

Namibian fairy circle debate rages on: Sand termites or Turing mechanism? [Updated]

Enlarge / Bare, reddish-hued circular patches in the Namib Desert known as “fairy circles” are also found in northwestern Australia.

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Himba bushmen in the Namibian grasslands have long passed down legends about the region’s mysterious fairy circles: bare, reddish-hued circular patches that are also found in northwestern Australia. In the last 10 years, scientists have heatedly debated whether these unusual patterns are due to sand termites or to an ecological version of a self-organizing Turing mechanism. Last year, a team of scientists made a strong case for what they deemed definitive evidence of the latter, thus ruling out sand termites, but was their declaration of victory premature?

A recent paper published in the journal *Perspectives in Plant Ecology, Evolution, and Systematics* offers a four-point rebuttal of those 2022 findings, concluding that sand termites may be to blame after all. Meanwhile, the authors of that 2022 study have offered a counter-rebuttal to the rebuttal; there is currently a preprint undergoing peer review at the same journal.

“The to and fro between opposing camps has often been nothing

less than vitriolic,” Michael Cramer, an ecophysiologicalist at the University of Cape Town who has studied fairy circles, told The New York Times last year. That’s partly because of how challenging it is to definitively prove causation for “a long-lived ecological pattern that cannot be replicated in the lab”—however strenuously one side or the other may claim to have proven their case.

As we’ve reported previously, the fairy circles can be as large as several feet in diameter. Dubbed “footprints of the gods,” it’s often said they are the work of the Himba deity Mukuru, or an underground dragon whose poisonous breath kills anything growing inside those circles. Scientists have their own ideas.

One theory—espoused by study co-author Norbert Jürgens, a biologist at the University of Hamburg in Germany—attributed the phenomenon to a particular species of termite (*Psammotermes allocerus*), whose burrowing damages plant roots, resulting in extra rainwater seeping into the sandy soil before the plants can suck it up—giving the termites a handy water trap as a resource. As a result, the plants die back in a circle from the site of an insect nest. The circles expand in diameter during droughts because the termites must venture farther out for food.

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The other hypothesis—espoused by Stephan Getzin of the University of Göttingen—holds that the circles are a kind of self-organized spatial growth pattern, specifically a Turing pattern, that arise as plants compete for scarce water and soil nutrients. In his seminal 1952 paper, Alan Turing was attempting to understand how natural, non-random patterns emerge (like a zebra’s stripes), and he focused on chemicals known as morphogens. He devised a mechanism involving the interaction between an activator chemical and an inhibitor chemical that diffuse throughout a system, much like gas atoms will do in an enclosed box. It’s akin to injecting a drop of

black ink into a beaker of water. Normally this would stabilize a system: the water would gradually turn a uniform gray. But if the inhibitor diffuses faster than the activator, the process is destabilized. That mechanism will produce a Turing pattern: spots, stripes, or, when applied to an ecological system, clusters of ant nests or fairy circles.

Getzin and colleagues published two papers in 2019 and a third in 2022 about their findings in support of the Turing pattern hypothesis, with Getzin telling Ars at the time, “We can definitively dismiss the termite hypothesis” about both Australian and Namibian fairy circles. He based that statement on the fact that his team could find no evidence of termite-damaged roots; rather, it was plant water stress that caused grasses to die inside the bare patch of fairy circles, based on their topsoil moisture measurements at a depth of 20 centimeters beneath the fairy circles. The grass plants self-organize unevenly and hence draw water unevenly to their roots and through diffusion in the sandy soils. The result is circular patches of dead grass.

“The support for the hydrodynamic explanation is now very strong, and the support for the termite cause is very weak,” Florida State University entomologist Walter Tschinkel, told The New York Times last year. (He was not involved in the 2022 study, but based on his own research, he supports the water-stress hypothesis.)

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