Raiders of the lost rainforest

By Stephen Brook

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Seeking miracle cures in the heart of the Daintree, Stephen Brook follows two ecologists into the Daintree in search of medical and agricultural gold.

IT'S a feeble, muddy track, where it does exist. For half a kilometre our research party ventures into the Daintree rainforest. The daily downpour has come and gone in the manner of far north Queensland and now the once-strong sun is fading.

A cry punctures the calm. Dr Paul Reddell, a gangly, frizzy-haired ecologist from the CSIRO, has executed a Harry Butler-style lunge at something on the ground and holds it up to me. It's a curious seed, corrugated green and brown, just smaller than a tennis ball, partially split into segments.

It's known as an idiot fruit, but more properly as Idiospermum australiense. It's a flowering plant, a very primitive angiosperm, so unusual that it has its own family in the scientific classification system, rather than populating the family that contains eucalypts, which has more than 3000 species.

This is the Daintree, one of the wettest areas in Australia, if not on earth. Last year Bellenden Ker, a mountain with a Bureau of Meteorology weather station on it, recorded a whopping 11,853mm of rain, its highest-ever rainfall. The tiny community of Topaz, on the Atherton Tableland, recorded 7003mm.

The wet tropics World Heritage area is a small part of Australia -- about 900,000ha -- but it holds staggering biodiversity. Globally, tropical rainforests cover less than 7 per cent of the earth but are home to more than 50 per cent of all species: more than 125,000 higher plant species, 5 million insect species and 1.5 million fungi species. The wet tropics of far north Queensland is one of the few sites that meets all the criteria for inclusion on the World Heritage List.

But we aren't here for the scenery. Reddell and his colleague Dr Victoria Gordon are bioprospectors, seeking plant extracts that may one day change the face of medicine and agriculture.

``You have seen a living fossil now,'' Reddell says excitedly, still holding the idiot fruit. It closely resembles the first flowering plants that existed about 100 million years ago, when dinosaurs still walked the earth.

It's also deadly. Dozens of them have remained on the forest floor, untouched since last year. This is amazing considering the volume and variety of animals that roam the area and the suite of fungi and insects populating the forest floor, all of which you'd imagine would find a nutrient-rich seed such as this irresistible.

``Nothing touches them,'' Reddell says. ``They are laced with cyanide. If you had one of these quarters, you would be dead.''

Gordon, a chemical ecologist, says the fruit is packed with nutrients and carbohydrates, ready food for the seedling after the seed germinates and starts growing. But as well as cyanide, it also contains alkaloids, a chemical group that includes nicotine, cocaine and morphine, as well as medicines used to treat heart disease, cancer and malaria.

``Some alkaloids can totally disrupt the nervous system ... That's why they are so important as drugs,'' Gordon says. ``Of the 12 commercially most important plant-derived drugs we have, 10 are alkaloids. What they are doing is protecting the nutrients for those seedlings.''

I ask where the name comes from. Gordon looks up at me for a moment. ``Well, you'd be an idiot to eat the fruit,'' he says.

This living museum holds one of the largest collections of living relics from ancient flora. It is also one of the world's last biological frontiers. Scientists barely know what lies within many of these plants. Some have been analysed before but by chemists, not by chemical ecologists such as Reddell and Gordon, who are using their knowledge of ecology to unlock floral secrets. I flap about, scribbling shorthand in my notebook and getting eaten alive by mozzies, before being abruptly warned not to step back.

Directly behind is a stinger plant, which has a small, bright-green grasshopper perched on one of its very large soft, round leaves. When the stinger plant, Dendrocnide moroides, bears fruit, they look like little pink bunches of raspberries.

But the warning -- and the plant's name -- are appropriate. The entire plant, even the fruit, bears delicate silicate needles that inject a toxin -- moroidin -- when touched. This poison can cause severe pain, swollen lymph nodes and depression, and the symptoms can last for months.

Reddell and Gordon, who work at the CSIRO's Tropical Forest Research Centre in Atherton, an hour's drive west of Cairns, have dodged many stinger plants as they search the Daintree for extracts that might prove useful to medicine and agriculture.

Since starting their research 18 months ago, they have found a number of crude extracts, including some from the fruit layers of a particular member of the proteaceae family that includes banksias, which kills golden staph bacteria much more effectively than standard antibiotics. Golden staph is a virulent bacteria that causes pneumonia and a multitude of other diseases, including urinary tract infections and mastitis. It is ubiquitous, resistant to antibiotics and a serious problem in hospitals.

The extract's components are being isolated and tested individually.

``After further testing, hopefully these things will be made available commercially,'' Gordon says.

Reddell and Gordon believe their approach as ecologists means they are able to find substances other scientists fail to. The ecologists are ``letting nature give us leads to potential new chemical entities''.

``The traditional approach is, you collect everything in sight and run them through a series of tests, but in a sense it's all a shot in the dark,'' Reddell says. ``Using ecological knowledge can focus you on where to look.''

Fascinated by how seeds manage to defend themselves against natural predators and get themselves dispersed throughout the forest, their research into seed ecology has turned into a quest to find useful chemicals.

They found that large seeds such as the idiot fruit and some smaller seeds avoided by animals, insects and microbes contained unusual chemicals worth studying.

Reddell and Gordon suspected that plants would need to ``package'' their seed defences into different parts of the fruit. So they collect the fruit from high in the forest canopy with the aid of a slingshot weight and a bit of fishing line, then examine fruit and seeds in

separate layers, peeling off the layers of fruit, separating skin, flesh, seed case, testa (seed coat) and seed interior.

``The useful compounds are at such low concentrations within the fruit part that they would not have been identified if the common practice of examining the whole fruit been followed,'' says Gordon.

The CSIRO's entomology division recently found strong insecticidal properties in some of the extracts collected by Reddell and Gordon (which they won't identify publicly) and the organisation's molecular science division is interested in identifying specific ``bioactive'' compounds in them.

Reddell hopes their investigations will lead to discoveries of anti-insect and anti-cancer compounds.

``With most cancer treatments, what you are looking for are things that are toxic to cells. There's a very simple logic to it. In nature one of the mechanisms plants use to protect themselves is to use toxins,'' he says.

He talks about fleshy fruit that stops seeds from germinating until animals can distribute them around the forest. Some form of biological-friendly weed control is contained in the fruit.

If it can be captured and used agriculturally, it could produce a weed killer that works without putting hydrocarbons into the environment.

Scientists have long been investigating substances found in plants in the hope of finding miracle cures.

``More than 25 per cent of all medicines in the Western world are plant-derived natural products,'' says Gordon, who qualified as a scientist after studying naturopathy and prescribing traditional medicines to people in Tasmania.

``However, 70 per cent of the world's population relies fully upon traditional medicines which are all natural products.''

The flip side is the potential danger to the rainforest of unregulated commercialisation of plant extracts. But Reddell and Gordon argue that if scientists are unable to synthesise the active compounds in the lab, the demand for the host plants would require them to be grown in plantations and could form the basis of a new industry in north Queensland.

Unlocking these secrets on the ground is difficult enough, but the mysteries high up in the forest canopy are even more elusive, if only because of the difficulty of access. The canopy level in the Daintree rainforest is about 25m.

In the past scientists have floated through it on hot-air balloons and swung from ropes. Three partners of the Rainforest Co-operative Research Centre, based at the James Cook University campus in Cairns, decided to solve this problem by building a crane from which they could study the canopy at close quarters.

The crane -- the first in Australia and the southern hemisphere -- rises nearly 50m out of the rainforest over the canopy near Cape Tribulation. It can pivot 360 degrees and the three-man gondola can be lowered to any level.

Disaster struck shortly after its installation when category-three Cyclone Rona crossed the coast in February last year, destroying a large part of the canopy and making it more difficult to do scientifically valuable work in one of the world's most biologically significant rainforests. Undaunted, scientists are studying the canopy as it recovers.

The Rainforest CRC is one of scores dotted around the country that are jointly funded by government and industry bodies, including the University of Queensland, Griffith University, state and local government, tourism bodies and the Wet Tropics Management Authority. A key partner is the CSIRO Tropical Forest Research Centre with headquarters in Atherton.

Scientists at the research centre are using ecological modelling of weather and vegetation patterns to uncover the history of the rainforest and attempt to ascertain its fate.

The Daintree rainforest looks like it has been there since ancient times but, except for small pockets, this is not the case. Dr David Hilbert and his colleague Dr Bo Ostendorf have seen the rainforest come and go, its death and renewal over thousands of years -- all with the aid of computer simulation. They have plotted the history of the rainforest and how climate affected it over tens of thousands of years.

There was little rainforest 18,000 years ago, they believe. This was the time of the last glacial maximum, when the world was colder and drier than today -- not ideal conditions for a tropical rainforest.

On the computer monitor the rainforest appears as a small patch of green, overrun by the tan colour denoting a sclerophyll (eucalypt) forest, much more suited to the drier conditions.

With a mouse-click we travel forward to 5000 years ago, a period warmer and wetter than today, when the rainforest was at its peak.

These days the rainforest is smaller than 5000 years ago, and on the drive from Cairns to the Daintree you can see pockets of darker rainforest forming in the sclerophyll, underlining the fact that most of the rainforest is only 10,000 or less years old.

Global warming means the climate will continue to change and with it the rainforest.

``The problem with human-induced climate change is that it's very rapid compared with rates of climate change in the past,'' says Hilbert, an ecological modeller and senior research scientist.

A one-degree rise in temperature in the Daintree is predicted during the next 50 years, and a 10 per cent reduction in precipitation is possible.

``If climate change is very rapid, forests cannot keep pace with that change,'' Hilbert says. ``Consequently, the same forest is expected to be stressed by the climate change.''

How will a warmer and wetter world affect the rainforest?

``The simple answer up here is that that type of climate change would be good for some types of rainforest and bad for others.'' Some rainforest types would be substantially reduced in size and ``you could possibly lose some species'', Hilbert predicts.

This means some extracts could be lost before the bioprospectors discover them. *

Caption: Fruits of the forest: deadly idiot fruit, top left; Paul Reddell and Victoria Gordon examine their finds, above

Bioprospectors: Victoria Gordon and Paul Reddell collecting Daintree samples that could yield useful chemicals