The Gooey Details Behind a Glow Worm's Starry Night Illusions

A still image taken from some 60 hours of time-lapse video shot in the Waitomo caves in February.
JORDAN POSTE / STOKED FOR SATURDAY

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Trilobites

By JOANNA KLEIN

In the Waitomo caves in New Zealand, thousands of blue lights dangle from the ceilings, twinkling like stars in a night sky.

Tourists flock to the caves, awe-struck by the starry night illusions all around them.

But the truth about this natural wonder may be hard to fathom — unless you're one of the glowing maggot masterminds behind it.

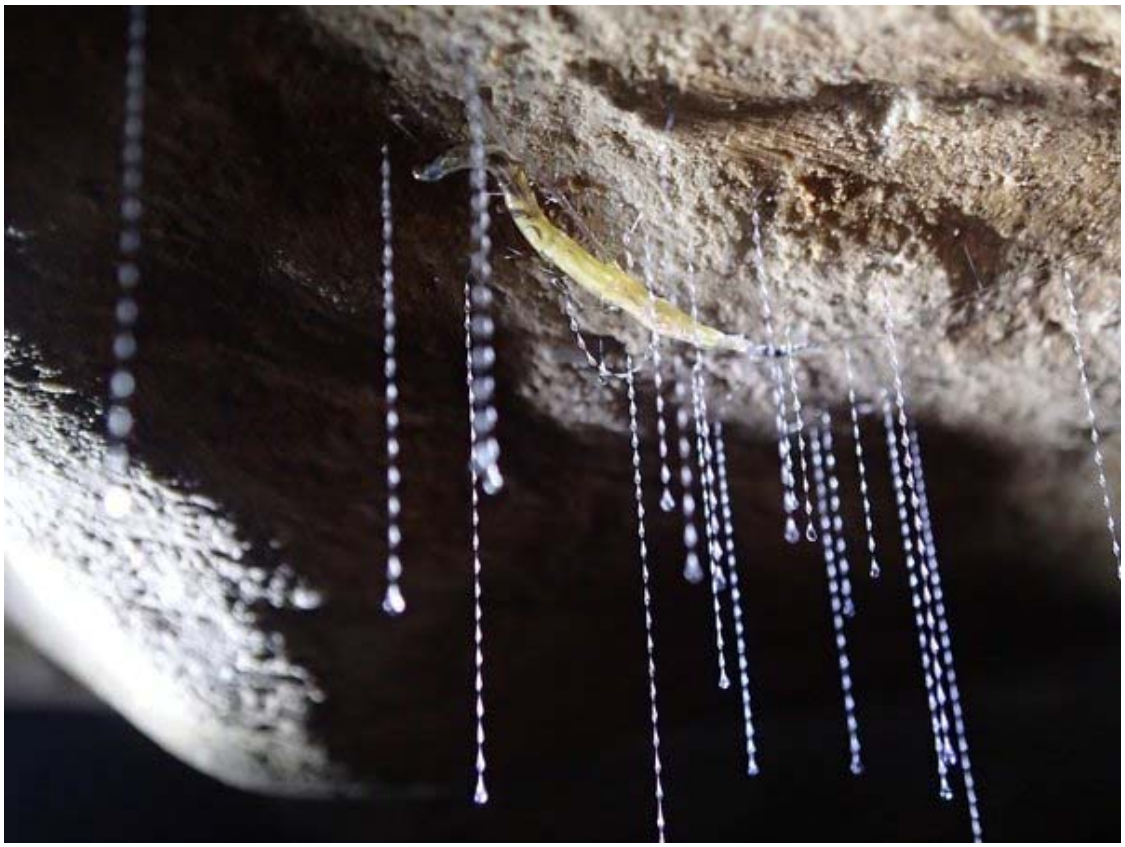
In the humid cave, the insects use bioluminescent light and silk threads covered in sticky, reflective droplets to attract and capture prey. Janek von Byern, a zoologist at the University of Vienna in Austria who studies the slimy secretions of creatures like snails and salamanders, and his international colleagues, spent months in two dark caves in New Zealand studying and characterizing the glow worm's own gooey glue.

Thanks to their results, published Wednesday in the journal PLOS One, we can now present the real story of the glow worms of New Zealand's Waitomo Caves — down to the gross and microscopic details.

For a century, scientists have called the glow worms Arachnocampa luminosa: arachno, because of their spider-like silk traps, and luminosa, because they glow.

But this glow worm's row of fishing lines turn out to be little like a spider's web. "It's functionally completely different — and chemically — and structurally, also," Dr. von Byern said.

Along cave walls and ceilings, a fungus gnat egg hatches. The larva constructs a tube of mucus that can be up to a foot long. It coughs up dozens of silk strings — about a sixth the width of a human hair, and up to nearly two feet long — and dangles them from the bottom of the tube. It regurgitates mucus onto the silks, which collects in tiny droplets that, because of their special crystalline structure, absorb water from the surrounding humid atmosphere and expand.



A glow worm and its nest.
VICTORIA DORRER

The glue consists of 99 parts water; one part nasty. The mucus is just waste: protein, salt and what looks to be urea — a chemical found in urine that when combined with formaldehyde back in the day, made a stellar — but toxic — wood glue.

To attract its victim, the glow worm illuminates its net of reflective drops by turning on its bioluminescent tail and shuttling through its mucus tube. This is far from the discrete presentation of a spider's web, which, by the way, comes from glands in its abdomen, not waste in its mouth.

As it shuttles, the glow worm checks its lines for mayflies that may have flown into them and gotten stuck in the glue. "Pulling it up, and then eating, pulling it up and then eating — until it comes to the prey and then eats the prey," Dr. von Byern said. "Easy."

Each thread can hold about three mayflies before it breaks. This keeps the whole nest from falling, but it wouldn't cut it for a spider's web, which must withstand a number of environmental challenges.

The scientists collected thousands of these threads and tested them with about 400 pounds of equipment they carried in and out the caves. They had to do the tests

inside, because when the strings were removed from the humid atmosphere, the droplets disappeared.

“A typical spider glue will absorb water from the atmosphere even at normal, ambient humidities,” said Todd Blackledge, a biologist who studies spider webs at The University of Akron in Ohio and was not involved in the study, “but these glow worms have to be in these damp, moist caves or their glues will dry out very, very quickly.”

Dr. von Byern found that if humidity drops below 80 percent — the droplets evaporate. Without the sticky nets, the glow worms starve.

The arrival of tourists in the caves brings changing temperatures and dropping humidity. Once tourists caused the humidity in a cave to change so much that the glow worms vanished and didn’t return for half a century. Now, some caves have automatic door systems that lock up, preventing any entry or exit, until the humidity is back to normal.

Waitomo's Lights
VIDEO BY STOKED FOR SATURDAY

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