

DNA IN THE GARDEN

April marks the 50th anniversary of Watson and Crick's letter to Nature describing the DNA double helix. To mark this, the BBSRC and Kew are co-presenting an interactive exhibition on plant DNA called 'DNA in the Garden'. This exhibition illustrates modern research in plant science in the context of historical landmarks flowing from the study of DNA. The event also highlights the importance of comparative studies of DNA data, which now pervades many research activities at Kew, especially systematics.

DNA sequence analyses are used in systematic studies at all taxonomic levels. Much research now focuses on generic relationships within families; for example, the first large-scale phylogeny of Meliaceae has just been published by scientists at the University of Vienna and Kew (*Amer. J. Bot.* 90, 471; 2003). Using DNA sequences from the plastid genes *rbcl* and *matK* as well as a portion of 26S nuclear ribosomal DNA, it was shown that only two subfamilies instead of four should be recognised and none of the current tribal classification is appropriate. The economic and ecological importance of Meliaceae is disproportional to its size with the family including many important timber species, such as mahogany (*Swietenia*), and species used for their biologically-active compounds, like neem (*Azadirachta indica*). Thus a phylogenetic classification is fundamental to further studies.

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Species-level phylogenetics are now receiving increasing attention. DNA studies can be used to infer modes and tempos of speciation since contrasting traits such as habitat and pollinators can be studied in sister species pairs. Kew's scientists presented species-level data for genera from biodiversity hotspots at the symposium 'Plant species-level systematics: patterns, processes and new applications' (13-15 November 2002, University of Leiden). One example is research in collaboration with the Botanical Garden of Geneva that has documented how pollinator shifts have promoted speciation in the gesneriad genus *Sinningia* in the Atlantic coastal forests of Brazil (*Amer. J. Bot.* 90, 445; 2003). Another study in collaboration with Imperial College London and



A new sculpture at Kew by Charles Jencks celebrating 50 years of the DNA double helix for 'DNA in the Garden'.

the botanical gardens at Missouri and Kirstenbosch has examined the radiation of the peacock irises *Moraea* in relation to their adaptation to various pollinators and rates of speciation (*Mol. Phyl. Evol.* 25, 341; 2002). Several other complete species-level phylogenetic trees are being produced (e.g. Australian *Conostylis*, Neotropical *Codonanthe/Nematanthus*), and they will ultimately shed light on the factors that have promoted species diversification.

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Below the species level and working on British biodiversity, a new project with the National Museum of Wales will screen c.400 samples of *Sorbus* (whitebeams,

M. Perret



Sinningia cochlearis. DNA studies reveal that this species shows a shift to hummingbird pollination.

rowan and wild service tree) from different parts of the UK using genetic fingerprinting techniques. The project will assess the origins of the apomictic microspecies that occur in hotspots including the Avon Gorge near Bristol and the Brecon Beacons in South Wales. AFLP markers are being used to assess species delimitation and levels of variation within and between populations. A set of plastid DNA markers that allow determination of the female parent of the microspecies has been developed at Kew with funding from the Kleinwort Trust.

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DNA in the Garden runs at Kew from 29 March to 11 May 2003.



Director's Message

Tradition and Innovation

This issue highlights two key anniversaries – 50 years since Watson and Crick's classic paper elucidating the structure of DNA, and 150 years since the founding of the Kew Herbarium. Both anniversaries will be celebrated at Kew and both connect to a third key anniversary in the study of plant diversity – 250 years since the publication of *Species Plantarum* by Linnaeus in 1753.

Linnaeus sought to catalogue and name all the world's plants and at that time he was aware of about 8,000 plant species. Since then, knowledge of the plant kingdom has expanded dramatically and we now estimate the number of plant species at about 420,000, with the total continuing to climb as botanical exploration continues throughout the world. The basic techniques for documenting and studying plant diversity used today are the same as those used by Linnaeus – visual analysis of similarities and differences, combined with the traditional practice of making dried reference specimens. Specimens are the essential samples on which knowledge of plant diversity is based and the key point of reference for any plant name. In other ways though, research on plant diversity – at Kew and elsewhere – has been changed fundamentally by a succession of key advances ranging from Darwin's ideas on evolution to the elucidation of genetics and the rise of molecular biology. All of these developments have had an impact on the way in which Kew does its work – and both tradition and innovation have contributed to the distinctive range of activities and approaches that comprise Kew's contemporary science portfolio.

One of our key goals for 2003 is to bring more of Kew's behind-the-scenes scientific work into the public sphere. The 'DNA in the Garden' exhibit will be associated with two Open Days in the Jodrell Laboratory. Visitors will have the opportunity to learn how DNA-based research provides new ways to understand how living plant diversity came to be, and how it can be conserved and used in sustainable ways. Similarly, the anniversary celebrations in the Herbarium will also provide opportunities to see parts of Kew's collections that are not usually open to the public. Visitors will be able to understand the significance of Kew as one of the leading repositories of information on plant diversity anywhere in the world.

Kew is much more than just a magnificent garden. By opening up our behind-the-scenes activities to the public in 2003 we hope that we can build a greater appreciation of Kew's importance as a centre for research and conservation. We also hope that the experience gained this year will enable us to plan for permanent improvements in levels of public access to Kew's unique resources.

Prof. Peter R. Crane, Director

AWARDS

MBE

GAIL BROMLEY, formerly Head of Education at RBG Kew and now working in a development and advisory capacity, was awarded the MBE in the New Year's Honours List for 'services to education'. Gail developed the current schools and adult education programmes, Kew's international suite of diploma courses and the volunteer guide programme. She has also established best practice systems for educational delivery in botanic gardens in many areas of the world, particularly South America.

Engler Medal

David Frodin was awarded the Engler Medal in Silver on 15 November 2002 for the second edition of his monumental work, the *Guide to Standard Floras of the World*. The medal is given annually by the International Association of Plant Taxonomy to recognise outstanding contributions in plant taxonomy.

ACTION AGAINST WILDLIFE CRIME

PLANT identification and authentication were aspects of Kew's work highlighted by Madeleine Groves, Dr Peter Gasson and Chris Leon speaking at a meeting of the Partnership for Action Against Wildlife Crime (PAW), hosted by Kew and Defra, on 19 February 2003 at Kew. PAW members include representatives from organisations involved in wildlife law enforcement in the UK and it provides opportunities for statutory and non-government organisations to work together to combat wildlife crime. Kew is the UK CITES Scientific Authority for Plants, and Kew scientists assist enforcement officers, including HM Customs & Excise, in the UK and within the EU with plant identification and analysis for criminal investigations, inspections and seizures. Kew also hosted a joint police and customs training course in March 2003, and more training packs are being developed to assist enforcement officers in the implementation of CITES.

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Panax quinquefolius cultivated in Jilin, China.



A. McRobb/RBG Kew



The main library at Kew.

Kew LIBRARY catalogue

THE Kew Library Catalogue is now available on the Internet and contains about 145,000 records. The library collections form a global bibliographic reference source for plant science, research and conservation. The catalogue has been searched over 25,000 times since the launch in October 2002. www.kew.org/library.

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Some CITES enquiries involve chemical authentication. CITES-listed American ginseng (*Panax quinquefolius*) can be distinguished from Asian ginseng (*P. ginseng*) by using liquid chromatography – mass spectrometry to analyse ginsenosides. Dr Geoffrey Kite and co-workers at Kew found that these methods can be extended to analyse the more labile malonylated ginsenosides, giving further chemical characters to support authentication (*Rapid Commun. Mass Spectrom.* 17, 238; 2003). Kew is also working with Middlesex University as part of a project funded by Defra and the International Fund for Animal Welfare to identify herbs that can be used in traditional Chinese medicine as substitutes for tiger bone, rhino-horn and bear bile.

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

The joint Kew-Phytochemical Society of Europe conference 'ChemoSystematics 2003' (2-4 July, 2003; RBG Kew) will examine the role of modern systematic phytochemistry in taxonomy, ecology, authentication and compound discovery. www.kew.org/chemo.

ARABIDOPSIS GENOME SIZE

THE small garden weed *Arabidopsis thaliana* hit the headlines in 2000 when it became the first plant to have its genome sequenced. The landmark paper published in *Nature* estimated the genome size of *Arabidopsis* to be about 125 Mb, based partly on new DNA sequencing data. This raised doubts, as many scientists had previously estimated its genome size to be much larger. To resolve this discrepancy scientists at Kew and Texas A & M University (USA) compared the genome size of *Arabidopsis* with the completely sequenced genome of the nematode worm *Caenorhabditis elegans* (c. 100 Mb) using flow cytometry. The results showed the genome size in *Arabidopsis* to be c. 157 Mb (about 25% larger than the estimate based partly on DNA sequencing). Extra DNA in unsequenced gaps is mainly composed of highly repeated (possibly junk) sequences but may also include some informational genes. *Annals of Botany* 91, 547 (2003).

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Arabidopsis Seed Longevity

Kew's collaborative research with Horticulture Research International and the Nottingham *Arabidopsis* Stock Centre has modelled the effects of moisture content and temperature on seed longevity in two ecotypes of *Arabidopsis thaliana*. This study on the 'lab-rat' of the plant kingdom makes it possible to predict longevity under a range of storage conditions and to identify particularly short- or long-lived lines. The modelling process also advances the statistical understanding of how seed storage data should be analysed. *J. Exp. Bot.* 54, 993 (2003).

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DNA IN THE GARDEN



Genome Size Database ...

Version 2.0 of the Plant DNA C-values database was released in January 2003. This database is the world's prime reference source for plant genome size estimates and lists DNA amounts for almost 4,000 species of land plants.

... and meeting

Kew will host the second international discussion meeting on plant genome size (sponsored by *Annals of Botany*) on 11-12 September 2003.

For information on the meeting and the database go to www.kew.org/cval/homepage.html.

Chocolate Genes Survive Freezing

THE chocolate flower (*Cosmos atrosanguineus*) is believed to be extinct in the wild in Mexico, and cultivated material in Britain and elsewhere does not produce seeds. For this reason, a method for cryopreservation has been developed for this species in order to ensure its long-term survival in cultivation. Some cell damage occurs during the process, and this has now been documented using transmission electron microscopy. Despite this damage, no genetic variation was detected in regenerated plants using the fingerprinting technique AFLP (amplified fragment length polymorphism). Cryopreservation therefore appears appropriate as a tool in the conservation of the chocolate flower. *Annals of Botany* 91, 65 (2003).

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Genomics and Seed Dormancy

THERE is considerable ignorance of how seed dormancy is controlled at the molecular level and this hampers the development of more efficient practices in crop production, *ex situ* conservation and habitat creation and restoration. A new 4-year Defra-funded collaboration between HRI Wellesbourne, Kew, and the University of Wageningen aims to enhance understanding of the molecular basis of physiological dormancy. Micro-array technology will be applied for a large-scale comparison of gene expression in seeds of Brassicaceae, from model species to wild germplasm.

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POLYPLOIDY IN THE GARDEN

Polyploidy (the multiplication of genomes) is a key factor in plant development and evolution, and it was recently suggested that eukaryotes may all be polyploid. An international conference on polyploidy on 27-30 April 2003 (organised by The Linnean Society and Kew) will bring together over 100 scientists to assess the phenomenon from a diverse range of perspectives including genetics, systematics and ecology.

Polyploidy in *Asplenium*

THE rock fern subgenus *Ceterach* of *Asplenium* is a prominent member of the European flora, but it also occurs elsewhere in Eurasia and Africa. Understanding its evolution has historically been made problematic by frequent occurrence of auto- and allopolyploidy, and several ploidies are often sympatric, a fact that has been little appreciated. In a study using flow cytometry to document ploidy and nuclear ribosomal and plastid DNA sequencing to demonstrate patterns of relationships, Lien van den Heede and Prof. Ronald Viane (Ghent

University) and Prof. Mark Chase (Kew) were able to document the complicated reticulate evolutionary pattern of these plants. They also found that the rock fern group is not monophyletic. A plastid haplotype and an ITS allele were discovered in one set of polyploid (tetra- and hexaploid) species from the Canary Islands and Madeira that indicated the existence of an as yet undiscovered (perhaps extinct) diploid from that region. *Amer. J. Bot.* 90, 481 (2003).

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HERBARIUM ANNIVERSARY

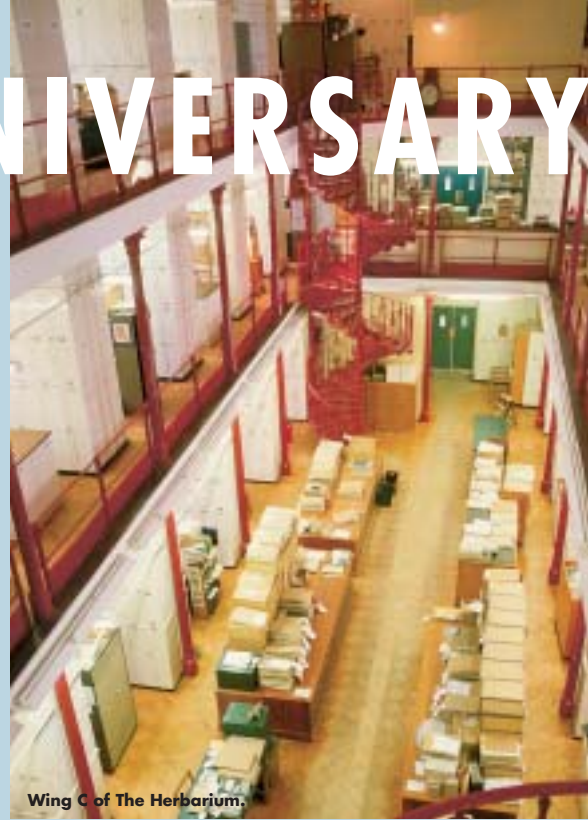
THIS year marks the 150th Anniversary of the founding of The Herbarium at Kew. In 1853, the herbaria of Sir William Hooker and Rev. William Bromfield were brought into temporary accommodation on the ground floor of Hunter House at Kew together with Bromfield's library of about 600 volumes. Through expanding scientific study, exchanges, acquisition and gifts, the herbarium and library grew rapidly and wings were added in 1877 (Wing C), 1902 (Wing B), 1932 (Wing A) and 1968 (Wing D), to house the expanding collection. In 1989 a compactor store in the quadrangle was opened and a sub-basement was excavated under Wing A.

Kew's herbarium has grown to an estimated 7,000,000 specimens, comprising pressed plants (flowering plants, gymnosperms and ferns), carpological and spirit collections, and it is a comprehensive representation of the world's flora. It is particularly rich in historical and type

specimens from Europe (including the British Isles), tropical and South Africa, the Americas, SE Asia, Australasia and China. Modern collections of particular importance are held for tropical Africa, Madagascar, SE Asia, and South America. The Library has expanded to 150,000 volumes, 4,000 journals, 200,000 botanical illustrations and a huge historical archive.

The purposes of the collections are four-fold: a reference for the accurate naming of plants, a repository for voucher material, a source of information, and a source of material for scientific studies. These major parts of Kew's work are currently largely hidden from the public. We aim to increase accessibility to the collections, through direct access, databases of specimen information and ePIC (the electronic Plant Information Centre) in order to utilise the collections for the better management of plant resources.

Prof. Simon Owens, Keeper of The Herbarium



Wing C of The Herbarium.

New Taxa

A COMMON misconception is that the rate of discovery of new species of flowering plants must have declined since Victorian times when The Herbarium was founded. However, new species continue to be described at the amazing rate of about 2,400 per year, mainly from the tropics and subtropics. With botanical exploration continuing to discover distinctive novelties, taxonomy is far from being just a museum occupation and benefits greatly from fieldwork.

Some 10% of all newly described plants are orchids. Currently the richest areas for novelties are the Andes of Colombia and Ecuador, Madagascar, the Malay Archipelago and Indochina. In the northern Andes and SE Asia, 25-30% of the species revised in generic monographs prove to be new! In Africa, the rate is lower but still exceeds 10%. An exciting new orchid from Madagascar is *Eulophia epiphytica*, only the second epiphytic species of *Eulophia* and the only one lacking pseudobulbous stems.

New genera are also being established at a rate of about 100 a year. Some are the result of DNA studies but others are new discoveries. In the *Leguminosae* of Madagascar, Dr David Du Puy and his colleagues described three new genera, *Peltiera*, *Pyranthus* and *Sylvichadsia* (and 129 new species). The genera *Satranala*, *Lemurophoenix* and *Voanioala* were all described as new by Drs John Dransfield and Henk Beentje while preparing the *Palms of Madagascar*. Just last year Aljos Farjon and colleagues described *Xanthocyparis*, a distinctive new genus of conifer from northern Vietnam.

Novelties add spice to the life of taxonomists and often clarify phylogenies and improve classifications for the benefit of all.

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Vietnamese Slippers

VIETNAM has a remarkable and diverse orchid flora that is still being explored and described. Orchids are the largest family in the flora and may exceed 1,000 species with more being described every year as remoter areas are explored. The slipper orchids are a small but showy part of the flora and the 22 currently known species and natural hybrids are described in a new book *The Slipper Orchids of Vietnam* (L. Averyanov, P. Cribb, Phan Ke Loc & Nguyen Tien Hiep; RBG Kew) together with the first detailed accounts of their habitats, biology and ecology. Although almost half the species have only been discovered within the past ten years, many are already threatened with extinction by the combined problems of forest destruction and commercial collecting. Immediate measures are necessary both within Vietnam and abroad to protect what remains. ISBN 1 84246 047 1, £37.50.

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P. Cribb



Paphiopedilum micranthum

Herbarium Phytochemistry

HERBARIUM fragments were used by Dr Geoffrey Kite in two chemosystematic studies in legumes using mass spectrometry. Working with Dr Jan Wieringa (Wageningen University) it was found that the distribution of hydroxypipelicolic acids was in accordance with the segregation of the genus *Monopetalanthus*. A separate study revealed that *Baphiopsis* contained an unusual trihydroxypipelicolic acid otherwise only known from *Baphia*, supporting the relationship suggested from DNA sequence analysis. *Biochem. System. Ecol.* 31, 45 & 279 (2003).

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A. Farjon



Madagascar Projects

TWO major projects have begun in Madagascar and will form an important part of Kew's programme there over the next three years. The Madagascar Threatened Plants Appeal aims to raise £250,000 for a series of projects focusing on the *ex situ* conservation of 15 species of rare and threatened orchids, palms and succulents. Dr Adam Britt has been appointed to co-ordinate the project and Tiana Randriamboavonjy has been employed to assist him and will be based in the Antananarivo office.

The Madagascar Vegetation Mapping Project, a collaboration between Kew, Missouri Botanical Garden and Conservation International, has been funded by a US\$150,000 grant from the Critical Ecosystems Partnership Fund. This project will be based in The Herbarium's GIS Unit and will draw on the Unit's expertise developed in producing their last (and still most widely used) vegetation map of Madagascar. Both projects will benefit from Kew's new Landrover, which was delivered to the Kew house in Antananarivo at the end of January.

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Euphorbia Red List

In March, Thomas Haevermans submitted Red List assessments of all 170 taxa of *Euphorbia* in Madagascar to IUCN. 98% of Madagascar *Euphorbia* species are endemic to the island and many, especially the succulent taxa, are highly desired by horticulturists and severely threatened by illegal collecting. Thomas is preparing his PhD on the phylogeny and taxonomy of this group.

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Aloe suzannae, one of the species in the Madagascar Threatened Plants Appeal.

Sheffield Mycological Herbarium

THE mycological herbarium of the University of Sheffield, comprising over 3,000 collections including a significant number of types, was recently donated to Kew. The herbarium includes a range of fungal groups but it is based mostly on Prof. John Webster's collections of ascomycetes and their anamorphs, which were his main research interests. It also includes material of many of Webster's students, most notably the collections of *Trichoderma* which were the basis for the monographic work by Mien Rifai. The herbarium is an invaluable resource that has been much studied by fungal taxonomists worldwide and it is a major addition to the Kew holdings. Thanks are due to Dr Tony Lyon at Sheffield, who retires this year, for arranging the donation of these collections.

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THIRD TAIWANIA POPULATION

CONIFERS are known to contain an inordinate proportion of ancient relicts. One such 'living fossil' is *Taiwania cryptomerioides* known from Taiwan and the border mountains between Yunnan in China and Myanmar. In October 2001, Vietnamese botanists found a population of *Taiwania* in forest remnants in the Hoang Lien Mountain Range in northern Vietnam and wanted to know its status. In China, this magnificent tree has apparently been introduced in several areas long ago, without known records, leading to erroneous claims of a wider natural distribution, so new discoveries have to be considered carefully.

Last year Aljos Farjon was invited to travel to Vietnam by Fauna & Flora International (FFI) to investigate the *Taiwania* population and some other critical conifers. *Taiwania* was growing

Taiwania cryptomerioides discovered in the Hoang Lien Mountains of northern Vietnam.

with another member of Cupressaceae, *Fokienia hodginsii*, in remnants of montane evergreen angiosperm forest at c. 2,000 m and was typically emergent. Given the ecology and remoteness of the site, Aljos is convinced that the population is indigenous. Its survival, however, is under threat with only about 100 trees remaining and most of the forest cleared by burning for grazing. With FFI, Aljos has prepared recommendations for the rescue of this population of *Taiwania*, a conifer that once existed across much of the Northern Hemisphere.

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

Recent work on the early stages of cone development carried out by Sol Ortiz Garcia (Latin American Research Fellow) and Aljos demonstrated that *Taiwania* together with *Cryptomeria*, another member of Cupressaceae, have primitive cones that link these taxa directly to ancient and extinct Mesozoic conifers, further strengthening the concept of *Taiwania* as a living fossil. *Am. J. Bot.* 90, 8 (2003).

ELECTRONIC INFORMATION

Web Checklists

As part of the Monocot Checklist Project at Kew, a draft of the palm and orchid checklists have now been put on the web at www.kew.org/data/monocots. At the moment these are text files that have been made available with expert checking in mind. If you spot a mistake or have a different opinion, please make a contribution. In a few months time, a revised copy will be put on the Internet as a searchable database.

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Fungal Portal

Within Britain there is a great deal of information about fungi, but it is not easily accessible. This information could be collated and presented over the Internet through a fungal portal – a window through which information on fungal biodiversity in the UK could be accessed. As part of a scoping study with Defra, it is planned that different groups in the UK would assess the support for such a Fungal Information System (FIS). The study will determine user requirements for FIS, consult on and define its potential content and scope and identify similar national or international initiatives, assessing relevance, linkages and potential for joint working.

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Digitising Specimens

Five high resolution and specially adapted scanners are now available in The Herbarium to capture detailed images of herbarium specimens. These are being used to digitise type images upon request of scientists worldwide, and also within specific repatriation projects, aiming to make Kew's collections more accessible over the Internet, together with interactive specimen databases. The overall objective is to deliver information and images as identification aids to enable botanists and students in other countries to check and update the botanical names of their specimens.

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Borneo Rattans CD

Dr John Dransfield and Meesha Patel have completed an interactive key to the rattans of Borneo. The key (written in LUCID 2.1 developed by CSIRO, Australia) provides a means for identifying all 147 rattan species recorded for the island. Each species is illustrated by colour images of all major plant parts and often also with images taken in the wild. Distribution maps based on herbarium records and conservation rankings are also provided. Botanical jargon has been eschewed to make each entry in the key as easy as possible and, in practice, it should be easy to identify a Bornean rattan, even from very fragmentary material.

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This summer, Kew and Wakehurst Place will be holding an ambitious festival concentrating on British biodiversity. 'Go Wild' (24 May - 28 September 2003) will highlight the native fauna and flora that can be found in the Gardens and explores the diversity of wild habitats throughout the UK. It will also look at sustainable practices in traditional agriculture and land management. UK plant biodiversity and its conservation is an important theme of Kew's research.

BIRCH CAN RESPOND TO CLIMATE CHANGE



New research suggests that long-lived plants such as birch could adjust genetically to global climate change.

It has generally been believed that adaptation to climate in long-lived woody species would have to come from phenotypic plasticity, whereas annual or short-lived plants could adapt more rapidly genetically or shift ranges because of their relatively rapid population turnover rates. In a study of an English population of birch (*Betula pendula*) for which accurate ages were known (some more than 40 years old), Dr Colleen Kelly (University of Southampton), Prof. Mark Chase, Dr Mike Fay, Anette de Bruijn (Kew) and Prof. Ian Woodward (University of

Sheffield) found that such long-lived species show distinct patterns of genetic segregation based on the annual mean temperature in the year of their establishment. This finding, if a generalised response in such plants, could bring into question assumptions currently used in models for how plants might respond to global climate change. It shows that this species at least will have a greater than expected capacity to adjust genetically. *Ecol. Letters* 6, 87 (2003).

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

Genes in the Club

THE triangular club-rush (*Schoenoplectus triquetus*) previously occurred on several rivers in southern England but it is now restricted to the Tamar in SW England. Hybrids between this species and its relatives *S. lacustris* and *S. tabernaemontani* still persist elsewhere, and these generally have intermediate stem morphology. However, genetic studies have shown that plants from the Thames, morphologically similar to *S. tabernaemontani*, are actually of hybrid origin. Thus the genome of *S. triquetus* still survives on the Thames. The plants are more or less sterile, and this seems to be a more useful character than stem morphology. *Watsonia* 24, 433 (2003).

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

EN Contract

THE three-year contract (2000-2003) between English Nature and Kew for genetic studies relating to the Species Action Plan programme has been extended for a further two years (2003-2005). Results from these studies are used to inform conservation management decisions. Under the renewed contract, studies will include an extension of work on the lady's slipper orchid (*Cypripedium calceolus*; see *Kew Scientist* 22) and estimates of genetic diversity in English red helleborine (*Cephalanthera rubra*) populations, using markers developed for use with the sword-leaved helleborine (*Cephalanthera longifolia*; see *Kew Scientist* 22).

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Biodiversity Challenge

OVER 100 specialists from 84 of the UK's conservation bodies met at the Plant Diversity Challenge Conference at Kew on 5 February 2003. The meeting, jointly organised with Plantlife International and JNCC, formulated draft plans to ensure that the 16 targets of the Global Strategy for Plant Conservation (GSPC) are achieved in the UK by 2010. The GSPC has been developed through the Convention on Biological Diversity and was adopted unanimously at the Convention's Sixth Meeting of the Conference of the Parties in April 2002. Kew's work will contribute to many of the GSPC targets, including producing widely accessible working lists of plants, making conservation assessments, *ex situ* conservation of threatened species, and education and capacity building.

Contact: Andy Jackson (a.jackson@kew.org)
See www.plantlife.org.uk for draft papers

Andy Jackson was appointed to the new post of Head of Wakehurst Place on 1 February 2003. Andy was formerly the Conservation & Woodland Manager and European Biodiversity Officer at Wakehurst. In his new role he will work closely with Kew's Director to manage the expanding scientific and visitor activities at Kew's sister garden.

Rare *Arum* Pollination

IN Britain, the rare lords and ladies (*Arum italicum* ssp. *neglectum*) occurs only as thinly scattered populations across southern England and the Channel Islands. In a recent study, Drs Anita Diaz (Bournemouth University) and Geoffrey Kite (Kew) concluded that pollinator availability is unlikely to be the reason for this rarity. As with the more widespread *A. maculatum*, the main pollinator was *Psychoda phalaenoides*, even though the chemical composition of the inflorescence odours of the two species showed some differences. *Watsonia* 24, 171 (2002).

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



Arum italicum ssp. *neglectum*

A. Diaz

NEWS IN BRIEF

CHIEF Scientist Visit

Following his appointment as Defra Chief Scientist, Prof. Howard Dalton made three visits to RBG Kew in 2002, including tours of The Herbarium and Micropropagation Unit in May, the Millennium Seed Bank in September and the Jodrell Laboratory in October.

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Cryoprofessor

In December 2002, Hugh Pritchard was appointed Visiting Professor in Cryobiology at the University of Luton. Hugh is one of a small team of UK cryopreservation experts who are working with Prof. David Rawson and Dr Tiantian Zhang at the university to develop a masters course in cryobiology. This will cover the principles and practice of cryobiology in relation to medicine and biodiversity.

Contact: Prof. Hugh Pritchard (h.pritchard@kew.org)

Seed Volatiles

'Sniffing success or failure', a new 2-year collaborative Defra-funded project between the Central Science Laboratory and Kew, aims to develop non-invasive techniques for the rapid assessment of seed quality (success or failure to germinate). Using GC-MS and NIRS, combined with the biochemical determination of antioxidants, the project will relate the volatile fingerprint of seeds to putative mechanisms of viability loss during environmental stress. The work will have applications in UK conservation and horticulture, and could enable a rapid quality assessment of seed bank collections.

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New Editor

Dr Martyn Rix is the new editor of Curtis's Botanical Magazine, taking over from Brian Mathew who was editor for nine years. Martyn's first issue (vol. 20, No 1; February 2003) is a volume on composites with the introduction and seven 'plant portraits' written by Dr Nicholas Hind, with either Tony Hall, Nicki Biggs or Dr Mike Fay as co-authors.

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Latin American Research Fellowships

Following the resounding success of the first Kew Latin American Research Fellowships Programme (KLARF), we are delighted that The Andrew W. Mellon Foundation of New York City has awarded a further US\$340,000 grant to Kew for a second programme, running from 2003 to 2005. KLARF 2 will continue the work of its predecessor in supporting 3-12 month fellowships for Latin American plant scientists to carry out research at Kew, the Natural History Museum and other European institutes.

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Dr Samia Heneidak

G. Kew

Successful PhD Theses

IN December 2002, three PhD students who had undertaken research at Kew successfully defended their theses. Mohammed Al Fredan's thesis was entitled 'Systematics and population variation of the genus *Senna* L. (Leguminosae) in Saudi Arabia', Yan-Peng Ng studied the 'Molecular systematics and evolution of *Eria* (Orchidaceae)' and Nicolas Salmin's thesis was on 'Large trees, supertrees and the grass phylogeny'. During his research Nicolas constructed the most comprehensive phylogeny so far for grasses (*Syst. Biol.* 51, 135; 2002).

Gerardo Salazar successfully passed his viva on 21 February 2003. His thesis on the 'Phylogeny and classification of subtribe Spiranthininae (Orchidoideae; Orchidaceae)' included the first assessment of the position of the enigmatic genus *Manniella*, which Gerardo managed to collect in Cameroon.

Samia Heneidak has now obtained her PhD for a thesis entitled 'Biosystematic studies on the species of subfamilies Asclepiadoideae and Periplocoideae (family Apocynaceae *sensu lato*) in Egypt' for which she studied a wide suite of morphological, anatomical, cytological, biochemical and molecular characters.

MONOCOTS III

AT the Third International Conference on the Comparative Biology of the Monocotyledons, hosted by Rancho Santa Ana Botanic Garden, California, 31 March – 4 April 2003, Kew staff played a major role, organising or speaking in 11 out of 19 of the organised sessions. Meetings in this series are held at five-yearly intervals (previously Kew and Sydney) and, in addition to reporting progress in the previous five years, monocot specialists from around the world formulate collaborative research goals for the period leading up to the next conference. Among those organised or co-organised by Kew staff were general sessions on monocot phylogeny, floral evolution and pollen and taxonomically focused sessions on Cyperaceae/Juncaceae, Dioscoreales, Liliaceae, Liliales, Orchidaceae and palms.

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AFRICA Plants for Life

A SEPASAL (Survey of Economic Plants for Arid and Semi-Arid Lands) node is now established at the Kenya Resource Centre for Indigenous Knowledge (KENRIK) and local botanists Stephen Mogere (co-ordinator), Ruth Adeka, Maryam Imbuni and Staline Kibet are entering data on the uses of East African dryland species. Funded by The Charles Wolfson Charitable Trust, this project has provided KENRIK with an internet connection, so making data held in SEPASAL more readily available regionally to help support conservation and sustainable development.

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The first phase of African Wild Harvest, a project collating quantitative data on the nutritional value of African wild food plants, has been completed. In collaboration with Medical Research Council Human Nutrition Research (HNR) and funded by the Nestlé Charitable Trust, nutritional information on 20 priority Ethiopian species has been compiled. Rory McBurney recently visited potential partners in Ethiopia and Kenya (including KENRIK) to develop plans for the next phase of the project, including ethnobotanical surveys and the development of a Wild Food Plant Nutrient Database linked to SEPASAL.

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Developing methods for the sustainable use of seeds of multipurpose trees in dryland Africa has been boosted by a grant of more than £15,000 from the Dennis Curry Charitable Trust and Mr Childs. The 'Seeds of Hope' project aims to improve seed handling methods, especially for storage and germination, of a range of key trees in West Africa in a collaboration with the Centre National de Semences Forestieres in Burkina Faso.

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P. Little/RBG Kew

Dr Bill Baker viewing *Pritchardia arecina*, a palm ranked as 'Critically Endangered', that flowered for the first time at Kew in February. This species is only known in the wild from the island of Maui in the Pacific where there are about 500 individuals. Emma Fox and her staff in the Palm House plan to pollinate the palm in the hope of obtaining seed.



Prince Charles being welcomed by Kew's Director, Prof Peter Crane, and the Chairman of Kew's Trustees, Lord Blakenham, before he opened the restored Nash Conservatory

P. Little/RBCKew

Royal Opening for Nash Conservatory

HRH The Prince of Wales opened the renovated Nash Conservatory on 24 February 2003. The conservatory, designed by John Nash in 1825, was originally built at Buckingham Palace, but it was moved to Kew in 1836. It first housed Southern Hemisphere plants and then tropical aroids (hence its former name of Aroid House). The humidity caused deterioration of the iron framework and extensive resoration was required. The Nash Conservatory will now be used as an educational resource for some of the 60,000 school children who visit Kew each year. The project was supported by Defra, Prof. Harold and Mrs Joan Lambert and The Headley Trust.

X-RAY COMPUTED TOMOGRAPHY

X-RAY computed tomography (CT) has been applied to plant structural research for the first time. X-ray CT produces 2D images or 'slices' that display differences in X-ray attenuation arising from density variation within an object, and these slices can be reconstructed into a 3D density map. Medical X-ray CT scanners use non-lethal X-ray energies to produce low-resolution images, but high-resolution (high-energy) scanners have found applications in science and industry.

The technique is employed mainly in the earth sciences, but it has also been used to study the interior structure of fossils non-destructively and the *in situ* development of plant roots in the soil. However, X-ray CT had not been applied in the

field of plant anatomy until scientists from Kew visited Prof. Tim Rowe and his team at the Jackson School of Geosciences, University of Texas at Austin, which hosts the University of Texas High-Resolution X-Ray CT Facility.

Six specimens were selected for examination by X-ray CT: a tulip flower, an inflorescence of *Leucospermum tottum*, a pineapple, a nutmeg, a fruit of the palm *Syagrus flexuosa*, and a piece of oak wood. These were chosen to represent a diversity of different plant parts. As expected, the best resolution of internal structure was obtained with samples that contained tissues with different densities, but for all the specimens the method also provided stunning images of the external structure.

The Kew team thought that the technology's greatest novel advantages were its non-destructiveness and the reconstructed 3D images produced. These images could be manipulated digitally to perform various measurement and visualisation tasks, such as viewing sections in different orientations. The movies resulting from this study can be viewed at www.digimorph.org. *Trends in Plant Science* 8, 2 (2003).

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Three-dimensional cutaway reconstruction of the fruit of *Syagrus flexuosa* obtained by high-resolution X-ray computed tomography.



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