS

This paper is dedicated to the memory of Bill Havers, who died in 2002, after 16 years of successfully managing Homefield Wood nature reserve. His efforts, more than anyone else's, were responsible for the current very encouraging situation for *O. militaris* at Homefield Wood.

We are particularly appreciative of the efforts of Svante Malgrem, who raised the young *O. militaris* plants in Sweden, and to Margaret Ramsey of the Royal Botanical Gardens, Kew, who supervised the propagation and transplantation of these young plants. We also thank the many wardens, volunteers, and B.B.O.W.T. staff who have contributed to the management of the reserves, and the owners of the sites for allowing them to be managed for the rare orchids.

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