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Researchers' discovery astonishes worldwide

Barcoding is no longer a term only affiliated to consumer goods. Thanks to the research efforts made by Dr Michelle van der Bank of the University of Johannesburg (UJ) and a group of international scientists, a gene has been identified to distinguish between the majority of plant species on earth.

This gene, which can be used to identify plants using a small sample, could lead to new ways of easily cataloguing different types of plants in species-rich areas like rainforests. It could also lead to accurate methods for identifying plant ingredients in powdered substances, such as in traditional Chinese medicines, and could help to monitor and prevent the illegal transportation of endangered plant species. The team behind the discovery found that DNA sequences of the gene 'matK' differ among plant species, but are nearly identical in plants of the same species. This means that the matK gene can provide scientists with an easy way of distinguishing between different plants, even closely related species that may look the same to the human eye.

The researchers made this discovery by analysing the DNA from different plant species. They found that when one plant species was closely related to another, differences were usually detected in the matK DNA.The researchers carried out two large-scale field studies: one on the exceptionally diverse species of orchids found in the tropical forests of Costa Rica, and the other on the trees and shrubs of the Kruger National Park in South Africa.

This was a collaborative project between teams from South Africa led by Dr Michelle van der Bank of the Department of Botany and Plant Biotechnology at the UJ, the United Kingdom by Dr Vincent Savolainen, dual appointee at Imperial College London's Department of Life Sciences and the Royal Botanic Gardens, Kew and Costa Rica by Diego Bogarin, Lankester Botanical Garden, University of Costa Rica. The scientists' findings were published in the *Proceedings of the National Academy of Sciences* journal in February 2008.

Using specimens collected from Costa Rica, Dr Savolainen and colleagues were able to use the matK gene to identify 1,600 species of orchid. In the course of this work, they discovered that what was previously assumed to be one species of orchid was actually two distinct species that live on different slopes of the mountains and have differently shaped flowers adapted for different pollinating insects. Dr van der Bank and her team was able to use the matK gene to identify the trees and shrubs of the Kruger National Park, also well known for its big game animals.

Dr Savolainen explains that in the long run the aim is to build on the genetic information the team gathered from Costa Rica and South Africa to create a genetic database of the matK DNA of as many plant species as possible, so that samples can be compared to this database and different species accurately identified. According to Dr van der Bank the electronic DNA barcoding database for the trees and shrubs of the KNP, which will include pictures, distribution maps and herbarium scans will be launched in mid April at the Science Network Meeting in the Kruger National Park.

“In the future we’d like to see this idea of reading plants’ genetic barcodes translated into a portable device that can be taken into any environment, which can quickly and easily analyse any plant sample’s matK DNA and compare it to a vast database of information, allowing almost instantaneous identification, “ Dr Savolainen says.

Although Dr Savolainen concedes that such technological applications may be some years away from realisation, he says the potential uses of the matK gene are substantial: “There are so many circumstances in which traditional taxonomic identification of plant species is not practical – whether it be at ports and airports to check if species are being transported illegally, or places like Costa Rica where the sheer richness of one group of plants, like orchids, makes accurate cataloguing difficult.”

The matK gene may not, however, be able to be used to identify every plant species on Earth. In a few groups of species, additional genetic information may be required for species-level identification because hybridization – where species cross-breed and genetic material is rearranged - may confuse the information provided by matK. This research was funded by the Defra Darwin Initiative, the Universities of Johannesburg and Costa Rica, the South African National Research Foundation (Thuthuka program), the Royal Botanic Gardens, Kew, and the Royal Society.

Dr Holger Eckhardt SANPARKS says “The DNA-barcoding project from the University of Johannesburg will not only benefit the KNP by providing information on the distribution of common and rare plant species but also highlight areas with endemicity, i.e. areas containing species that only occur there and nowhere else. Another benefit will arise once the technology for scanning and identifying species *in situ* becomes available; using hand-held equipment to immediately identify species in the field will save an enormous amount of time since time for literature citing and training of people can largely be reduced.”

Prof. Kinta Burger, Dean, Faculty of Science at University of Johannesburg said: “The investigation which gave the results which are reported on in this press release is but one of the number of innovations which research workers at the UJ have achieved. It is an embodiment of the aim of the Faculty of Science, and the UJ, to establish and maintain professional contact and collaboration with esteemed colleagues and institutions across the world. The benefits of such collaboration can be seen in the development of an identification system which will see applications in many diverse fields of activity, ranging from theoretical taxonomic botany to economic plant use, the saving of endangered plant species and forensic botany, to

mention but a few. The UJ anticipates that further research and development of this project will lead to further refinement of the techniques and possible even to the development of the technology required to make it accessible to workers in the field".

Joan Ruddock, Minister for Climate Change and Biodiversity said: "This is a great breakthrough that could save many endangered plants. The Defra-funded Darwin Initiative has a reputation for producing real and lasting results and I congratulate everyone involved in this project which could have huge benefits for plant identification and conservation in the future. "

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