Royal Horticultural Society

Sharing the best in Gardening

RHS Science

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Second John MacLeod lecture

Met Office Chief Scientist Julia Slingo addressed the question of gardening and climate change in the second annual John MacLeod lecture in November, encouraging gardeners to speak out on the subject. Of particular interest was her account of how the growing season has lengthened in different ways in different parts of the UK.

Said RHS Acting Head of Science John David, "Julia's lecture combined existing information on climate change with new data, providing a fascinating insight into how we can expect the UK climate to change over the next 30 years and its likely impact on UK gardens." ■

RHS President Elizabeth Banks welcomes the audience at the second annual John MacLeod lecture in November. A video of the lecture can be viewed on the RHS website at rhs.org.uk/Video/Science/John-MacLeod-lecture-video**. The new RHS Science Prospectus (see p.2) was also launched at the lecture.**

RHS takes leading role in ash dieback crisis

The RHS reacted quickly to the ash dieback story, closing wooded areas at Hyde Hall, issuing phytosanitary guidance in RHS Gardens, participating in Defra's November summit, which led to the Government's action plan, and circulating advice to exhibitors on movement of *Fraxinus* material at RHS Shows. For more about the role of the Advisory and Plant Health teams, see page 7. ■

RHS Botanist James Armitage wins national journalism award

At the 2012 Garden Writers Guild Awards in November RHS Senior Botanist James Armitage was awarded Trade Journalist of the Year for his series of three articles in *Garden Design Journal.* "I was delighted to receive the award," said James, who recently completed ten years' service at the RHS. "I consider it an acknowledgement of the practical value of our diverse garden flora." The three articles were intended to encourage the use of a wider palette of plants in garden design. ■

For more information:

- johndavid@rhs.org.uk
- http://press.rhs.org.uk/RHS-Science-and-Advice.aspx

GARDEN MEDIA GUILD

RHS Senior Botanist James Armitage (centre) **accepts his award from Chris Packham** (left) **and Ian Small, Head of Sales and Marketing at Briggs & Stratton, who sponsored the award.**

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In brief

New staff at Wisley. RHS Science welcomed two new members of staff in November 2012. **Claudia Bernadini** (right) joined as Climate Change Plant Scientist to work on a KTP project on climate change with the Science team at Wisley and the School of Agriculture at the University of Reading. This will involve establishing a framework for research on the impact of climate change in UK gardens and updating 'Gardening in the Global Greenhouse', a report produced jointly with the National Trust and the UK Climate Impacts Programme in 2002. Claudia has also worked for Botanic Gardens Conservation International and as a horticulturist at RBG Kew. She studied Forestry at the University of Florence, and has a PhD in Environmental Psychology. **Gracie Barrett** (top left) joined as Horticultural Scientist in a jointly funded position between the RHS and the Horticultural Development Company. Gracie will undertake much-needed research into watering, plant nutrition and growing media at amateur and professional production scales. This will require her to work closely with commercial growers as well as her colleagues at Wisley and RHS members. Gracie previously worked as laboratory manager at Laverstoke Park and her PhD investigated the effects of soil temperature on arbuscular mycorrhizal symbiosis.

Science prospectus launched. A new booklet has been produced by staff to bring together information about the wide range of research and other activities of RHS Science.

Titled 'Introducing RHS Science', this 16-page publication is intended to provide an overview for potential collaborators, funding bodies and prospective students, as well as anyone with an interest in our work. Copies of the prospectus are available from RHS Science – please contact John David for further information.

Above right. Gracie Barrett (left) and Claudia Bernadini.

PHOTOS: CLAUDIA BERNADINI (RIGHT), PAUL ALEXANDER (LEFT)

Biodiversity action plan for Wisley

A Biodiversity Action Plan for the native plants of Wisley garden has been published by **James Armitage** and **Barry Phillips**. Following on from their Flora of Wisley (*Wild Flowers of Wisley*, 2010), James and Barry selected 20 species growing on the Wisley Estate that were of local or national conservation importance, including bird's nest orchid (*Neottia nidus-avis*) and prickly poppy (*Papaver argemone*). In conjunction with Garden Manager Matthew Pottage and Wisley Curator Colin Crosbie, steps were identified to ensure the plants' survival in a way that would not detract from the Garden's ornamental value.

Around a third of all flowering plants and ferns indigenous to Britain can be found growing at the Wisley site and it is hoped the plan will help illustrate how gardens can act as important refuges for native flowers while continuing their primary purpose. Designed by Richard Sanford of Horticultural Informatics, the document can be downloaded from the Plant Sciences area of the intranet. Hard copies are also available, and have been printed using funds raised from the sale of *Wild Flowers of Wisley*.

Right. *Papaver argemone*, one of Wisley's rarest plants.

Second annual PhD symposium

RHS Science hosted its second annual PhD symposium in November. In addition to RHS PhD students, this year's event also welcomed researchers from other horticultural research institutions, including East Malling Research and Reading, Sheffield and Warwick universities.

Student talks and posters were presented to an audience of more than fifty scientists, horticultural advisors and gardeners, and covered a wide range of research topics, from hoop-petticoat daffodil taxonomy (left) and the role of biochar in the composting process to the pathogenicity of *Armillaria* and the influence of plant provenance on soil biodiversity. The plenary lecture, delivered by RHS Science Committee member Dr Ken Thompson, gave an entertaining and inspiring reminder of the importance of communicating our research to non-specialists as well as to other scientists. The day concluded with a tour of RHS propagation facilities and practices led by RHS Gardens and Operations Team Leader Sam Gallivan.

MARK BOLTON

An annual event in the Science calendar, the PhD symposium provides internal and invited external PhD students with an opportunity to present their research to an interested, informal audience and encourages the development of the growing RHS PhD community. It also helps to strengthen our links with existing and potential collaborative research partners and enhance the external profile of RHS Science.

PHOTOS: CHRISTOPHER WHITEHOUSE

Above. **RHS PhD / University of Surrey student Emma White, whose talk was entitled 'Preferences and perceptions of the gardens at RHS Wisley'.**

RHS Plant Selector's Top 20

Woody plants dominate the latest list of most viewed plant profiles on RHS Plant Selector (apps.rhs.org.uk/plantselector), with trees and shrubs accounting for 19 of the top 20. *Amelanchier lamarckii* (right) currently holds the No. 1 spot, with 16500 views, followed by *Amelanchier* × *grandiflora* 'Ballerina' and *Acer griseum*. This contrasts with Advisory's top 20 enquiries, where apples, roses and clematis head the list, but could be influenced by the top plants' year-round interest, as well as their coverage elsewhere on the site. It may also indicate that gardeners are more inclined to research their more expensive planting choices. "Our experts are constantly adding new plants and refining the information, so the top plants are likely to change," says Rupert Wilson of Horticultural Informatics. "The current AGM review will also have an impact, once the database has been updated."

CLAIRE CAMPBELL

New sward for London park. Lionel Smith, an RHS-sponsored PhD student, has started work with the Royal Borough of Kensington and Chelsea on a new form of biodiverse floral lawn. This is the first time that a public park has featured this new form of sward. Lawns are usually associated with closely trimmed grass, but in this instance, the area with be covered only with suitable flowering plants. "It will be interesting to see how visitors to Avondale Park react," says Lionel. "I hope to get some feedback as part of my research." The plants are currently being grown at the Borough's nursery facilities and will be planted out in March 2013. They should start flowering in late April, and reach their peak in May.

For more information about RHS Science news ▶ johndavid@rhs.org.uk

Joint Science-Curatorial rescue plan for Wisley's soft fruit

by Jenny Denton

PLANT HEALTH

Recently, the Wisley Fruit team became increasingly concerned about the health of the gooseberry and red currant cultivar collection. Dieback was occurring in many of the plants and they were keen to pin down the problem and find solutions.

The Plant Health team helped investigate, as signs of fungal infection were evident in the most severely affected plants. Stem sections showed characteristic wedge-shaped staining through the cross-section, leading both teams to suspect *Eutypa lata*. However, *E. lata* can be difficult to distinguish from other related *Diatrypaceae* fungi based solely on morphology. The Plant Health team cultured isolates and DNA analysis of samples confirmed that *E. lata* was the cause of the dieback in each case.

E. lata is known to be a devastating disease of grapevines and research has shown that *Ribes uva-crispa* and *R. rubrum* are also significantly at risk. This vascular pathogen causes cankers associated with old pruning wounds, leading to branch death.

Keen to preserve this important collection, the Fruit team has implemented new hygiene protocols, altered pruning regimes and revised propagation practices to minimise infection and is trying to revive the ailing cultivars. Semi-ripe cuttings taken earlier this year have been tested and are so far disease-free, giving hope of a management solution. However, numerous other woody genera (including *Prunus*, *Malus*, *Pyrus* and *Juglans*) can be affected by *E. lata*; as symptoms often don't appear on plants for several years, it will now be necessary to monitor the whole fruit collection for similar outbreaks. ■

For more information:

► jennydenton@rhs.org.uk

PHOTOS: JENNY DENTON (GOOSEBERRY STEMS); RHS (INSET)

Above. **Staining in pruned gooseberry stems.** Right. **Cut branches of grapevine showing the wedge-shaped staining characteristic of *Eutypa lata*, a cause of dieback.**

Wisley's gooseberries: a nationally important collection

Wisley holds the National Plant Collection of gooseberries, a valuable genetic resource with more than 165 varieties, some of which date back to the 19th century. The collection was featured in the November 1st edition of the BBC programme 'The Great British Food Revival', which included an interview with RHS Fruit Specialist Jim Arbury.

Says Rebecca Bevan, Fruit Team leader, "We've always known *Eutypa* was a problem in the collection, but the Pathology team have enabled us to see that it was the primary cause of all the plant losses we'd had, even in cases where the symptoms appeared to be different. This has spurred us on to dramatically change our management practices to reduce the spread of the fungus."

Above. Gooseberry 'Crompton's Sheba Queen', engraved after an original by Augusta Withers, from the *Pomological Magazine*, 1828 (RHS, Lindley Library).

Casting light on a coastal icon

by James Armitage

BOTANY

PHOTOS: RHS HERBARIUM (RIGHT); MARTIN MULCHINOCK

Above. **Cabbage palms (*Cordyline* spp.) are well known for their colourful foliage forms, as in the cultivars 'Southern Splendour'** (left) **and 'Torbay Dazzler', but are also emblematic of the exotic style of planting which characterises the "English Riviera"** (inset).

Cordyline species grown outdoors in the British Isles were introduced in the 19th century from New Zealand, where five species are recognised. Horticultural selection of colourful foliage forms soon began and these days a wide range of cultivars is available. Though generally attributed to *Cordyline australis*, some have morphological characters more associated with other species and appear to be hybrids.

RHS Science has initiated a series of research projects to clarify the taxonomy of these important garden plants. A pilot study (conducted with RBG Kew) suggested that the New Zealand species are extremely closely related and that where grown in close proximity hybrids are likely to occur.

Another molecular study has recently been completed at Reading University by Lucy Wenger, an RHS-sponsored MSc student. Results have been obtained which, combined with a morphological analysis, should shed new light on the parentage of and relationships between the garden cultivars. It is hoped that these findings will make it possible to establish a means of reliably identifying parentage by vegetative characters alone.

In a third study, more results are expected shortly from East Malling Research, where state of the art equipment has been used to obtain sequences from large areas of the chloroplast genome of *Cordyline* species. These, in conjunction with the work carried out at Reading, can be used to create a phylogeny of these taxonomically complex plants and provide novel insights into their evolution and development. ■

Behind the science

- **Why does the RHS conduct this kind of research?** Knowing the parentage of garden plants is valuable not just in providing a settled nomenclature but in ensuring classifications are predictive of appearance and cultivation requirements and in informing future breeding work.

- **What does a "molecular study" involve?** In the case of Lucy Wenger's research, regions of chloroplast DNA were compared in an attempt to gain further insights into the relationship between the species and allow inferences to be made about the parentage of the cultivars. Sequences from 12 regions of DNA were used, offering the largest molecular dataset yet compiled for the New Zealand species of *Cordyline*.

- **What else could this research tell us?** Cordylines are typical of many members of island floras in that rapid morphological change, driven by strong selection pressures, has not been accompanied by deep molecular change so that interfertility remains intact. As human activity breaks down ecological barriers, understanding how species are related, and how hybrids between them can be recognised, is important for conservation and the management of vulnerable ecosystems.

For more information:

► jamesarmitage@rhs.org.uk

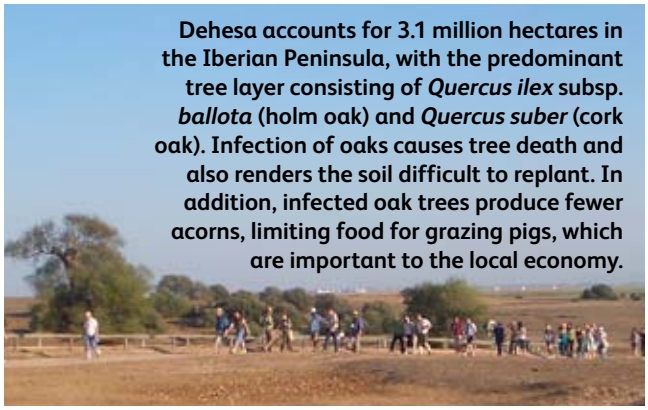
Low-cost solution to root rot unveiled at international *Phytophthora* conference

A system that uses low-pressure trunk injections could extend the lifespan of trees infected with *Phytophthora*. The system, which involves the use of phosphite to encourage feeder root development, was one of the exciting techniques demonstrated to delegates at the International Union of Forest Research Organization (IUFRO) conference in Cordoba (Spain) last autumn. The RHS was represented by Béatrice Henricot and Geoff Denton of Plant Sciences.

Fifteen new *Phytophthora* species have been identified since the last conference (March 2010) and were presented through posters and talks. Geoff presented a poster ('ITS based identification and phylogeny of *Phytophthora* spp. detected in UK gardens') reporting three new species, as yet unnamed; two were identified in collaboration with a Dutch group, and a third from RHS research alone.

The trunk injection system was demonstrated during a field trips to local multi-purpose woodlands ("dehesa"). The low-pressure system means it doesn't require expensive equipment for high pressures, which can result in bark splitting. This combination of applying phosphite and a low-pressure injection system appears to be a cost-effective way to significantly increase tree longevity post-infection.

PHOTOS: GEOFF DENTON



Dehesa accounts for 3.1 million hectares in the Iberian Peninsula, with the predominant tree layer consisting of *Quercus ilex* subsp. *ballota* (holm oak) and *Quercus suber* (cork oak). Infection of oaks causes tree death and also renders the soil difficult to replant. In addition, infected oak trees produce fewer acorns, limiting food for grazing pigs, which are important to the local economy.

For more information:
▶ beatricehenricot@rhs.org.uk, geoffdenton@rhs.org.uk

Green roof research: update

Since early 2011, RHS has been expanding our knowledge of the cooling and insulating potential of green roofs through a PhD project at the University of Reading. Carried out by **Madalena Vaz Monteiro** (left) and supervised by **Tijana Blanusa**, the project aims to investigate alternatives to *Sedum* in providing building insulation and aerial cooling, based on the differences in leaf thickness, colour and hairiness. During 2012 a number of activities relating to this green-roof project took place. In particular, an outdoor experiment compared temperature profiles and energy balances in 2x2m plots of bare soil (some painted white and others naturally dark brown), planted with *Sedum* as well as *Heuchera*, *Salvia*, *Stachys* and *Sempervivum* (right). This experiment was set up to establish whether the differences that Madalena measured between succulent and herbaceous species in an earlier controlled-environment experiment could be replicated in a field situation out of doors.

For more information ▶ tijanablanusa@rhs.org.uk

PHOTO: MADALENA VAZ MONTEIRO

RHS Science and the ash dieback crisis

Although organisations such as the National Trust and the Woodland Trust have had a greater share of the headlines, the RHS has played an active role in the ash dieback story from the start. This has been on three main fronts: advice to members, expert advice to government, and advice to the public through the media and online.

Advice to members

Direct enquiries from members began as soon as the story broke, and peaked again with the publication of Principal Research Scientist Béatrice Henricot's article on ash dieback in the January *Garden*. Since then, there has been a decrease in enquiries. Says Guy Barter, Chief Horticultural Advisor: "In 2012 we recorded 172 ash enquiries, compared to 36 in the previous year. I expect enquiries to fall until the summer, when new infections will become apparent and worried gardeners will seek our guidance."

Media and online

Although concerns are focused on ash in the wild, cultivars and non-native species are quite common in gardens. Science staff were quick to provide advice in the media and online, with appearances from Andrew Halstead on Radio 4's Material World and Guy Barter on BBC1's Breakfast and Radio 4's Gardening Today. Advisory staff also contributed to coverage in the *Times*, the *Mail*, the *Telegraph*, and local radio stations, while the Advisory ash dieback webpage was updated to keep abreast of developments in October and November.

Contribution to the Government action plan

On 7 November, John David and Eoin Redahan attended the ash dieback summit called by Environment Secretary Owen Paterson. This was followed by intensive work to formulate an interim control plan for the disease and involved a range of stakeholders, including the RHS. The plan was published by Defra on 6 December, and will be subject to further review as knowledge of the disease progresses. ■

CAROL SHEPPARD (LEFT); BOB MARTIN

Above. **RHS Chief Scientist John David** (left) **and Chief Horticultural Advisor Guy Barter.**

Chronology of a crisis

Ash dieback (*Chalara fraxinea*) first became newsworthy in August 2012, when the HTA reiterated concerns it had first raised in a letter to Fera in 2009, calling for a ban on imported ash trees. In September, with several cases identified in the nursery trade and recent plantings of imported stock, the Woodland Trust followed suit, predicting that Britain could lose 30% of its wooded areas (80m trees) to the disease.

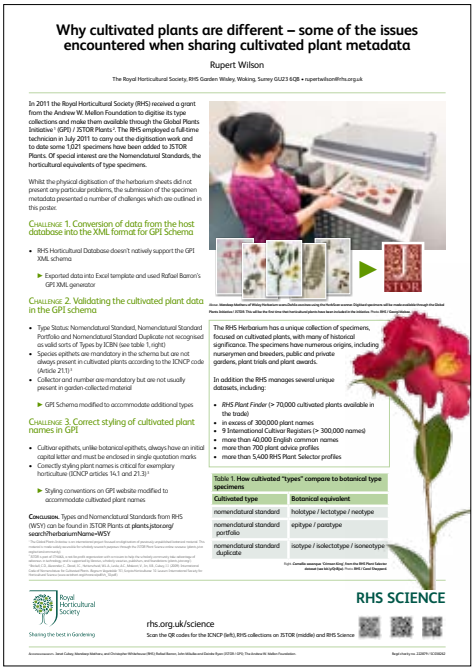
The story did not take off until the end of October, however, when infected trees were found in the natural environment in Kent and East Anglia. There was intense press interest in the development, with repeated allusions to Dutch elm disease. There was also a high-profile response from government, with a crisis committee (under COBR, better known for its responses to international incidents) convened to discuss the matter on 2 November 2012. It was after this meeting that Environment Secretary Owen Paterson exhorted the public to "wash their boots, wash their dog, wash their child" after visiting wooded areas.

On 7 November, there followed a "tree summit" of government officials, representatives from industry, and plant health experts, including the RHS Chief Scientist, John David. This resulted in an interim control plan (see main story), to which the RHS contributed. Throughout November and December, various developments remained among the "most read" items on the BBC website, with the number of known infected locations rising to 520 by Christmas. Since then, media attention has abated slightly: the BBC website for instance has run no new ash dieback stories this year.

For more information ▸ johndavid@rhs.org.uk

Towards an international infrastructure for biodiversity information

Rupert Wilson recently travelled to China to attend the 2012 TDWG Biodiversity Information Standards Conference in Beijing, where he presented a poster featuring the Herbarium Digitisation project and the challenges faced when sharing cultivated plant information with the Global Plants Initiative.


Why cultivated plants are different – some of the issues encountered when sharing cultivated plant metadata

Rupert Wilson

The Royal Horticultural Society, RHS Garden Wisley, Woking, Surrey GU23 6QB • rupertwilson@rhs.org.uk

In 2011 the Royal Horticultural Society (RHS) received a grant from the Andrew W. Mellon Foundation to digitise its type collections and make them available through the Global Plants Initiative[1] (GPI) / JSTOR Plants[2]. The RHS employed a full-time technician in July 2011 to carry out the digitisation work and to date some 1,021 specimens have been added to JSTOR Plants. Of special interest are the Nomenclatural Standards, the horticultural equivalents of type specimens.

Whilst the physical digitisation of the herbarium sheets did not present any particular problems, the submission of the specimen metadata presented a number of challenges which are outlined in this poster.

Challenge 1. Conversion of data from the host database into the XML format for GPI Schema

- RHS Horticultural Database doesn't natively support the GPI XML schema
  - ▶ Exported data into Excel template and used Rafael Baron's GPI XML generator

Challenge 2. Validating the cultivated plant data in the GPI schema

- Type Status: Nomenclatural Standard, Nomenclatural Standard Portfolio and Nomenclatural Standard Duplicate not recognised as valid sorts of Types by ICBN (see table 1, right)
- Species epithets are mandatory in the schema but are not always present in cultivated plants according to the ICNCP code (Article 21.1)[3]
- Collector and number are mandatory but are not usually present in garden-collected material
  - ▶ GPI Schema modified to accommodate additional types

Challenge 3. Correct styling of cultivated plant names in GPI

- Cultivar epithets, unlike botanical epithets, always have an initial capital letter and must be enclosed in single quotation marks
- Correctly styling plant names is critical for exemplary horticulture (ICNCP articles 14.1 and 21.3)[3]
  - ▶ Styling conventions on GPI website modified to accommodate cultivated plant names

Conclusion. Types and Nomenclatural Standards from RHS (WSY) can be found in JSTOR Plants at plants.jstor.org/search?herbariumName=WSY

The RHS Herbarium has a unique collection of specimens, focused on cultivated plants, with many of historical significance. The specimens have numerous origins, including nurserymen and breeders, public and private gardens, plant trials and plant awards.

In addition the RHS manages several unique datasets, including:

- *RHS Plant Finder* (> 70,000 cultivated plants available in the trade)
- in excess of 300,000 plant names
- 9 International Cultivar Registers (> 300,000 names)
- more than 40,000 English common names
- more than 700 plant advice profiles
- more than 5,400 RHS Plant Selector profiles

Table 1. How cultivated "types" compare to botanical type specimens

Cultivated type	Botanical equivalent
nomenclatural standard	holotype / lectotype / neotype
nomenclatural standard portfolio	epitype / paratype
nomenclatural standard duplicate	isotype / isolectotype / isoneotype

RHS SCIENCE

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Scan the QR codes for the ICNCP (left), RHS collections on JSTOR (middle) and RHS Science

Since 1985, this international meeting has brought together scientists and IT professionals from all sectors of the Natural Sciences domain on an annual basis to promote their work and foster greater collaboration. One particular highlight this year was the first African Biodiversity Symposium, where delegates from Ghana, Kenya, Tanzania and the Democratic Republic of Congo shared their experiences and challenges in capturing information on the rich biodiversity of those countries. Says Rupert, "As usual the conference provided a great way to keep in touch with the latest technological developments, share experiences and gain knowledge from delegates around the world."

Plants for Bugs project on BBC Radio 4

Helen Bostock of Advisory can be heard discussing Plants for Bugs in the 20 December 2012 edition of Radio 4's Saving Species (www.bbc.co.uk/programmes/b01pcsmf).

For more information about Science publications:
▶ johndavid@rhs.org.uk

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Shaw, J.M.H. (2012). New orchid hybrids May–June 2012. *Orchids Australia Supplement* **24**(6): 1–16.