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Editorial

Conservation biology of orchids: Introduction to the special issue

Scientists, conservationists and many members of the general public are now well-informed about the escalating losses of biological diversity throughout the world. Most concerned individuals also appreciate many of the natural and anthropogenic causes of biodiversity losses, the potential economic and environmental costs of such losses, and the attendant threats to ecosystem functioning. Less well-appreciated is the fact that there is much variation in the resilience and susceptibility of both individual species and categories of species in the face of threats to their survival. Relative to other plant families, there is evidence (e.g. Hutchings, 1989) that orchids are subject to high levels of threat, through both natural and anthropogenic causes. In some respects the Orchidaceae can be seen as a highly successful family, having diversified into an estimated 25,000 species, with representatives capable of occupying almost every conceivable ecological situation, apart from marine environments and habitats characterised by extreme cold throughout the year. However, orchids also feature prominently in many national Red Data Books, and the abundance of many orchid species is believed to have fallen to critical levels in recent decades. It is difficult for those entrusted with the task of conserving these charismatic species to be certain of the best management regime to use because orchids have complex life histories that require lengthy and detailed study to understand.

Fortunately, orchids have long held a strong attraction for amateur and professional breeders, artists, photographers and (less fortunately) collectors. Their popularity is probably due to the beauty of many orchids, the variety of forms they have evolved, and their astonishing adaptations for facilitating pollination. Consequently there is much disparate, and often anecdotal, information about many species. More recently, orchids have also attracted interest from professional scientists, and there is now very detailed information at least on a small number of representative orchid species. For example, the population ecology of some orchids has been studied more extensively (in some cases for decades), than that of almost any other plant species (e.g. Tamm, 1972, 1991; Wells, 1981; Wells and Cox, 1991; Willems, 1989, 2002; Hutchings, 1987a,b; Hutchings et al., 1998; Kull, 1998, 1999). In 1990, a series of workshops was initiated to bring together scientific information on aspects of orchid biology and conservation and to discuss future research, management and conservation of orchids. To date, three workshops have been held, in 1990, 2001 and 2004 (Wells and Willems, 1991; Kindlmann et al., 2002). Two other recent milestones in understanding the ecology and conservation of orchids were the First Orchid Conservation Congress, which was held in Perth, Australia, in 2001, and a volume of papers written by experts on a variety of topics relevant to orchid conservation (Dixon et al., 2003). The set of papers assembled here presents results from the most recent International Orchid Workshop, which was held in 2005 in Haapsalu, Estonia. The papers address a wide range of topics in orchid biology, ranging from analysis of problems in orchid taxonomy to management regimes for the conservation of individual species.

Two papers address evolutionary topics. Pillon et al. (2006) assess biodiversity in the taxonomically complex genus *Dactylorhiza* using molecular methods. The greatest diversity in this genus is found to be in the Caucasus and Mediterranean Basin, rather than in western Europe, as is conventionally believed. They attribute this misconception to taxonomic inflation caused by regional variation in research effort. Cozzolino et al. (2006) use molecular and field-based evidence to show that, in the food-deceptive orchids *Orchis mascula* and *O. pauciflora*, hybridization is common but introgression is rare. Parental taxa have higher fitness than their hybrids, suggesting that there is little threat of the hybrids displacing the parents. However, it is recommended that hybrid zones should be considered as important for conservation, because they are sites for evolution of new orchid species.

Whigham et al. (2006) report the first large-scale study to determine whether orchids can accumulate viable seed banks in the substrates of their natural habitats. This is important work; little is known about orchid seeds because their small size makes them very difficult to study. The study shows that seeds of several species retain viability and can germinate for several years in the field. This information suggests that, at sites where orchids have recently become extinct, it may eventually be possible to restore populations by germinating seeds from a viable seed bank.

Kull and Hutchings (2006) present a comparative analysis of declines in orchid range in two highly contrasting European countries – Estonia, which has very low human population density and much conserved semi-natural habitat, and the UK, where population density is much higher and remaining semi-natural habitat is rapidly losing species. Over approximately the same time period there has been much higher orchid decline in the UK. Interestingly, the relative rates of decline for orchids of different habitat types in these two countries contrast strongly with those reported for other European regions (Jacquemyn et al., 2005).

Five papers consider population ecology and management of orchid species in widely different parts of the world. Janečková et al. (2006) analyse the effects of weather and mowing frequency on the wetland orchid *Dactylorhiza majalis*, concluding that annual mowing after fruit set produces the greatest benefits for individual plants and populations. Gregg and Kéry (2006) examine the relationships between survival, plant size, life-state and dormancy in populations of the North American orchid *Cleistes bifaria*. Using capture–recapture models they report that models based on classification of orchids using both size *and* life-state produce the most accurate information for evaluating different management regimes for conservation. Coates et al. (2006) study the critically endangered gaping leek orchid (*Prasophyllum correctum*) in Australia, concluding that the most suitable management for its conservation involves frequent disturbance, especially burning, as this shortens the time orchids spend in dormancy, reduces mortality, promotes flowering, and, presumably, maximises the potential for recruitment. Tremblay et al. (2006) study population dynamics of epiphytic or lithophytic *Lepanthes rupestris*, analysing applicability of metapopulation theory. Finally, Zotz and Schmidt (2006) present a valuable study of a tropical forest epiphytic orchid, *Aspasia principissa*. Current population growth rates fall far short of population maintenance. They suggest that this is due to a long-term decline in precipitation and consequent increased forest dynamics, involving more frequent tree branch falls and tree deaths, leading to higher mortality of the epiphyte.

Several of these papers present new detail about the threats faced by orchids in the modern and the future world. Each one of them contributes important new information to our understanding of different facets of orchid biology. The information presented here increases our capacity to conserve these extraordinary species. We hope that these papers will also encourage more researchers to allocate time to the study and conservation of endangered orchids throughout the world.

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