Reason for magic mushroom's trip

Josh Gabbatiss

THE hallucinogenic effects of magic mushrooms are well documented. But nobody knows what psilocybin, the chemical responsible, does for the mushrooms themselves.

Now, one of the first genomic analyses of hallucinogenic fungi has deciphered psilocybin production, and even suggested a function for it. By messing with insect neurochemistry, psilocybin may act as a psychedelic repellent.

A team of researchers led by Jason Slot at Ohio State University compared the genomes of three hallucinogenic fungi with three non-hallucinogenic relatives. By doing so, they identified the cluster of genes responsible for making psilocybin (*bioRxiv*, doi.org/cbx2).

The gene cluster is found in several distantly related groups, suggesting that the fungi swapped genes in a process called horizontal gene transfer. This is uncommon in mushrooms: it is the first time genes for a compound that is not necessary for the fungi's survival – called a secondary metabolite – have been found moving between mushroom lineages.

Since these genes have survived in multiple species, Slot thinks psilocybin must be useful to the fungi. "Strong selection could be the reason this gene cluster was able to overcome the barriers to horizontal gene transfer," he says.

Hallucinogenic mushrooms often inhabit areas rich in fungi-eating insects, so Slot suggests psilocybin might protect the fungi, or repel insects from a shared food source, by somehow influencing their behaviour.

The specific purpose of many secondary metabolites is unknown, says Peter Spiteller at the University of Bremen, Germany. But that's not to say they don't have a use. "Secondary metabolites are not just produced for fun," he says.

JURGEN FREUND / NATUREPL

Psychedelic insect repellent needed

However, while psilocybin has been shown to affect the brains of mammals including mice, there is little evidence that it affects insects or other invertebrates – barring a famous 1962 study showing that it changes the way spiders build webs.

That said, other fungi use similar substances to influence insects, "for example the zombie ant fungus," says Slot. And insects have nervous system receptors similar to those affected by the psilocybin successor molecule psilocin in humans.

In a second study, a group led by Dirk Hoffmeister at Friedrich Schiller University Jena in Germany was able to go one step further. After obtaining a legal permit, they have developed a way to make psilocybin using enzymes (*Angewandte Chemie*, doi.org/gbp6hh).

This has never been done before and could set the stage for commercial production. In recent years there has been a revival of interest in psilocybin's potential as a therapeutic drug, an area of research that had stalled due to tough 1970s drug laws. ■

Bizarre star could host an exo-Saturn

THE "alien megastructure" star that has been puzzling us for the past few years might have a more ordinary explanation: an orbiting Saturn-like planet, complete with wobbling rings.

In 2015, a group led by Tabetha Boyajian, then of Yale University, found that a star called KIC 8462852 had dimmed several times over a few years in a way they couldn't explain.

The star had been observed by the Kepler space telescope between 2009 and 2013 as it hunted for exoplanets by staring at a patch of sky. When a planet passes in front of a star, an event called a transit, the light intensity dips slightly and then returns to normal.

But KIC 8462852, since dubbed Tabby's star, didn't behave that way, with the amount of dimming varying wildly. Speculation abounded, with explanations ranging from exoplanetary comets to a vast orbiting "megastructure" built by an advanced alien civilisation.

Now Mario Sucerquia and his colleagues at the University of Antioquia in Colombia have proposed another possibility: a ringed planet, similar to Saturn, orbiting close to the star. Such a planet would dim the star's light in an irregular way during a transit.

First, the rings would block some of the star's light, followed by the planet, which would dim it further. Then, after the planet passes, the rings would block some light again.

But because the rings would be at a different angle each time, the small dips at the beginning and end of the transits would be larger or smaller. Without seeing many transits, there would be no obvious pattern to this.

"Explanations for the odd dimming ranged from exoplanetary comets to a vast alien megastructure"

To test this idea and measure the irregularity, Sucerquia and his colleagues simulated a light curve from a ringed planet about one-tenth the Earth-sun distance from its star. They found another effect: the star would tug on the rings, making them wobble. This would make the silhouette of the rings as seen by an earthbound observer even more irregular from transit to transit (arxiv.org/abs/1708.04600).

A ringed planet has been floated to explain Tabby's star before, but that would have required a world many times the mass of Jupiter, enough to make it a small star. This new-found wobble means the planet could be the mass of Neptune. Jesse Emspak ■