of some tubes and played either a recorded sound of water, white noise, or nothing. Intriguingly, the plants seemed able to tell that they were being duped. Even when the alternative was parched soil, almost all chose to grow away from the speaker. They could only be persuaded to grow towards a speaker when forced to choose between two, in which case they chose the one playing watery noises. Dr Gagliano suspects—but cannot yet prove—that the small magnets found in the speakers are responsible for such discerning behaviour. A few older papers have suggested that plants can detect magnetic fields.

Still, the findings suggest that, in the absence of soil moisture, pea plants can detect the sound of water in pipes and follow it to its source. That too could prove to be valuable information. Plant roots are a big cause of damage to sewer systems all over the world. In Germany, the annual cost of root removal and associated pipe repair is around €28m ($tktkm). The assumption had been that it was leaks that attracted the roots. Dr Gagliano's results suggest that even watertight pipes might still come under attack. The solution, she says, might be to invest in pipes that are silent as water runs through them.

A cry for help

And while plants are able to detect sounds, some also produce them, albeit unintentionally. This was demonstrated in April by the team at Tel Aviv University. Lilach Hadany, the team's leader, knew that plants could sometimes be made to vibrate. This can happen when they do not have enough water. That causes air bubbles to form in the xylem, a specialised tissue that transports water from a plant's roots to its leaves. When those bubbles collapse, they transmit small shock waves into the surrounding tissues. Previous work had shown that those vibrations could be measured with devices stuck to the plants themselves. Dr Hadany wondered whether they might be audible from farther away.

So the researchers put tomato and tobacco plants inside a microphone-lined box. Half had been watered, while half had been left parched. The researchers repeated the experiment with another set of plants, half of which had their stems cut, and half of which were left undamaged.

The microphones picked up very little sound from healthy plants. But those lacking water, or which had been cut, made a fair bit of noise, albeit at frequencies too high for humans to hear. Different stresses produced different kinds of sound. When the recordings were fed to a machine-learning algorithm, it was able to tell the sounds emitted from thirsty plants from those from the damaged ones.

When the experiment was repeated in a noisy greenhouse, Dr Hadany found that microphones could still detect the sounds from 10cm away. Experiments on cacti, corn, grapevines and wheat produced similar results, as did tomato plants suffering from an infection of mosaic virus, a common pathogen that can damage yields.

Farmers monitor the health of their crops by eye. (Mosaic virus, for instance, is so named because of the mottled pattern produced on the leaves of suffering plants.) That can be hard to do properly over an entire field. But if plants are broadcasting auditory indicators of distress, then wiring a field with microphones might help farmers keep an ear out for trouble.

That plants live in a world full of sound is no longer in doubt. But plenty of questions remain. One is the effect of human civilisation. It is well known that the din of city life makes bird calls harder to hear, forcing the animals to sing more loudly. Since trickling water, hungry caterpillars and suffering plants are all very quiet, it seems worth investigating whether plants face similar problems. Researchers might even apply to King Charles for funding. ■

Biological fieldwork

What the leaves know

Swabbing plants for DNA is enough to track animals in a rainforest

BIOLOGICAL FIELDWORK can mean trips to exotic places. But the work itself can be tedious, especially when you are trying to track down elusive subjects. The most common method is to send a few eager graduate students armed with camera traps and several weeks of spare time. But perhaps not for much longer. A paper published in *Current Biology*, whose lead authors are Christina Lynggaard at the University of Copenhagen and Jan Gogarten at the Helmholtz Institute for One Health in Germany, suggests an easier method: simply swabbing nearby leaves for DNA.

The DNA in question is called "environmental DNA" (eDNA for short). It refers to all the genetic information that animals shed as they go about their daily business: breathing, urinating, moving around, or interacting with their environment in any way. In recent years gene-sequencing technology has become quick and sensitive enough to pick out genetic sequences from particular animals—including humans—from this ubiquitous eDNA.

One way of doing so is simply to blow air through filters, then analyse them to see which critters live in the vicinity. Aware of that technique, Drs Gogarten and Lynggaard wondered if there might be a simpler approach. Air-sampling systems can take days to do their work. Maintenance must be done, and filters must be changed. But given that eDNA is literally blowing around ecosystems, the researchers wondered if it might be collecting on leaves.

The leaves of many plants are waxy and somewhat sticky. The researchers theorised that eDNA might end up stuck to leaves and that it could subsequently be collected by swabbing them. They tested their theory in the dense rainforests of Kibale National Park, in Uganda. Using simple cotton swabs, and wearing masks and gloves to prevent contaminating the samples with their own DNA, they visited three areas of the park and collected eight swabs at each site, then took them back to Copenhagen for analysis.

The swabs revealed the presence of 26 birds, 24 mammals, one amphibian and one fish, with each swab containing DNA from eight animals on average. More than half the samples were good enough to work out the precise species they came from. The smallest (weighing just 19 grams) was the reclusive Stella wood mouse. The largest was the 3.8-tonne African elephant. The fish turned out to be a catfish that the researchers suspect was eaten by a bird, which then defecated some fishy DNA onto the leaves.

Swabbing for animals, then, seems to work. Moreover it is cheap, easy and fast. Graduate students will have to be content spending less time specimen-hunting in far-flung parts of the world.