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Scientists unveil plant DNA barcode

A new way of classifying DNA looks likely to create shortcuts in many processes that are currently rather tricky.

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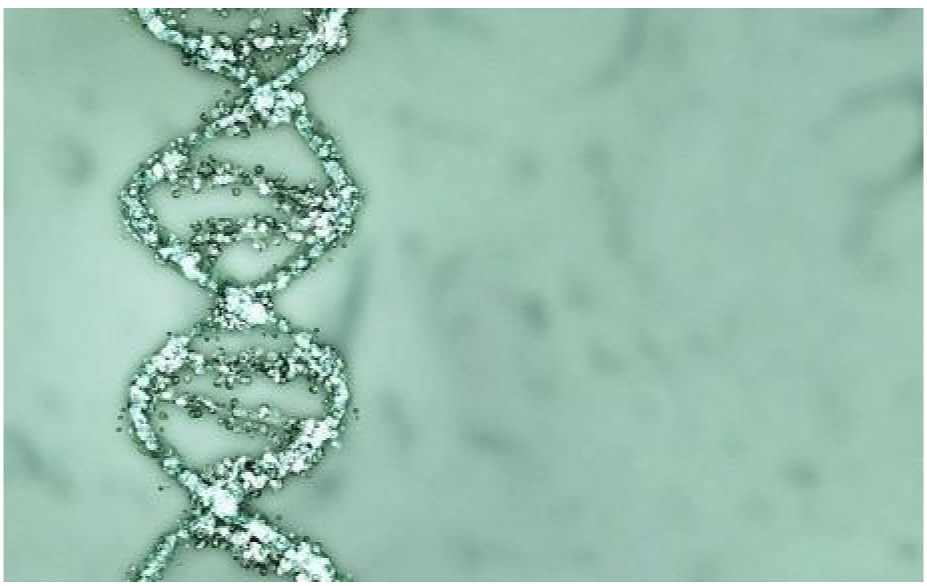

A section of DNA is to be used as a kind of barcode that will allow it to be easily identified. Photo: Getty

Scientists meeting at the third International Barcode of Life conference in Mexico City this week have agreed on a region of DNA that will be used to identify plants by genus in a new system of codification.

Although genetic "barcoding" of animals, which allows scientists to identify animals from a small section of thier DNA, is already well-established, the system has until now not worked for plant species.

Data about different plant species will then be made available to scientists around the world on a global database and the technology could be used in a number of ways, including tackling the illegal trade in endangered species and identifying new pathways of food webs.

The latter will provide a mine of previously unseen data about the subtle and intricate connections between the world's animals and plants.

DNA barcoding was first proposed in 2003 as a system that would enable scientists to identify a species even if it were damaged or not fully grown.

It uses a very short genetic sequence from the genome in the same way that a supermarket scanner distinguishes products using the black stripes of a Universal Product Code.

The technology enables barcodes to be obtained from tiny amounts of tissue and to identify different species that might, to the untrained eye, look very similar.

Dr David Schindel, executive secretary of the Consortium for the Barcode of Life (CBOL) at the US Smithsonian Institution, said that there had been “an extraordinary growth” in barcoding technology.

Explaining how the process works, he described the system as like “creating a phone book” that includes the names of species and their unique DNA barcode sequence.

Dr Schindel said that the first step in collecting DNA barcode, is to take a known species - one that has been identified by a specialist - and remove a tiny piece of tissue, for example, the leg of a mosquito.

“That then goes into a lab where we extract all the DNA,” said Dr Schindel.

“Then the DNA undergoes a process of amplification to find the short, but standardised region of DNA, of which we make multiple copies.

“By that point, we have the names of the species, the voucher ID of the specimen - in other words, we know which mosquito gave us the leg - and the DNA sequence.”

The gene region that is being used as the standard barcode for almost all animal groups, known as ‘CO1’, is a string of 650 letters that can be used to identify birds, butterflies, fish, flies and many other animal groups.

If the barcoding system works, the string of letters will be the identical, or very similar, for the same species.

The barcode is then uploaded to a global database - the Barcode of Life Data Systems - which already holds more than 700,000 entries representing 65,000 species. Scientists hope that within the next five years, five million specimens from 500,000 species will have been catalogued.

Botanical barcoding has proved more challenging because DNA in plants behaves quite differently to DNA in animals, so the same section of genome cannot be used.

Scientists have been working for four years to identify a barcode and a team of researchers finally narrowed down seven potential barcodes to two possibilities - and on Tuesday, the final choice was announced.

Delegates at the conference in Mexico were told that a combination of two gene regions taken from the chloroplast genes, known as *rbcL* and *matK*, would be used as barcodes for plants on land, although a working group of 42 plant scientists plans to reassess that decision in 18 months.

"This will not be a 'hallelujah' moment in the sense that we'll have 99 per cent ability to detect plants," said Schindel. "But I'm absolutely convinced that this is the best decision we can make at this moment."

Applications of plant DNA coding include identifying when the illegal trade in endangered species is taking place, spotting poisonous species and fragmentary material in forensic investigations.

But potentially, the main application will be assessing the diversity of species in the world's diversity hotspots where a shortage of conservation skills hampers conservation efforts.

Dr Schindel said that the barcode database is now being used to identify unknown species by scientists working in the field who discover a specimen that they do not recognise.

At the moment, people who find a specimen would have to take a sample to a laboratory in order to establish the DNA code, explained Dr Paul Hebert, of the University of Guelph, Ontario, who first proposed DNA barcoding as a way of identifying species.

But he said that in the future, he hoped a device - a handheld barcoder - would be developed that would allow people to establish the DNA code of a specimen in the field.

He added that just a feather or a pellet, or "touching a frog's back" was enough to retrieve sufficient cells to establish a specimen's DNA code - and that therefore an animal does not have to be killed or injured for the process to work.

Identifying unknown species is just one application of barcoding. The system is also being used to tackle wildlife smuggling.

Experts say that courts in Kenya and Uganda often give the benefit of the doubt to smugglers of hard-to-identify bushmeat – but DNA coding can identify if the meat is from an endangered species of animal.

In Brazil, a man caught smuggling 58 eggs in 2003 said they were quails. The eggs never hatched, but genetic testing showed that they were parrots.

Scientists have also said that DNA coding could help track how animal diets may change due to global warming by using the technique to study the DNA genetic code of food in the guts of hunters.

Dr Hebert said that, for example, a bat's pellet can show scientists what that bat has eaten.

New research conducted by barcoders has shown that eight bat species feed on over 300 types of insects, one of the widest food webs known. Comparing diets now with those in the future could help scientists to understand how climate change may affect nature.