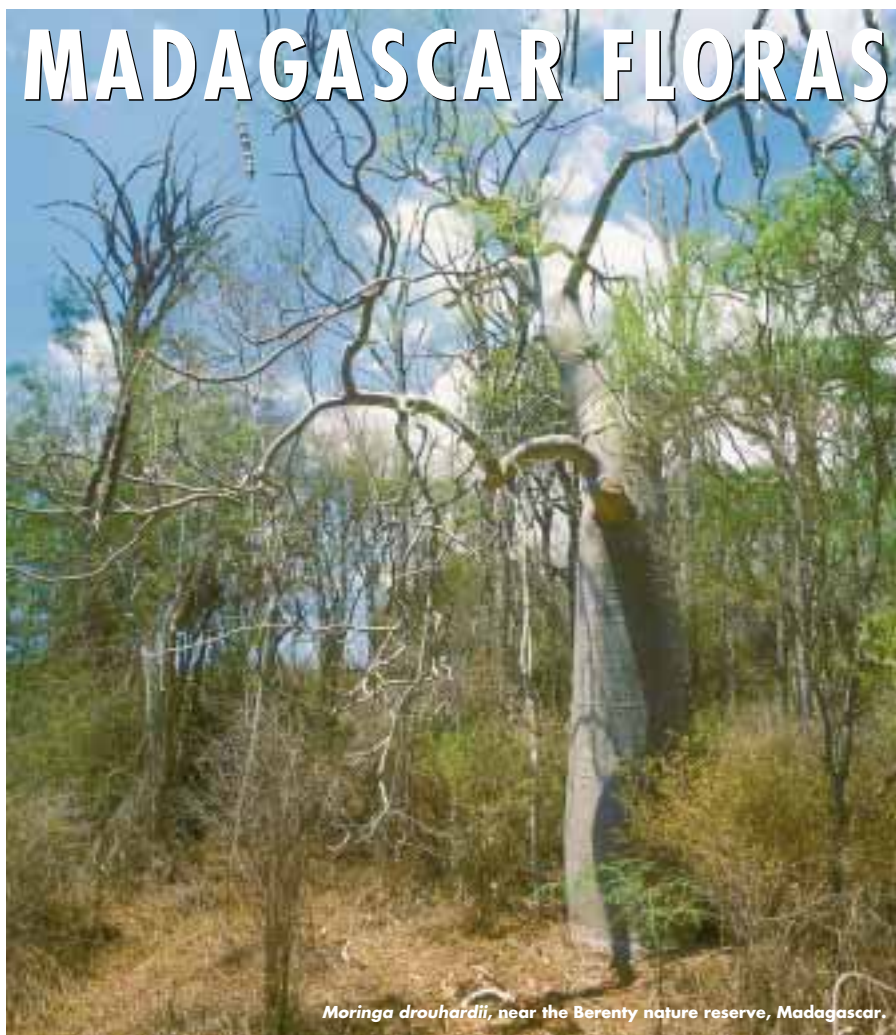


**F**EW countries are as biogeographically unusual as Madagascar. This is a consequence of the island's long isolation; it separated from Africa some 120 million years ago and India about 88 million years ago. The uniqueness of its flora is reflected in two recent publications, the *Generic Tree Flora of Madagascar* and *The Leguminosae of Madagascar*. The research for these books revealed that of Madagascar's 490 indigenous genera of trees, 161 are endemic, and a remarkable 80% of its 573 native legumes are found nowhere else.

The *Generic Tree Flora of Madagascar*, written by Dr George Schatz (Missouri Botanical Garden), is the first practical field manual for the identification of Madagascar's native and naturalised trees. It results from a joint project (funded by the Zimmermann Foundation) between the Missouri Botanical Garden and Kew, in collaboration with FOFIFA and Tsimbazaza in Madagascar and Museum National d'Histoire Naturelle in Paris. Identification keys to the genera emphasise vegetative and gross morphological features and follow descriptions to each of the 106 families, for which introductory keys are also provided. The genera are treated with full descriptions (nearly all accompanied by a representative illustration) with extensive notes on the species in the genera as well as local names.

**1** The *Leguminosae of Madagascar* is the product of a project that originally aimed to produce a checklist of the legumes of the island for the International Legume Database and Information Services Project (ILDIS). However, it rapidly became clear that our knowledge of the family in Madagascar was incomplete, and that a full flora account, as well as fieldwork, was desirable. The project was a collaboration between Kew, the Laboratoire de Phanérogamie in Paris (the herbarium of which is rich in relevant material) and several institutions in Madagascar. Many species were collected and photographed during fieldwork; details of the collections can be found in the SONNERAT database ([www.mnhn.fr](http://www.mnhn.fr)). The contributions were translated and edited by Dr David Du Puy (former Kew researcher) who also wrote a substantial part of the text. Dr



*Moringa drouhardii*, near the Berenty nature reserve, Madagascar.

A. Melchior/RBG Kew

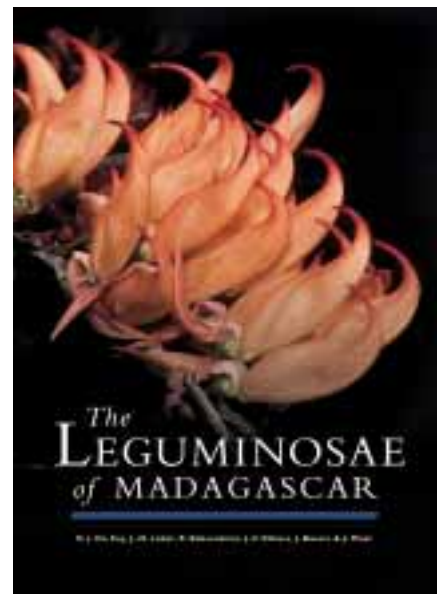
Justin Moat (Kew GIS Unit) contributed GIS-based maps and analyses of species distribution. Some are available on Kew's website ([www.kew.org](http://www.kew.org)). Six new genera and 129 new species were described during the project. One of the new genera, *Peltiera*, has not been collected for many years and may well have become extinct by the time it was described. The book is illustrated by numerous line drawings made from specimens at Kew and Paris and by colour photographs mostly taken in the field by David Du Puy. The use of digital printing technology has allowed the price to be kept to a minimum.

Contact: Dr Mike Lock ([m.lock@kew.org](mailto:m.lock@kew.org))

*Generic Tree Flora of Madagascar* (G. Schatz; Missouri Botanical Garden & RBG Kew). ISBN 1 900347 82 2, £25. Available in French and English versions.

*The Leguminosae of Madagascar* (D. Du Puy, J.-N. Labat, R. Rabevohitra, the late J.-F. Villiers, J. Bossier & J. Moat; RBG Kew). ISBN 1 900347 91 1, £65.

Order at [www.kew.org/publications/](http://www.kew.org/publications/)





## Director's Message

The Importance of Generalists

A pervasive development in science during the twentieth century has been the relentless trend towards specialisation. As the volume of knowledge expands, individual scientists become most comfortable knowing more and more about less and less. Many fields that were once coherent are now fragmented, and in biology this trend has been fuelled by pervasive reductionism that has sought fundamental insights at the cellular, genetic and molecular level. Tightly focused programmes of research have massively advanced our understanding in many areas but this must be balanced with the recognition that important advances often come where traditionally separate fields overlap.

At Kew our science programmes address the diversity of plant life, how it came to be, what its current status is, and how it can be conserved and used in sustainable ways. Therefore almost all Kew's scientists are generalists to some degree but, because plant diversity is so vast, there is an inevitable tendency to specialise in particular plant groups. Specialisation has advantages in designing focused research programmes that may make rapid progress, but it also has some disadvantages, particularly in supporting the objectives of plant conservation. To undertake basic ecological work, anywhere in the world, it is crucial to be able to identify plant species – not only from flowers and fruits, but also from leaves and stems. Even in the UK this can be a significant challenge, but in those parts of the world with high plant diversity it is especially difficult and requires an extraordinary level of generalist botanical knowledge.

At Kew we are seeking to balance the need for focused enquiry with that of continuing our tradition of generalist plant identification skills. We have established several teams within the Herbarium that have a regional remit, rather than a focus on a specific plant group. Staff in these teams will develop general identification skills, based on their experience in sorting, identifying and curating the great variety of material that comes into Kew. For certain needs, particularly conservation, developing these skills is just as important as encouraging the publication of specialist papers.

By broadening our plant identification capacity, Kew will be better able to contribute to conservation assessments in the most biodiverse regions in the world. We hope this will facilitate the selection, establishment and monitoring of *in situ* reserves, and highlight critical plant groups for future focused study. Our aim is to place a still greater range of skills at the disposal of our users and partners and ensure that we continue to have scientists on Kew's staff who can truly see the wood for the trees.

Prof. Peter R. Crane, Director

## WORLD HERITAGE SITE NOMINATION

RBG KEW has been selected as the UK's 2002 nomination for World Heritage Site status. The nomination was announced by the Arts Minister Baroness Blackstone at Kew on 18 January. Kew is proposed as a cultural landscape designed and created intentionally for scientific and aesthetic purposes. The diverse living collections of the Gardens, supported by comprehensive preserved collections, provide one of the strongest criteria for inscription. The site is also associated with works of universal significance; for example, Charles Darwin studied plants from Kew, and the second director, Sir Joseph Hooker, was instrumental in arranging for Darwin's evolutionary theories to be presented jointly with those of Alfred Russel Wallace.

To advance the nomination, site management and conservation plans are being prepared that will provide a framework for conserving Kew's architectural and heritage landscapes while developing the site to improve visitor and scientific facilities.



A. McRobb/RBG Kew

Baroness Blackstone at Kew, after her announcement of the World Heritage Site nomination, viewing *Ramosmania rodriguezii*, a plant which symbolises the international significance of the collections at Kew. Only one tree of *R. rodriguezii* remains in the wild in Rodrigues but recently Belinda Parry travelled to Rodrigues and Mauritius to repatriate 11 young plants grown at Kew. Whilst there, she also gave training in advanced propagation techniques.

## AWARDS

### Citation Award

ISI recently informed Prof. Mark Chase, head of Kew's Molecular Systematics section, that he was one of the top 15 most highly cited authors in their Plant & Animal Science category. To recognise this achievement ISI will present him with an award at 'Experimental Biology 2002' in New Orleans in April. ISI used a new evaluation tool, ISI Essential Science Indicators, to calculate total citations from papers indexed from 1991 to 31 October 2001. In this ten-year period Mark has been an author on 70 papers recording a total of 2,092 citations. In ISI's words this is "a fantastic achievement".

P. Cribb



*Lycaste skinneri*, an orchid studied by Angela Ryan for her PhD.

### Other Honours

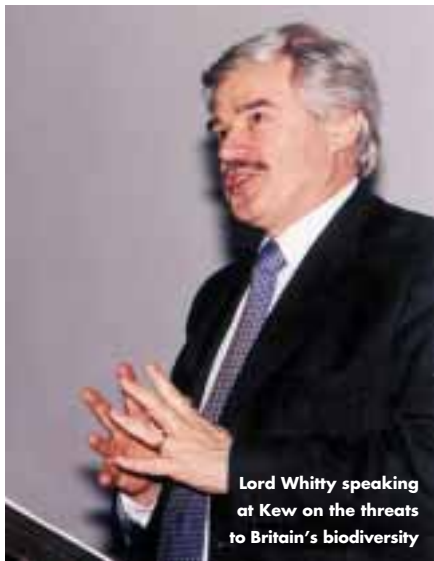
IN February 2002, Prof. Peter Crane was elected as a Foreign Member of the Royal Swedish Academy of Sciences in its class for Biosciences. In October 2001, Dr Paula Rudall was awarded a DSc from the University of London in recognition of her research in plant micromorphology.

### PhD Awards

FIVE students, who undertook research at Kew, each successfully defended their thesis in the past six months. Ziba Jamzad (University of London) undertook a phylogenetic study of Iranian species of *Nepeta* (Lamiaceae) and passed her viva in October. In December Mathieu Perret (University of Geneva) passed with honours for a study on floral evolution and speciation in Sinningieae (a tribe of Neotropical Gesneriaceae), and Cristina Inocencio Prestel (University of Murcia) defended her thesis on a characterisation of *Capparis* L. subgenus *Capparis* (Brassicaceae). In January Angela Ryan (University of London) was awarded a PhD for a 'A phylogenetic assessment of *Lycaste* and *Anguloa* (Orchidaceae)'. Finally in February, Mitra Noori (University of London) made a successful defence of her work on characterising Iranian species of *Sophora* and *Ammodendron* (Leguminosae).

In addition, David Roberts (orchid taxonomist at Kew) defended his PhD research on orchids of Mauritius in October 2001.

## ENVIRONMENTAL LECTURE



Lord Whitty speaking at Kew on the threats to Britain's biodiversity

A. March/RRG Kew

THE conservation of Britain's biodiversity was the topic of the 11<sup>th</sup> Kew Environmental Lecture on 11 February 2002, delivered by Lord Whitty, Science Policy Minister at the new Department of Environment, Food & Rural Affairs. The Minister spoke on the effects climate change and declining air quality could have on the native plants and animals and highlighted Britain's declining river habitats. More positively, he reported progress on reducing acid rain and increasing plant diversity in hedgerows, while extolling the virtues of sustainable agriculture. He considered that the new Department, which funds most of the work at Kew, was well placed to address future challenges, although it faced complex issues.

After the lecture, Lady Rosemary Fitzgerald was presented with the 2nd Marsh Botanical Award for conservation of UK biodiversity. The award was made for her work in support of aquatic plants and the Biodiversity Action Plan. Lady Rosemary, an independent botanist, also made 104 seed collections for the UK Flora Programme of the Millennium Seed Bank Project, more than any other single collector.

## Recovery Awards

KEW has been involved with English Nature's Species Recovery Programme since its inception in 1991, contributing to activities on *Pyrus cordata* (Plymouth pear), *Centaurea cyanus* (cornflower), *Cypripedium calceolus* (lady's slipper orchid) and *Damasonium alisma* (starfruit), among other focus species. At the conference to mark the 10<sup>th</sup> Anniversary of the Programme (held in Derbyshire in December 2001), the input of Kew into the programme was recognised by certificates awarded to Andy Jackson, Margaret Ramsay, the Sainsbury Orchid Project and the Millennium Seed Bank Project.

Contact: Margaret Ramsay (m.ramsay@kew.org)

## Tooth Fungi

A £6,000 grant from English Nature has been awarded to Kew to study the population diversity and speciation in *Hydnellum* and *Phellodon*. Little is known about the population diversity of these fungi or the mechanisms of population maintenance and spread. These are important considerations for the determination of future Biodiversity Action Plans. The project will investigate the genetic diversity of *H. scrobiculatum* and *P. confluens*, at and between sites in SE England and Scotland, and will use molecular methods to identify the relative roles of mycelial growth and fruiting body production in population maintenance and spread. DNA sequence variation within the group will first be compared to investigate speciation, so sequences from related species, including the rare *H. aurantiacum*, will be obtained.

Contact: Dr Brian Spooner (b.spooner@kew.org)

## DNA IDENTIFIES ORCHID

*ORCHIS MILITARIS* (military orchid) is one of Britain's rarest orchids, occurring at only three sites in England (Buckinghamshire, Oxfordshire and Suffolk). Natural pollination is rare in the UK, but pollinia were recently found on the head of a solitary bee (*Nomada panzeri*) visiting a plant at the Buckinghamshire site. The pollinia were sent to Kew to be identified as they may have come from another species. The most likely alternative was *Ophrys insectifera* (fly orchid), although *Dactylorhiza fuchsii* (common spotted orchid) and *Cephalanthera damasonium* (white helleborine) also occur at the site. Visual inspection of the pollinia excluded *C. damasonium* but to eliminate the other species it was necessary to use molecular techniques. DNA was extracted from one pollinium and the internal transcribed spacer region of nuclear ribosomal DNA was sequenced. The sequence was a perfect match for *O. militaris*, demonstrating that sufficient DNA for sequencing can be extracted from a single pollinium and that *N. panzeri* is a potential pollinator of *O. militaris* in the UK.



*Orchis militaris*

P. Gasson

Contact: Dr Mike Fay (m.fay@kew.org)



*Hydnellum aurantiacum*; unpublished paintings by Carleton Rea held the Kew library.

## Wild Plant Economy

Helen Sanderson and Dr Hew Prendergast have submitted a report to the Countyside Agency on the commercial uses of wild and traditionally managed plants in England and Scotland. It contains the results of a 12-month project that determined which species are used, investigated management and harvesting issues, calculated values of products and the numbers of jobs supported, and identified threats and future opportunities. The report

shows that coppiced woodlands and wetlands (particularly reedbeds and willow withies) are the most commercially significant habitats, generating the highest employment. It also reveals previously undocumented uses such as heather for air filtration and high quality food and cosmetic products. An illustrated book based on the work will be published in Summer 2003.

Contact: Helen Sanderson (h.sanderson@kew.org)

# Deep Time



As the famous sculpture 'The Profile of Time' by Salvador Dalí is displayed in the Gardens, scientists at Kew are studying why molecular clocks do not tick at the same speed for all lineages of plants. Their work on 'molecular living fossils' was presented at the 'Deep Time' meeting (University of Florida, 22-23 February 2002), which aimed to co-ordinate the production of a comprehensive phylogenetic tree for all living and fossil angiosperms. This goal is aided by innovations in the systematic analysis of non-molecular character types and supertree methods to combine data, as well as discoveries of missing evolutionary links. Members of the House of Lords Select Committee on Systematics visited Kew on 4 February 2002 to learn of these innovations in systematics.

A. McRobb/RBG Kew

## Molecular Living Fossils

MANY efforts to date evolutionary divergences using molecular clocks have often yielded age estimates inconsistent with fossil evidence. Such discrepancies can be attributed to the inadequacy of the fossil record, but many other sources of error can affect molecular-based estimates. In two recent studies, Prof. Peter Crane, Prof. Mark Chase and Dr Vincent Savolainen at Kew have been collaborating with Profs Pam and Doug Soltis (University of Florida), Dr Niklas Wikström (The Natural History Museum, London) and Dr Timothy Barraclough (Imperial College at Silwood Park) to explore the correspondence between the fossil record and molecular-based age estimates for the major clades of angiosperms (covering 75% of the families) and vascular plants. The researchers chose these groups because two well-supported trees based on multiple genes were available together with several well-substantiated dates from the fossil record. Therefore, potential errors due to inaccurate topology and uncertain calibration times were minimised.

They found that age estimates varied due to gene effects, codon position, lineage effects, method of inferring branch lengths and assumptions of rate constancy. However, even methods designed to ameliorate the effects of rate heterogeneity among lineages could not compensate for the dramatic decelerations in rates of molecular evolution in tree ferns; they are 'molecular living fossils', consistent with their relative morphological stasis for the past 165-200 million years. In angiosperms, the origin of the crown group of extant taxa is indicated to be Early to Mid-Jurassic, and the origin of eudicots is resolved as Late to Mid-Cretaceous, both of which dates are older than current fossil-based estimates. Putative biological reasons for the discrepancies between the fossil record and molecular-based age estimates are now being investigated. *Proc. Roy. Soc. B.* 268, 2211 (2001); *Proc. Natl Acad. Sci. USA* (in press).

Contact: Dr Vincent Savolainen  
(v.savolainen@kew.org)



The DNA of tree ferns appears to have evolved more slowly than that of other vascular plants.

G. Kew



The two foliage types of *Xanthocyparis vietnamensis*

## INNOVATIO

### Supertrees

LARGE and comprehensive phylogenetic trees are some of the best tools to study evolutionary patterns and processes. Such trees can be obtained by two different approaches. Either characters can be gathered from the widest possible range of taxa and used directly in an analysis to produce a 'big tree', or pre-existing published phylogenetic trees can be combined to create a 'supertree'. Although large multi-gene analyses are usually favoured, combinable data are not always available, and supertrees offer a suitable alternative.

Nicolas Salamin, Dr Trevor Hodkinson (Trinity College Dublin) and Dr Vincent Savolainen (Kew) have compared the various methodologies available to build supertrees. In doing so, they used over 50 published phylogenetic studies for the grasses to build the most comprehensive phylogenetic tree so far for this family, containing more than 400 genera. This supertree provides the basis for examination of, among other things, genetic linkage groups and the evolution of C3/C4 photosynthetic pathways. *Syst. Biol.* 51, 136 (2002).

Contact: Dr Vincent Savolainen  
(v.savolainen@kew.org)

### Recent Time

USING DNA sequence data, scientists from RBG Edinburgh and RBG Kew have showed that speciation in the Neotropical legume genus *Inga* occurred within the past 10 million years. This recent diversification may be true of other species-rich genera that contribute substantially to species numbers in the Neotropics. *Science* 293, 2242 (2001).

Contact: Terry Pennington (t.pennington@kew.org)

A. McRobb/RBG Kew



P. CHASE

## FOUND: Conifer Missing Link

A NEW genus of conifer has been described, which possibly represents a 'missing link' between true cypresses (*Cupressus*) and the false cypresses (*Chamaecyparis*). It is only the third new conifer genus reported in over 50 years. The conifer was found on a rugged limestone ridge in the karst mountains of northern Vietnam in 1999 by botanists from the Vietnamese Institute of Terrestrial Ecology (Hanoi), the Komarov Institute (St Petersburg), Missouri Botanical Garden and Kew (represented by Dr Phil Cribb).

Named as *Xanthocyparis vietnamensis* (golden Vietnamese cypress) by Aljos Farjon and colleagues from Vietnam and Missouri, the new conifer species is unusual in having two types of foliage, with some branches bearing

scale-like leaves while others have linear leaves. Its closest ally is believed to be *Chamaecyparis nootkatensis* (Nootka cypress), which has now been transferred to the new genus. As Nootka cypress is one of the parents of *x Cupressocyparis leylandii* (Leyland's cypress), this hybrid must also be renamed. Sadly, *X. vietnamensis* is already Critically Endangered in the wild with one of the biggest threats coming from the indigenous people who use the fragrant wood for coffins and shrines as well as firewood. A meeting of IUCN in Taiwan in December 2001 proposed that the mountain habitat of the species should be established as a conservation area.

Contact: Aljos Farjon (a.farjon@kew.org)

## LOST: Family

THE family Flacourtiaceae has always been extremely difficult to define, but its circumscription has consistently included two groups distinguished partly by their chemistries. Prof. Mark Chase, Sue Zmarzty and collaborators have now assessed phylogenetic relationships with *rbcl* DNA sequences and found that the two groups are indeed present, but some genera not previously considered as Flacourtiaceae should also be included. Embedded deeply in the group that includes *Flacourtia* are the two genera of Salicaceae, *Populus* and *Salix*. This relationship had previously been proposed from morphological (e.g. absence of petals) and chemical characters (salicylic acid in Salicaceae and some flacourts). Salicaceae has nomenclatural priority for this group. The other group, characteristically producing cyanogenic glycosides, surprisingly includes Achariaceae. This family name is conserved and is therefore adopted for the second group. *Kew Bulletin* 57, 141 (2002).

Contact: Prof. Mark Chase (m.chase@kew.org)



*Azara petiolaris*;  
formerly Flacourtiaceae,  
now Salicaceae.

# NS IN SYSTEMATICS

## LC-MS Aids Systematics

ADVANCES in instrumentation to analyse chemical mixtures, such as plant extracts, are permitting more accurate study of chemical characters for systematic purposes. Recently, Dr Geoffrey Kite has been developing methods to study non-protein amino acids in small fragments of herbarium material using liquid chromatography coupled to mass spectrometry (LC-MS). Working with Dr Helen Ireland (former Kew PhD student, now at Cardiff University), he has used these methods in a study of the legume genus *Bocoa*. The results revealed that five of the seven species contained very unusual non-protein amino acids,

such as 2,4-methanoproline and 2,4-methanoglutamic acid, that are otherwise only known from species of *Ateleia* and its sister genus *Cyathostegia* (Leguminosae). The two remaining species lacked these compounds. These chemical data supported the unexpected finding from DNA sequence analysis that some species of *Bocoa* were closely related to *Ateleia* and that *Bocoa* was not monophyletic. Helen is currently revising the genus *Bocoa* in the light of these and other data. *Phytochemistry* 59, 163 (2002).

Contact: Dr Geoffrey Kite (g.kite@kew.org)

Below Left: Katie Abranson (university placement student) operating the new FE-SEM.

Below Right: SEM and TEM of the same fossil pollen grain of *Fupingopollenites*.



## New SEM

A HITACHI S-4700-II cold field emission scanning electron microscope (FE-SEM) was installed at Kew in January 2002. The instrument allows plant specimens to be examined at high resolution at relatively low voltage, in some instances without being coated with metal. One of the first studies to be performed with the new FE-SEM was that of Prof. Wei-Ming Wang, visiting from the Nanjing Institute of Palaeontology and Palynology, China. Fossil pollen grains of *Fupingopollenites* were examined uncoated to allow for later examination using transmission electron microscopy. *Fupingopollenites* is a frequent fossil pollen genus in the Miocene of China and elsewhere. Although it has been compared with legume pollen, Prof. Wang's observations do not indicate a modern counterpart.

Contacts: FE-SEM; Chrissie Prychid (c.prychid@kew.org)  
Fossil pollen; Madeline Harley (m.harley@kew.org)

# ORCHID RESEARCH

Research on orchids constitutes a major part of Kew's work on monocotyledons. The collections in the Orchid Herbarium form the basis of numerous flora accounts and this year's orchid festival, 'Orchids at the Edge' (9 February – 10 March), focused on orchid conservation. The festival included displays of endangered species from the Kew living collections that are now benefiting from a supply of purer water.



A. Marchal/RBG Kew

## ORCHIDS THAT DECEIVE

SUBTRIBE Pleurothallidinae (Epidendreae: Orchidaceae) comprise an estimated 4,000 Neotropical species in about 30 genera, accounting for 15-20% of the species in the entire family. For over two centuries the generic boundaries and relationships in the subtribe have perplexed taxonomists, who relied primarily on morphological (chiefly floral) features in constructing classifications. Now Drs Alec Pridgeon, Rodolfo Solano and Prof. Mark Chase have resolved many systematic issues, including the artificiality and gross polyphyly of the genus *Pleurothallis sensu lato* (2,000 species), using DNA sequences from nuclear and plastid genomes (*Am. J. Bot.* 88, 2286; 2002).

One of the many revelations from this work was the convergence and reversal in some floral features that attract dipteran pollinators by deceit. This limits the usefulness of these features in reconstructing phylogenetic relationships in the subtribe. Well-supported clades in the phylogenetic analysis warranted several nomenclatural reassignments within Pleurothallidinae, and these were published in December 2001 in a companion paper (*Lindleyana* 16, 235).

Contact: Dr Alec Pridgeon (a.pridgeon@kew.org)

### Flies and Taxonomists



A. Pridgeon

*Pleurothallis perryi*, a 'true' *Pleurothallis*.

### Water Benefits

ORCHIDS at Kew are benefiting from improvements in water quality following the installation of reverse osmosis equipment to remove minerals. A water conductivity of less than 200  $\mu\text{S}$  is preferable for most Orchidaceae; previously the conductivity was 750  $\mu\text{S}$ , resulting in calcium carbonate deposits and poor growth. The purer water will be even more beneficial to carnivorous plants as these require a conductivity of less than 150  $\mu\text{S}$ .

Contact: Phil Griffiths (p.griffiths@kew.org)

### Nelson's Orchis

THE monographs of Erich Nelson (1897-1980) on European orchids are widely admired, particularly for his exquisite water-colours. Before he died, Nelson had published accounts of all the European genera except for *Orchis*. Now, his illustrations of *Orchis* have been reproduced loose as *Erich Nelson, Book of Plates of the genus Orchis* (Erich Nelson Foundation, Switzerland). An accompanying book, with an introduction by Dr Phil Cribb, appraises Nelson's work.

Contact: Dr Phillip Cribb (p.cribb@kew.org)

## ORCHIDS OF BHUTAN

A DELEGATION from Bhutan, that included the Minister of Agriculture, Lyonpo Kinzang Dorji, attended the launch of the *Orchids of Bhutan* on 26 January 2002 at the Royal Botanic Gardens, Edinburgh. The book, by Dr Nick Pearce and Dr Phil Cribb, forms the final part of the three-volume *Flora of Bhutan and Sikkim*.

Bhutan's relative isolation and precipitous terrain have inhibited detailed botanical surveys. The collections, held at Kew, of William Griffith (the first Western botanist to visit Bhutan in 1837-8) and Sir Joseph Hooker (who collected in Sikkim in the late 1840s) still provide the basis to our knowledge of the flora. Twentieth century collec-

tions are few, but the authors did visit Bhutan at the invitation of the Bhutanese government and added a number of records. The orchids, with 569 recorded species, represent almost 10% of Bhutan's flora. They are ubiquitous, being found in all vegetation zones from the forested terai in the south to the alpine meadows in the north. The country has some of the most spectacular and interesting Himalayan orchids, many known only from one or two collections.

Before the book launch, the Minister of Agriculture accompanied by Kunzang Thinley (Bhutan's Director of WWF) and Dr Sangay Wangchuk (Director of the Nature Conservation Division) visited Kew. The dele-

gation toured the Herbarium and Gardens with Jessica Beaghen, a third-year Kew Diploma student who visited Bhutan on her travel scholarship last May. While in Bhutan, Jessica discussed further development of the Botanic Garden in Bhutan with the Minister of Agriculture, including the possibility of composting waste from the weekend market to improve the poor soil. She has since been raising money for the restoration of polytunnels in the garden.

Contacts: Dr Phillip Cribb (p.cribb@kew.org)  
Jessica Beaghen (j.beaghen@kew.org)

*Orchids of Bhutan* (by N. Pearce & P. Cribb; RBG Edinburgh). ISBN 1 872291 19 8, £50.

# ADVANCES IN HERBAL AUTHENTICATION

STATE-OF-THE-ART liquid chromatography-mass spectrometry and gas chromatography-mass spectrometry, along with more traditional anatomical and morphological techniques, are being used at Kew in the authentication of plants used in herbal remedies and cosmetics. For example, Dr Geoffrey Kite used a quadrupole ion-trap mass spectrometer to detect the nephrotoxic and carcinogenic aristolochic acids in herbal pills sent to Kew for authentication. This involved developing a method to detect aristolochic acids I and II in crude extracts of multi-component herbal remedies without sample clean-up (*Rapid Communications in Mass Spectrometry* 16: 585, 2002). Similar methods are being used to confirm the identification of other plants used in traditional Chinese medicine as part of the research at Kew on Chinese medicines being co-ordinated by Christine Leon.

Because of the overall interest in plant-based products, there is a growing need to help traders authenticate and check the quality of plants. To date there is little formal regulation on the quality of plants being traded and this

could result in more people suffering adverse responses if poor quality material or incorrect plants are supplied. There are also many conservation issues in the increased demand for plants. Although many plants being supplied to the trade are from renewable sources some, such as sandalwood, are not always being sustainably harvested.

Dr Melanie Howes has been studying the quality and source of sandalwood extracts currently being traded in UK. Few companies could confirm the source of their sandalwood, and many extracts did not meet the international standard for sandalwood oil of a minimum free alcohol (santalol) content of 90%. The results were presented by Prof. Monique Simmonds at a conference in February on the 'Industrial Leadership for the Preservation of Medicinal and Aromatic Plants' in Philadelphia. The aim of this project is to enable companies to locate good quality sandalwood from renewable sources.

Contact: Prof. Monique Simmonds  
([m.simmonds@kew.org](mailto:m.simmonds@kew.org))



*Aristolochia manshuriensis* (= *Isotrema manshuriense*), traditionally used in Chinese herbal medicine. Its importation, sale or supply for medicinal use is now banned in the UK because of the potential toxicity of the aristolochic acids.

A. McRobb/RBG Kew

## S U S T A I N A B L E D E V E L O P M E N T

### Miscanthus origins

MISCANTHUS x GIGANTEUS is a grass being considered in the UK as a biomass crop, but its parentage is poorly known. RBG Kew was awarded a research contract by DEFRA (then known as MAFF) to determine which species gave rise to this hybrid. Dr Trevor Hodgkinson, Prof. Mark Chase, Steve Renvoize and collaborators have studied the genetic make up of the hybrid using a combination of DNA fingerprinting and sequencing and genomic *in situ* hybridisation. They determined that the two parents are *M. sinensis* and *M. sacchariflorus*. *Am. J. Bot.* 89: 279 (2002).

Contact: Prof. Mark Chase ([m.chase@kew.org](mailto:m.chase@kew.org))



*Miscanthus sinensis*.

A. McRobb/RBG Kew

### Paper Plants

PLANTS that have been used for paper-making are the subject of Volume 19, Part 1 of *Curtis's Botanical Magazine* (February 2002). After a general introduction, 'Paper, its Past, Present and Potential', by Kew's senior paper conservator, Jonathan Farley, there are plant portraits of *Broussonetia papyrifera*, *Edgeworthia chrysantha*, *Eichhornia crassipes*, *Lygeum spartum*, *Betula papyrifera*, and *Musa basjoo*, each accompanied by a new, full-page colour illustration. The issue is rounded off with 'Papyrus, Paper and Paper Making: A View of Kew's Economic Botany Collections' by Hew Prendergast.

Contact: Hew Prendergast ([h.prendergast@kew.org](mailto:h.prendergast@kew.org))



*Edgeworthia papyrifera* has been used for high quality papers in Japan.

### Drylands Projects

TWO projects, started recently within SEPASAL (Survey of Economic Plants for Arid & Semi-Arid Lands), aim to bridge the gap between scientific information and the needs of users.

A project with the National Museums of Kenya to establish a SEPASAL 'node' in Nairobi is being funded by The Charles Wolfson Charitable Trust. The project includes repatriation of data on East African plants, equipment provision, and training for local botanists in the use of 'Global Editing' software, enabling users to edit remotely data held in SEPASAL. The node is a step towards a distributed network of SEPASAL editors, and will make information more readily available for conservation and sustainable development projects in Kenya.

Wild foods are important supplements to staple diets of dryland communities and can be life-saving during drought or famine. African Wild Harvest is a collaboration with the Medical Research Council Resource Centre for Human Nutrition Research to collate information on micronutrient contents of dryland African wild plants and fungi. The project, supported by The Nestlé Charitable Trust, bridges the fields of botany, nutrition, and relief and development, and will also highlight research needs.

Contacts: SEPASAL; Steve Davis ([s.davis@kew.org](mailto:s.davis@kew.org))  
Wild Harvest; Rory McBurney ([r.mcburney@kew.org](mailto:r.mcburney@kew.org))

# WHAT'S NEW ON THE WEB

## DNA Bank

The DNA Bank at Kew, which has been an internal asset for molecular systematic studies, is now available for use by scientists worldwide. It contains more than 14,000 accessions, to which more than 2,000 new accessions are being added annually. Using a searchable website, researchers can see what is available and order aliquots of DNA. It is also possible to arrange for one of the DNA Bank Managers to extract and voucher DNA from any unrestricted material in Kew's living collections. There is a small handling charge to cover the costs of extraction and shipment, and all material is supplied under a standard agreement which prohibits commercialisation.

[www.kew.org/data/dnaBank/homepage.html](http://www.kew.org/data/dnaBank/homepage.html)  
or email [dna@kew.org](mailto:dna@kew.org)



Various tissues of *Iris* awaiting extraction for the DNA bank.

## SID release 2.0

As well as improvements to the searching facilities, release 2.0 of the Seed Information Database (SID) features a new module containing seed weight data for about 9,000 species. The seed storage behaviour data set has also been updated and expanded to cover a further 1,386 species.

[www.kew.org/data/sid/index.html](http://www.kew.org/data/sid/index.html)

## Fagales Checklist

A revised version of *The World Checklist and Bibliography of Fagales*, first published in hard copy in 1998, can now be searched via the internet. The checklist provides an inventory of validated names, bibliographic details, and distribution and life-form data for the ca 1,250 species in Fagales.

[www.kew.org/wcb/index.html](http://www.kew.org/wcb/index.html)



*Galanthus elwesii* in southern Turkey.

A. Davis

# SNOWDROP RESEARCH

THE genus *Galanthus* provides a focus for several research projects at Kew. Dr Aaron Davis has been studying snowdrops since 1990 and is a co-author of the recently published *Snowdrops*. This illustrated reference provides a botanical guide to the wild species, full histories and descriptions of over 500 cultivars, and information on cultivation and conservation. Recent studies by Aaron and Dr Neriman Özhatay (Istanbul University) resulted in the discovery of a new snowdrop species from northwestern Turkey: *Galanthus trojanus*. Aaron is also working with the CITES authorities in Turkey and Kerry Taylor of CAPS to produce distribution maps for *Galanthus* species using GIS software. These will be used in conjunction with fieldwork to assess the impact of

wild bulb collection and support recommendations to promote and maintain sustainable trade. In another project at Kew, Dr Lola Lledó and colleagues have recently completed a molecular phylogenetic study of *Galanthus* and *Leucojum*, showing that *Galanthus* is embedded within *Leucojum*. As a result, the segregate genus *Acis* is now recognised for *L. autumnale* and allies, including a number of rare endemics from the Mediterranean region. The common horticultural species, *L. aestivum* and *L. vernum*, retain the name *Leucojum*.

**Contact: Dr Aaron Davis ([a.davis@kew.org](mailto:a.davis@kew.org))**

*Snowdrops* (M. Bishop, A. Davis & J. Grimshaw; The Griffin Press). ISBN 0 9541916 0 9, £45.00.

## CITES China Links

ON a six-month fellowship to the UK, hosted by Kew, Mr Yu Yongfu from the CITES Management Authority of China undertook research on the Chinese orchid trade and produced training material for use in CITES implementation and enforcement. China is a major trader in CITES-listed plants, particularly orchids for horticulture and species used in traditional medicines. The fellowship, supported by the UK Foreign & Commonwealth Office, strengthens links between the CITES authorities for plants in China and the UK and provides data and support mechanisms to enable the Chinese authorities to identify detrimental trade.

**Contact: Jacqueline Roberts ([j.roberts@kew.org](mailto:j.roberts@kew.org))**

**Volume 3 of the CITES Orchid Checklist (ISBN 1 84246 033 1) was published recently by RBG Kew together with checklists for carnivorous plants (ISBN 1 84246 035 8) and Aloe and Pachypodium (ISBN 1 84246 034 X).**



Mr Yu Yongfu visiting HM Customs & Excise at Felixstowe, a major port receiving medicinal imports from China.

M. Grouss

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