

Botanists have been seeking out, describing and naming new plant species for hundreds of years. In the 16th century, plant hunter John Tradescant started a trend for collecting and classifying exotic species that reached frenzied levels in the 18th and 19th centuries. Records show, for example, that Matthew Flinders' 1801 expedition to Australia yielded 1,700 new species among the 4,000 specimens collected. Meanwhile Kew gained 40 new *Rhododendron* species from the '80 porter loads' of specimens it received from Joseph Hooker's collecting forays in the Himalayas in 1848.

Given that latter-day botanists have the advantages of air travel, digital maps and better access to scientific data, you might think we would have found all the world's plants by now. The surprising truth is that

experts are still discovering new species at the same rate as a century ago, adding 2,000 new names to the world's known flora every year. Even this rate is not fast enough, however. With ecosystems being rapidly destroyed by logging and urban advances, and with climate change now playing havoc with habitats, the race is on to find, name and preserve plants, many of which may be useful as foods, fuels or medicines, before they're lost to us for ever.

Kew has long been at the forefront of plant collecting, and its botanists are key contributors of new species. In 2009, its 250th year, Kew discovered more than 250 new species, including 24 new palms, three huge forest trees in Cameroon and new species of coffee, orchid, yam and indigo. Much of its success can be attributed to the knowledge and experience of its taxonomists,

and the unrivalled Herbarium of seven million specimens that underpins their work. 'Take Madagascar's palms,' says Bill Baker, head of palm research at Kew. 'We carried out a huge project there a few years back and produced the book *The Palms of Madagascar*, which doubled the known palm flora. That work helped us find the new species we described in 2009.'

Innovative use of technology is also contributing to new discoveries. Mijoro Rakotoarinivo, a botanist based in Kew's Madagascar Conservation Centre, has developed a means of predicting where new species will be found using geographic information systems (GIS). This technology allows different layers of scientific data to be plotted on digital maps and then analysed. (see also p22). Mijoro plotted 2,000 sightings of Madagascar's 188 known palm species,

along with information such as annual rainfall, geology, vegetation types and elevation. When the GIS is queried for an individual species, areas likely to provide favourable environmental conditions are highlighted on a map.

Mijoro is using this 'predictive mapping' technique to prioritise areas for 'ground-truthing', that is, sending in botanists to visit locations and see what species actually grow there. This is a good approach to use in Madagascar. Only ten per cent of the original vegetation remains intact and the fragments that do are usually in remote areas that are expensive and difficult to get to.

'In one locality in south-eastern Madagascar, Mijoro found an enormous diversity of palms using this technique,' says Bill. 'Not only did he rediscover a species that hadn't been seen since the early 1900s, he encountered the largest known population

Desperately seeking species

As habitats are destroyed and climates change, it's becoming ever more urgent to find and conserve the world's as yet undiscovered plant species. And Kew is leading the way, reports Carolyn Fry

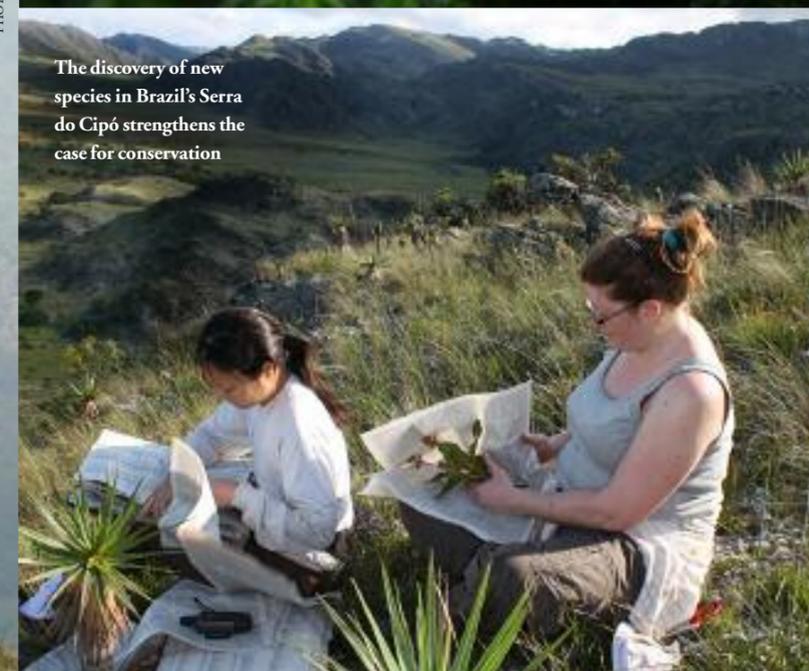


How many more unknown plants await botanists on Mount Mabu, Mozambique?



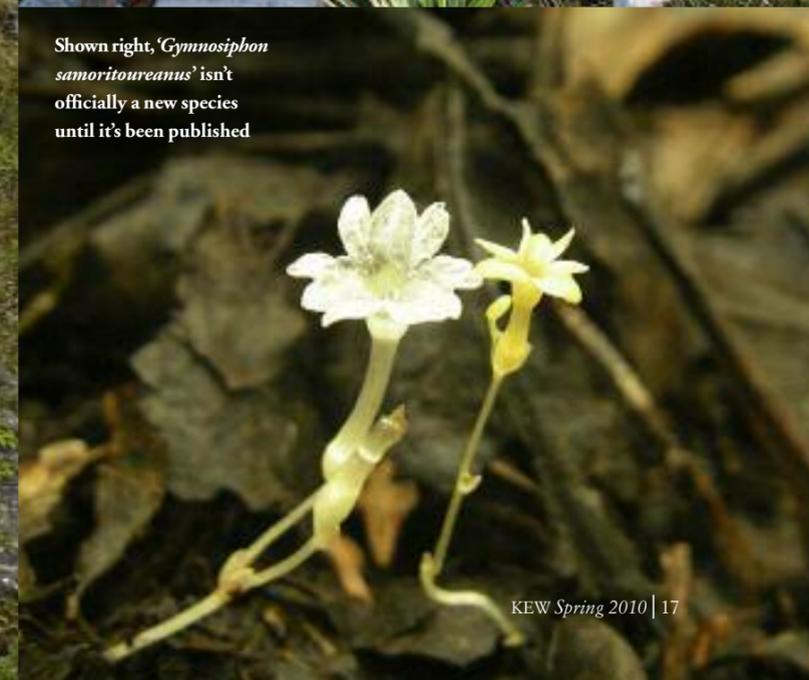
Just 35 specimens have been found of the Cameroonian tree '*Talbotiella velutina*'

PHOTOGRAPHS: TOM TIMBERLAKE, WILLIAM MILLIKEN, RBG KEW



The discovery of new species in Brazil's Serra do Cipó strengthens the case for conservation

Shown right, '*Gymnosiphon samoritoureanus*' isn't officially a new species until it's been published



of *Beccariophoenix madagascariensis*, an incredibly endangered palm, and found four new species.'

Aaron Davis, Kew's curator of the coffee family (Rubiaceae), is taking a similar approach using Google Earth satellite images. In his office within the Herbarium, Aaron brings up a Google Earth map of Madagascar on his computer screen, parts of which are dotted with 'pins' marking past botanical finds. 'Initially I decided to visit this area when planning our last expedition,' he says, zooming in on a pin-less and therefore unexplored area of dense forest. 'However, local customs dictated that we'd have to wear the male lamba, a loincloth-like outfit. Walking in a loincloth for more than 30 km in 30°C heat, with a good chance of encountering mosquitoes and leeches, didn't seem like a very good idea. So we went to another underexplored area and found at least six new species belonging to the coffee family, including two new species of coffee.'

Undertaking expeditions in remote parts of the world can be dangerous. Aaron recalls a trip to New Guinea when they had to cross a ravine, with a raging river 30m below, using only a slippery log for a bridge. Bill hasn't forgotten being attacked by a wild pig while collecting specimens of *Dransfieldia* (a palm named after Kew's former head of palm research, John Dransfield). And botanist Tim Utteridge of Kew's South-East Asia team spent a few days searching for new species on Mount Jaya, New Guinea's highest peak, just below the seeping dam of a glacial lake. Three days later the dam gave way and flooded the entire area.

Occasionally, though, difficult situations have themselves yielded new finds. Tim recalls how a fellow botanist once fell down a cliff, only to emerge minutes later clutching a previously unrecorded plant.

Botanists have to follow certain protocols before a new species of plant can be officially named and accepted into the world's flora. First, they must make an accurate description in the field and gather specimens with leaves, flowers and fruits for drying or preserving in spirit. Back in the Herbarium, these new collections are carefully compared to existing herbarium specimens to ensure the plant is new to science. The specimen on which a name is based is called a type and goes into Kew's Herbarium, and others around the world, for fellow botanists to consult.

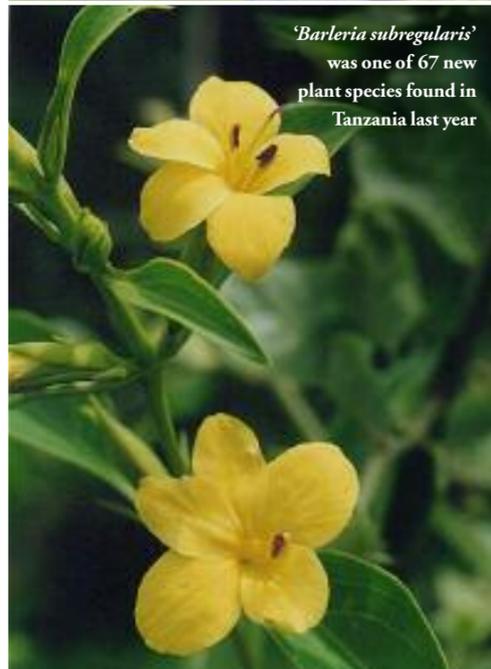
The new species is then given a binomial Latin or Latinised name, where the first word denotes the genus and the second the species. 'You have to have very specialist



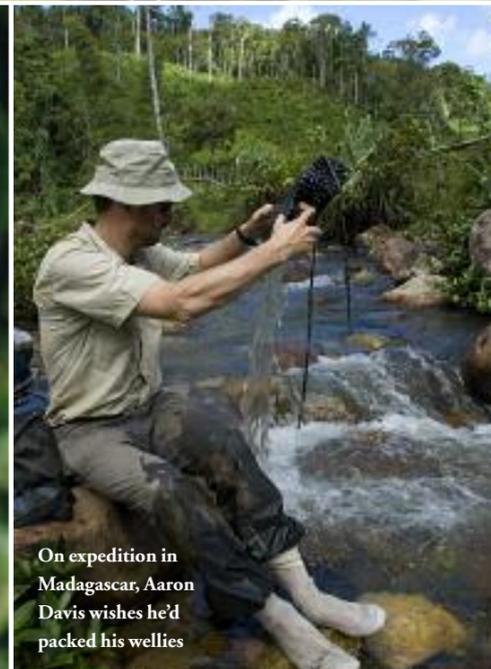
New plants are meticulously recorded in their habitat before samples are collected



As it eluded discovery until 2007, this tiny aquatic plant was given the name *Isoetes eludens*



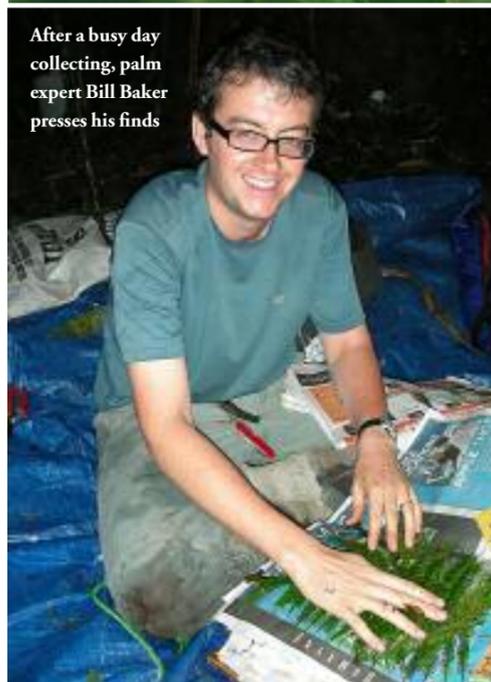
'*Barleria subregularis*' was one of 67 new plant species found in Tanzania last year



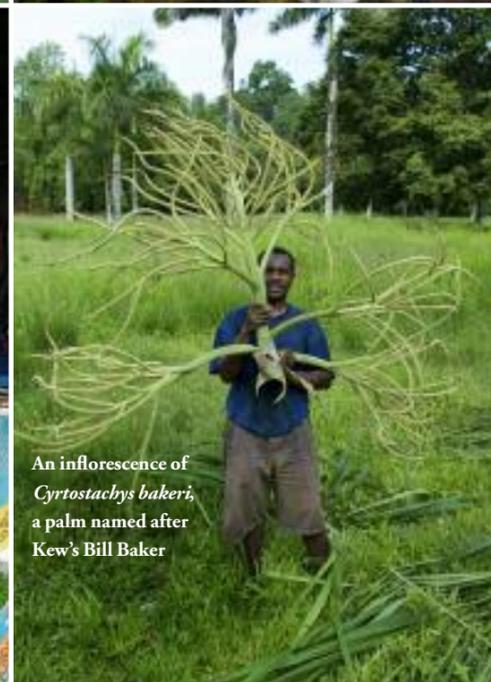
On expedition in Madagascar, Aaron Davis wishes he'd packed his wellies



In 2009, 14 new species of indigo came to light, including '*Indigofera serpentinicola*'



After a busy day collecting, palm expert Bill Baker presses his finds



An inflorescence of *Cyrtostachys bakeri*, a palm named after Kew's Bill Baker



Drying clothes and drying plant material, it's always a hive of activity at field camp

knowledge to be able to know in the field that a plant is a new species,' says Aaron. 'Sometimes it might be many years before you realise a plant is unknown to science, but other times it's immediately obvious you've got something new and amazing.'

A new name is not truly validated until a description of the plant has been published in a peer-reviewed journal and made available in more than one library. This publication must include a short description of the plant in Latin and will usually be accompanied by a line drawing or photograph of the species. That way, plant experts around the world can decipher details of new finds, whatever the language of the initial paper.

'Obviously a new species exists before it's described, but it's pointless raving on about any plant until it has been identified as new and given an accepted name,' says Aaron. 'Without a name, you can't make any practical decisions about its conservation, it can't appear in *The IUCN Red List of Threatened Species*, it can't be included in any local biodiversity action plan, and, if it's a traded species, it can't be protected by CITES, the Convention on International Trade in Endangered Species.'

Increasingly, Kew's expertise in recognising new species is helping prioritise areas for conservation. For example, between 1993 and 2003, Kew scientists surveyed plants in the Kupe-Bakossi region of Cameroon, finding 2,440 species, including more than 70 new finds, in 2,390 km². This made it the number one centre for plant diversity in tropical mainland Africa and a top priority for conservation. The hope is that, armed with the knowledge that Cameroon has something precious and irreplaceable, the government will now protect the entire area.

Experts recognise that saving whole habitats is the best way of conserving species-rich parts of the planet and the UN has designated 2010 as the International Year of Biodiversity to raise awareness of this fact. If we do manage to save the world's remaining botanical hotspots for posterity, thanks must go to the dedicated botanists who toil in remote parts of the globe and national herbaria to alert us of the riches still out there. ♣

Carolyn Fry is the author of *The Plant Hunters*, available from the shops at Kew and Wakehurst, and online at shop.kew.org, for the special price of £20, saving £10 on the RRP

Find out more about newly described plant species overleaf and at www.kew.org

A world of new species

Giant rainforest trees, rare and beautiful orchids, spectacular palms, wild coffees and an ancient aquatic plant are among the 295 new species discovered by Kew botanists in 2009

Orchids under threat

With more than 25,000 species, the orchids are probably the world's largest flowering plant family. Kew's orchid experts Jeff Wood and Phil Cribb added 38 new species to that total in 2009. Jeff Wood has been studying the orchids of Mount Kinabalu, the highest mountain in Borneo, for more than a decade, yet continues to discover species new to science.

'Kinabalu is unbelievably rich,' he says. 'In an area of just 1,200 km² there are 866 different orchids, including 13 new species described in 2009.' But these habitats are under threat – Borneo's forests are being logged for timber and converted into oil-palm plantations. Orchids also face the threat of illegal collection for the horticultural trade. The act of finding and naming these plants has thrown them a lifeline.



The orchid *Dendrobium jiewhoei* was discovered on Borneo's Mount Kinabalu

The highest numbers of new species came from eastern Africa and tropical southern Africa, with 67 from Tanzania alone. Thirty-three species were found in Madagascar and 62 in Borneo

Canopy giants

Among the most gigantic of the new species are three towering rainforest trees discovered by Xander van der Burgt and colleagues in the Korup National Park in Cameroon. *Talbotiella velutina* (see p17) and *Lecomtedoxa plumosa* both reach more than 30m into the forest canopy, but *Berlinia korupensis* (right), named by Kew's Barbara Mackinder, tops these with a huge, buttressed trunk more than 42 m in height and almost 1m wide.

Berlinia is a member of the pea family (Leguminosae) and bears beautiful white flowers, from which enormous pods about 30 cm in length develop. These explode when ripe, shooting their seeds away from the mother tree. Surveys of the Korup National Park have revealed that this tree is extremely rare – currently only 17 are known in one remote location, showing how important it is to conserve this habitat.



The largest new find in 2009 was the 42 m tall rainforest tree *Berlinia korupensis*



Cyrtostachys bakeri is one of many new species found during ongoing work in New Guinea

Palms large and small

An astounding 24 new species of palm were named in 2009. Some are enormous forest canopy trees, such as the 25m tall *Cyrtostachys bakeri* (above), discovered by Kew palm expert Bill Baker in Papua New Guinea, but most are slender understorey palms from the rainforest.

Twenty of the new palms were found in Madagascar. 'After 20 years of research we're still finding new species there,' says Baker. 'Half of all known Madagascan palms have been discovered by Kew botanists.' Less than ten per cent of Madagascar's original vegetation remains, and up to 300,000 hectares of forest are destroyed every year. Palms are used by local people for a variety of products, as well as for food and as construction materials. Nearly all of the island's native palm species are threatened with extinction, including *Dypsis humilis*, which has been reduced to ten individuals in an area heavily used for timber. Innovative conservation strategies involving local communities are needed to save them.

Cancer cure yam

Dioscorea strydomiana is a critically endangered species from South Africa, with only two populations of about 200 plants known in the wild. It doesn't look like a typical yam though (see below) – it is shrub-like in appearance with an enormous, slow growing, lumpy wooden tuber above the ground measuring up to 1 m in height and diameter. The tuber sprouts multiple shoots each spring.

This species is regarded as a cancer cure by local people and as a result is under threat from over-collection by medicinal plant collectors, who cut pieces off the tubers. Kew's yam expert, Paul Wilkin, describes the species as 'the most unique and unusual yam I've ever come across, and probably the most threatened.'



Dioscorea strydomiana is critically endangered, with just 400 specimens recorded in the wild

A splash of coffee

Seven new wild coffee species from Madagascar were named in 2009, taking the list of new coffee species discovered by Kew botanists in the last ten years to nearly 30. These new coffees come in all shapes and sizes – *Coffea pterocarpa* has winged fruits, while *C. namorokensis* is distinctly hairy. *C. ambongensis* and *C. boinensis* have the largest seeds of any coffee species – their beans are more than twice the size of those of *C. arabica*, the main species used in the production of the coffee we drink.

Kew's coffee expert Aaron Davis estimates that '70 per cent of wild coffee species are in danger of extinction, due to habitat loss and climate change.'

The seeds of *Coffea ambongensis* are twice the size of our more familiar arabica coffee beans



Nearly a third of the species described in 2009 are considered to be threatened with extinction

Discover profiles of many of the new plant species at www.kew.org/new-discoveries, where you can also find an interactive map and list of new species country by country