observations of orchids and his perceptive interpretations of their floral adaptations (1862) led him to conclude famously that "(n)ature... abhors perpetual self-fertilisation" and that many floral mechanisms promote outcrossing. To assess this hypothesis, Darwin conducted 11 years of crossing experiments (1876), demonstrating the typically detrimental effects of selfing (i.e., inbreeding depression). These findings then led him to elucidate the cross-promotion functions of heterostyly and dioecy (1877). This body of work established the foundation of much current understanding of the evolutionary ecology of plant reproduction; indeed, some of Darwin's hypotheses on the subject have been tested only during the last decade. Although Darwin's misunderstanding of genetic transmission and his failure to appreciate fully the significance of male function to the fitness of hermaphrodites, his seminal ideas about reproductive adaptation serve as an enduring legacy to the study of plant biology.

doi:10.1016/j.sajb.2009.02.013

The scent of the vanishing flora: New and uncommon volatile compounds in most diverse endangered plant species

R. Kaiser
Givaudan Schweiz AG, Fragrance Research, Ueberlandstr. 138, CH-8600 Dübendorf, Switzerland

As a part of our broad and ongoing search for new scent molecules and scent concepts in nature during the past 25 years, we have encountered an astounding number of interestingly scented species which, today, have to be considered as endangered. In our appreciation of these wondrous plants and in the hope to sensitize people for the many reasons making conservation activities so important, we decided in 2001 to focus even more on highly endangered scented species worldwide and to compile their scent compositions as well as complimentary information in an upcoming book entitled "The Scent of the Vanishing Flora". The purpose of this lecture is to give with a series of interesting examples from whole over the world an introduction to the concept of this future book. Discussed among others are new derivatives of (E)-4,8-dimethylnona-1,3,7-triene found in the flower scent of *Abeliophyllum distichum*, an Oleaceae native to Korea, the scent of the famous *Rothmannia annae,* a Rubiaceae endemic to the Seychelles, the scents of a series of South African species belonging to the families of Iridaceae and Orchidaceae, some highly interesting new compounds identified in the flower scents of South American orchid species, as the trans-(Z)-3-methyl-7-dodecen-4-olide dominating the floral scents of many *Kefersteinia* species, as well as the scent concepts of highly endangered Hawaiian species as those of *Brighamia insignis* and *Hibiscus waimeae* ssp. *waimeae*. Finally, we will end this fragrant journey around the world to the habitats of highly endangered species in one of the most arid regions, in the Death Valley, and discover also here new or uncommon plant volatiles.

doi:10.1016/j.sajb.2009.02.014

Phosphorus nutrition of Proteaceae and Cyperaceae: Strategies in biodiversity hotspots in old landscapes

H. Lambers
School of Plant Biology, Faculty of Natural and Agricultural Sciences, University of Western Australia, Crawley WA 6009, Australia

Western Australia was once part of Gondwanaland, and some of the most ancient parts of the Earth' crust can be found here. Moreover, the climate has been oceanically buffered, and the landscape has not been glaciated for a very long time. This makes Western Australia a rare region that has been above water for 90 million years, with prolonged oceanically buffered climates since the early Cretaceous, 140 million years ago. The southwest of Western Australia is also among the world's hotspots of higher plant species diversity. Therefore, this environment offers a unique opportunity to study plant adaptations to nutrient-poor conditions. A relatively large proportion of the species from the very phosphorus-poor soils in Western Australia cannot produce a symbiotic association with a mycorrhizal fungus, including most species belonging to the Proteaceae and Cyperaceae. This appears paradoxical, as mycorrhizas are considered an adaptation to phosphorus-impoverished soils. Instead, many species in these families produce root clusters. Root clusters release large amounts of carboxylates (e.g., citrate, malate), whose role is that of mobilisation of phosphate (P) and micronutrients. All of the species we have investigated form these specialised roots only when grown at very low P supply. The combination of the structure (many rootlets covered with root hairs or root hairs in a small volume) and functioning (considerably faster exudation rates than reported for species without these specialised root structures) allows for major accumulation of carboxylates in the millimolar range in the rhizosphere. Root clusters exude carboxylates in an 'exudative burst', thus minimising consumption by microorganisms before P has been mobilised. We have investigated carbon metabolism of the cluster roots of *Hakea prostrata* (Proteaceae) and dauciform roots of *Schoenus unispiculatus* (Cyperaceae), including respiration and carboxylate exudation of root clusters during their entire development. Root-cluster respiration peaks at an early stage, providing the metabolic energy during rapid growth early in their development. Carboxylate exudation peaks later during their development, lasting a few days only, the major carboxylates being citrate and malate. Active cluster roots of *H. prostrata* have more alternative oxidase (AOX) protein and express an additional AOX isoform of slightly lower molecular mass when compared with non-cluster roots. The role of the enhanced expression of the alternative oxidase is probably that of oxidation of NADH that is produced during carboxylate production, when there is little requirement for

ATP. Many Proteaceae, including *Banksia* and *Hakea* species, are readily killed by P fertilisation (P-toxicity). The extreme P sensitivity of *H. prostrata* (Proteaceae) is due to its very low capacity to reduce its P-uptake capacity at elevated P levels in the rhizosphere. This low capacity to down-regulate P uptake capacity is therefore in tune with the P-impoverished soil conditions in Western Australia.

doi:10.1016/j.sajb.2009.02.015

Seeds, seedlings and phosphorus

B. Lamont, P. Groom
Centre for Ecosystem Diversity and Dynamics, Department of Environmental Biology, Curtin University, Perth 6845, Australia

We review the phosphorus (*P*) nutrition of seeds, seedlings and young plants in Mediterranean-climate South Africa and Australia. We focus on the most studied group in both regions, the Proteaceae. *P* is translocated from the vascular system to the fruits and then efficiently (90%) to the maturing seeds. 50% of the above-ground P in *Banksia hookeriana* resides in the stored seeds. Total *P* storage per seed is a function of seed size and in turn a function of time to maturation (positively) and soil fertility (negatively) Seed *P* is stored in organic form as phytates. Seeds of 20 species of Proteoideae in the Cape weigh on average 50 mg with 0.4% *P* while those of Grevilleoideae in Australia weigh 130 mg with 1.4% *P*, suggesting that soils are more *P*-impoverished in Australia. *P* is transferred efficiently (95%) from the cotyledons to the seedling in two *Hakea* spp (seed weight >20 mg, *P*>0.2 mg) in their own soil and account for 75% of their *P* after 3 months of growth. For small-seeded species (<5 mg, *P*<0.05 mg), most *P* content is sourced from the soil in that time. We interpret high seed *P* as enabling species to maximise carbon gain from the shoots when soil-*P* sources are low. Much of the carbon is then translocated to the roots to maximise elongation as a drought-avoiding device. Small seeds produce small seedlings that are more drought-tolerant. Banksia seedlings can develop a root system >2 m deep in the first growing season, and by 18 months most internal *P* of even large-seeded species has been derived from the soil by efficient uptake mechanisms.

doi:10.1016/j.sajb.2009.02.016

Flow cytometry and its applications in plant population biology, ecology and biosystematics: New prospects for the Cape flora

J. Suda[a,b], J. Loureiro[a,b], P. Trávníček[a,b], J. Rauchová[a,b], P. Vít[a,b], T. Urfus[a,b], M. Kubešová[a,b], L.L. Dreyer[c], K.C. Oberlander[c], P. Wester[c], F. Roets[d]
[a]*Department of Botany, Faculty of Science, Charles University in Prague, Benátská 2, CZ-128 01 Prague, Czech Republic*
[b]*Institute of Botany, Academy of Sciences of the Czech Republic, Průhonice 1, CZ-252 43 Průhonice, Czech Republic*
[c]*Department of Botany and Zoology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa*
[d]*Department of Conservation Ecology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa*

Flow cytometry (FCM) is a high-throughput technology that simultaneously measures and analyses multiple parameters of individual particles (e.g., cells, nuclei). Over the last decade, applications of FCM in plant population and evolutionary biology, ecology, and biosystematics have expanded dramatically both in frequency and scope, primarily addressing questions of phenotypic manifestation, spatial distribution and evolutionary significance of genome duplication (polyploidy) and chromosomal variation (aneuploidy). The unsurpassed speed and reliability of estimating differences in nuclear DNA content by FCM paves the way for large-scale surveys at the landscape, population, individual and tissue levels. Representative sampling has made it possible to gain novel insights into the extent of intra- and inter-population ploidy variation, niche differentiation, and ecological preferences of particular cytotypes. The technique is also ideally suited for the detection and quantification of rare evolutionary episodes. Another attractive feature of FCM is the possibility to reformulate former taxonomic concepts and propose robust classifications based on a detailed understanding of population structure and phenotypic variation of polyploid groups under investigation. Discrimination among homoploid taxa and their hybrids, based on differences in genome size, is another unique aspect of FCM. In combination with molecular and phenotypic approaches, FCM promises qualitative advances in our understanding of genome multiplication and the population biology of vascular plants. Particular research avenues will be documented by case studies from various floras, including some running projects in the Cape floristic region, with special emphasis on the key geophytic genus *Oxalis*.

doi:10.1016/j.sajb.2009.02.017

The non-African oil-flowers and their bees: A brief survey

S. Vogel
University of Vienna, Austria

The four existing oil-flower domains of the world: the Holarctic, the Paleotropic, the Capensis and the Neotropic, have almost independently evolved and show little overlap. They represent an instructive example of convergency. Most oil-collecting bees as well as their oil-producing plant hosts of the Old World are not related to those of the New World. Nevertheless, all participants of this mutualism have

Endangered Species Until a few hundred years ago, species became scarce or died out because of natural causes. For example, there may have been a major climate change. Today, however, species become endangered mostly because of human activity. The main reasons are habitat destruction, wildlife trade, overhunting, and competition with domestic animals and animals brought into their habitat from elsewhere. Habitat destruction is the most serious problem for species in the wild. Most animals and plants can live only in a certain area, or habitat. If their habitat is destroyed, the species cannot Inspired by Dougal Stermer's book 'Vanishing Flora', Roman Kaiser worked for more than ten years on collecting the scent of 267 endangered plant species worldwide. In the present volume, he invites us to a journey along the hotspots of biodiversity, all of them bearing endangered species, and discusses their scents. This compilation renders the book an important contribution to the UN International Year of Biodiversity. Product Identifiers. Endangered Species: Causes, Effects & Solutions. An endangered species can be defined as species that is very likely to be extinct in the near future. The number of endangered species has dramatically risen over time.Â Thus, many animals and plants have to look out for new homes or they will be in danger of becoming extinct. Changes in natural living conditions.Â A big part of the endangered species problem is that people usually are unaware or simply do not care too much in their daily lives about our animals and plants. We have to change their attitude in a way that they are ready to reduce their consumption behavior in order to protect animals and plants. The scent of the vanishing flora: New and uncommon volatile compounds in most diverse endangered plant species. R. Kaiser Givaudan Schweiz AG, Fragrance Research, Ueberlandstr. 138, CH-8600 DÃ¼bendorf, Switzerland.Â In our appreciation of these wondrous plants and in the hope to sensitize people for the many reasons making conservation activities so important, we decided in 2001 to focus even more on highly endangered scented species worldwide and to compile their scent compositions as well as complimentary information in an upcoming book entitled â€œThe Scent of the Vanishing Floraâ€.Â most arid regions, in the Death Valley, and discover also here new or uncommon plant volatiles.