The Conservation of the Native Orchids of Lombardy
INFO

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Nomenclature of the orchids
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Il Castello, Cornaredo (MI), Italia.

Front cover:
Traunsteinera globosa in the Orobie
Bergamasche park (photo S. Pierce)

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Project ORCHIS began in 2009 and aimed to protect part of the high biodiversity of the Lombardy pre-Alps: a flora exposed to environmental risks associated with direct human pressures and global climate change. In this context, native orchids are a key group for biodiversity conservation. They combine a specialized and particularly vulnerable ecology with a preference for habitats that are becoming increasingly threatened. This combination of requirements means that many orchid species do not receive sufficient protection, and specific conservation measures are required to allow a return to traditional forms of grassland management and grazing of pre-alpine and alpine pastures. Faced with this emergency, habitat conservation is often insufficient to ensure an effective barrier against the extinction of species with important natural significance, especially in the face of phenomena such as global warming and the gradual abandonment of pasture by man. For the first time in Lombardy, and also representing one of the first cases in Italy, the protection of flora in the wild has now been extended to include protection away from the habitat, in the form of a germplasm bank, a kind of safety-deposit box for seeds and plant material. That deposit may be used in coming centuries if habitat conservation fails, halting the extinctions of numerous plant species that have been a hallmark of human history. Thanks to modern technology that allows seeds to be kept alive for long periods, it will be possible to create new plants to be reintroduced in the appropriate places. During the project described here, over 10,000 seedlings including some of the most important orchid species have been produced in the laboratory and returned to the wild. Demonstration plots showing the environments in which orchids and other native plants live have been recreated for educational purposes near to mountain hostels managed by the Club Alpino Italiano (CAI). The superb results of project ORCHIS allow us to look to the future with confidence but also with the awareness that our environment depends primarily how we decide to act.

FRANCO GRASSI
President of the Orobie Bergamasche Park
Our native orchids are the most mysterious of beings, appearing for only the briefest of moments during the year, usually as pink or white stars scattered amongst the swaying greens and yellows of our meadows and pastures. Pallid forms, such as the ghost orchid (*Epipogium aphyllum*), haunt the darker corners of the woodland, but these are neither as diverse nor as locally characteristic as the grassland species. Most orchids are so strongly associated with species-rich meadows and pastures, maintained according to traditional methods, that they find it difficult to survive in a changing modern world. This short book will explain how
meadow and pasture orchids have become so intimately dependent on our ways of life, and what is currently being done to guarantee the future of these rarest of plants as traditional agricultural methods are increasingly forgotten. Meadows, strictly speaking, are grasslands that are maintained by mowing, and we shall also see examples of pastures where orchids grow where the grass is grazed. We shall visit examples of lowland meadows and upland pastures throughout the Lombardy region, and examine in some detail the conservation projects currently being undertaken in Lombardy’s natural parks, particularly Parco Monte Barro and Parco delle Orobie Bergamasche. We shall explore the role of parks in providing safe havens for orchids, and the use of cutting-edge techniques being developed to reproduce these plants. Orchid reproduction is complex, in many ways defining what it means to be an orchid, and this must be understood if we hope to successfully manage orchid habitats or reproduce and reintroduce these plants.
All orchids have one particular petal (the labellum) that is different from the others, modified to form a landing platform for pollinating insects. The pollen is packed into two parcels called pollinia, which are glued onto the head or body of the visiting insect. The pollinia are arranged so that they can touch the insect in the correct place, because the orchid sexual organs (the parts that dispense and take delivery of pollen) are all united into a single column. Thus the insect delivers all of the pollen directly to the column of the next flower it visits, wasting none. **Only orchids do this.** Each pollen grain fertilises a single ovule (equivalent to an egg in animals), which develops into a single seed, and many thousands of infinitesimal seeds are scattered as a fine powder on the wind. Thanks to this special relationship with insects, orchid flowers have extremely distinctive and sometimes bizarre shapes that capture our imaginations and reward the senses.

Most of our native orchids escape summer drought by retreating below ground, producing a fresh tuber each year that grows next to the previous year’s tuber. It is from these twin tubers that we get the name orchid, which in Greek means “testicle”.

This way of life was originally a way for species in a Mediterranean climate to survive where it is the hot summers, not the winters, which kill plants. Thus most species can produce only a few leaves each year, which are small and lie close to the ground, meaning that orchids find it difficult to get enough sunlight when surrounded by taller plants. A meadow, in which plants are cut and the light arrives at the ground surface, is a good place for them to live.

One of the side effects of this way of life is that orchids actually grow during the winter and many, such as the early spider orchid (*Ophrys sphegodes*), flower as soon as the warmer spring permits.
By mowing, humans have artificially extended suitable conditions for orchids over greater areas, and orchids have become intimately associated with the traditional ways of life that we are now losing in an industrialised age.

A rare white form of *Gymnadenia conopsea* in a pasture in the Orobie Bergamasche park (photo S. Pierce)

*Ophrys sphegodes* in a meadow at Monte Barro (photo S. Pierce)
“Plant a tree” is a slogan that is often heard when people are encouraged to conserve nature. However, if the aim is to save as many species as possible then planting trees is not ideal. Why? Because one square metre of meadow may contain 30 or 40 species, but the same area of woodland may contain only 2 or 3.

The best way to save many wild flowers is to stop tree seedlings from becoming established by mowing. The ideal situation, exemplified by Parco Monte Barro, is a mosaic of grassland and woodland that conserves as much biodiversity as possible.

The effect of cutting abandoned grasslands is rapid and striking, and is shown in these photos from Monte Barro. The first shows neglected grassland invaded by woody plants. As part of an EU LIFE project, the park cut the trees in this area and, in the second photo, this was enough to restore the grassland.

The sword-leaved helleborine (Cephalanthera longifolia), an orchid, is visible. This can lie dormant in a vegetative (non-flowering) state for several years and orchid roots are “plugged in” to a network of soil fungi that can provide them with a small
amount of food. Seeds are also present in the soil. Thus, as soon as the trees are cut, many flowers can reappear immediately.

The most important people for the conservation of meadow orchids are actually the private individuals who carry on the tradition of mowing. Collectively, olive groves, vineyards and private meadows cover large areas of land and traditional mowing regimes are carried out with an experienced eye for the seasons, avoiding damage to the flowers and fruits. Natural parks can learn from this experience, and provide “islands” of security, where traditional management regimes may be guaranteed, amongst a sea of urbanisation.
Population size and distribution reveal which species benefit from habitat conservation or ex situ reproduction. © 2006 Society for Conservation Biology.

Sometimes orchid populations can become so small that even habitat conservation is not enough to help them recover. Small populations attract fewer pollinating insects, and when pollinators do arrive at isolated groups of plants they tend to make short hops between neighbouring flowers, pollinating closely related individuals, rather than the lazy random flights they make when surrounded by a wealth of flowers. Thus pollen tends to fertilize close relatives and, following the same principle as a marriage between cousins, this can lead to problems of infertility and development. What can be done?

Research conducted at the CFA shows that orchid populations fall into three categories, allowing us to identify those that are at risk:

- species found in a range of habitats, needing no conservation,
- species that are locally common within a particular habitat and which respond well to habitat conservation,
- species with small populations even within their ideal habitat.

These latter species, including orchids such as the bee orchid (Ophrys apifera) and autumn lady’s-tresses (Spiranthes spiralis), are those that benefit when habitat conservation is not enough

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from extra help in the form of artificial reproduction and restocking of the population. When the “at risk” populations have been identified we can obtain pollen from a larger, healthier population of the same species to produce seed. In the photo we can see pollen being taken from a flower of the extremely rare endemic insubric bee orchid (Ophrys benacensis), using a toothpick to mimic the head of a visiting insect.

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Artificial reproduction of orchids at the CFA

As orchid seeds travel on the wind they are too small to carry nutrient reserves, and usually rely on the help of particular soil fungi to help them germinate. The fungus attacks the seed, but the orchid is usually able to break down fungal cells and use the “spare parts” as nutrients. However, it is unreliable, costly and time-consuming for us to use this to reproduce plants, and if we provide the correct conditions in the laboratory we can stimulate orchids to germinate on their own. Orchids need sugar to germinate, and also small amounts of mineral nutrients. The seeds are dormant and need time to absorb nutrients and start germinating – time during which bacteria and other micro-organisms can invade, use all the nutrients, and then kill the seeds. For this reason seeds are grown in sterile conditions. First they are dipped in bleach, washed...
in sterile water, and sown on a nutrient-gel in disinfected glass or plastic containers. We can also add artificial hormones or fruit juices that contain natural plant hormones which stimulate germination – coconut milk is particularly effective. At the CFA we germinate seeds in flat plastic dishes, as the seeds are so small that we must use a microscope to check how germination is progressing. When plantlets start to produce their first green leaf they are transferred to upright tubes. The whole process takes one or two years, depending on the species, until the plants are a centimetre tall and produce a small, fat tuber.
The cultivation and restocking of orchids

In late summer dormant orchid tubers are taken out of their sterile containers, transferred into a well-draining soil mixture in small pots, and placed in the greenhouse. They will produce a new rosette of leaves and grow in the cold, surviving temperatures of minus 10°C so long as it is not too wet (a combination that can rot the leaves and roots). In the summer they lose their leaves and must remain dry. Once again, the plant survives as a tuber and starts to grow new leaves in the autumn. The timing of this cycle depends on the species. Orchids are extremely sensitive to disturbance, and each time plants are transferred from sterile dishes to tubes, and ultimately to soil, around half of the plants die. Extremely high death rates also occur for young plants in nature, and this is one of the reasons why orchids produce tens of thousands of seeds in each fruit. This means that for a species such as *Ophrys benacensis*, represented by just 10 wild plants at Monte Barro...
in 2006, we have nonetheless been able to produce enough plants to substantially increase the original population and also re-establish populations that have previously disappeared – over 75 mature plants of this extremely rare species were produced and used to reinforce the population of Monte Barro.

*Ophrys benacensis* flowered in captivity for the first time in the world, at the CFA in April 2010 (photo S. Pierce)

*A three-year old plant of O. benacensis, ready for transplantation into the wild (photo S. Pierce)*

*n Ophrys sphegodes* produced from seed, flowering at the CFA (photo S. Pierce)

*Ophrys benacensis* returned to the wild at Parco Monte Barro (photo S. Pierce)
Project ORCHIS

Project ORCHIS (Orchid Restocking and Conservation for Higher altitude Indigenous Species) aimed to reproduce and restock alpine and sub-alpine orchid species, particularly for the Orobie Alps in the Parco delle Orobie Bergamasche. The project included notable successes such as the discovery of a method for the germination of the small white orchid (*Pseudorchis albida*)\(^3\), which has never before been successfully reproduced. Other key species included the lady’s-slipper orchid (*Cypripedium calceolus*), the vanilla orchid (*Nigritella nigra* ssp. *rheillicani*) and the frog orchid (*Coeloglossum viride*). A total of 9000 plants of 14 species were reproduced from seed and used in population restocking during the project\(^4\) (see front cover image).

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The project addressed a number of problems that orchids face: it included studies of pollination problems, and also aimed to help protect orchids against human disturbance by educating the public. This was achieved mainly via the production of “demonstration plots” near a number of **CAI mountain refuges** (hostels) in the Orobie Alps and at **Parco Monte Barro**. These were constructed using orchids and “companion plants” that were all produced from seed during the project, and aimed to demonstrate what the local orchids look like and also the kind of vegetation in which they live. These will be highly visible to the people that are most likely to visit orchid habitats but who are perhaps unsure what orchids are. The refuges involved are shown on the map on the inside back cover of this publication.

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Orobie Bergamasche Park

The Orobie Bergamasche Park is a montane forest park. With a surface area of approximately 70,000 hectares, it represents the greatest area of wild landscape of any of Lombardy's natural parks. It encompasses the western peaks of the Orobie, majestic mountains that stand tall to over 3,000 metres in elevation, realm of the eagle, the alpine ibex, and breathtaking views.

The park also includes part of the territory of the Mountain Communities of Valle Seriana, Val di Scalve and Val Brembana, including a total of 44 municipalities. The flora and fauna are highly diverse: fruit of the unique characteristics of the park, including the variety in its landscapes, the richness of its surface waters and range of elevations.

At the heart of the Orobie Bergamasche the Serio falls cascade 315 metres and discharge ten thousand cubic metres of water from Lake Barbellino, at 1,750 m elevation: the falls include three successive waterfalls of 166, 74 and 75 metres, ending up in the Serio river, which carries up to 6 cubic metres of water a second.
Location of the demonstration plots of Project ORCHIS at mountain hostels in the Orobic Bergamasque Park and at Monte Barro Park

LEGEND
- Mountain hostels (refuges)
- Lakes
- Site of Community Interest (SCI)
- Parco Regionale delle Orobie Bergamasche
- Parco Regionale del Monte Barro

Map of CAI mountain refuges where the demonstration plots of Project ORCHIS are located (D. Turri)