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SCIENCE & SPACE

Some (worms) like it hot

Study finds worms thriving in hot-water

Friday, April 14, 2006; Posted: 11:02 a.m. EDT (15:02 GMT) Friday, April 14, 2006; Posted: 11:02 a.m. EDT (15:02 GMT)

WASHINGTON (Reuters) -- A species of worm that thrives on undersea hot-water vents prefers the hottest water possible, choosing to live at temperatures that kill other animals, researchers reported on Thursday.

Their unique abilities to withstand hot water shooting like a geyser from hydrothermal openings may help the stalk-like worms prey on bacteria that other animals cannot reach, the researchers report in Friday's issue of the journal Science.

The tiny worms, known scientifically as *Paralvinella sulficola*, chose water heated to 122 Fahrenheit (50 degrees Celsius) and made brief forays into water as hot as 131 degrees Fahrenheit (55 degrees Celsius), Peter Girguis of Harvard University and Raymond Lee of Washington State University reported.

"To our knowledge, every other vent organism down there dies at temperatures way below 50 and 55" Celsius, Girguis said in a telephone interview.

The worms live on underwater vents found at depths of 1.4 miles (2,200 meters) off the Pacific coast of Washington. They are studied and collected using submarines such as the deep-sea ALVIN submersible, or robots.

They belong to a group known as polychaetes and build tubes made out of mucus but can move around freely. They resemble tiny red palm trees, with frond-like red gills.

Many different animals live on the deep undersea vents, not merely tolerating the sulfur, heat and pressure but thriving in it. They eat the bacteria that can live in much higher temperatures than more complex animals.

The water pours out of the vents at temperatures far above the boiling point but it quickly cools in the chilly sea water. Because of the conditions, it is difficult to know precisely which temperatures the animals can tolerate.

So Girguis and Lee set up a unique experiment.

"We wanted to see what temperatures the worms preferred and what temperatures they

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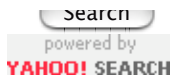
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could survive," Girguis said.

They built a special pressurized aquarium, with a heating element on one end and a cooling element on the other.

This created a thermal gradient -- with water ranging in temperature from 68 degrees Fahrenheit (20 degrees Celsius) to 142 degrees Fahrenheit (61 degrees Celsius). They threw the worms in.

"What happened really kind of shocked us, which is they all very quickly moved when we imposed the thermal gradient," Girguis said.

"They just picked up and went," he added. "It was like they were having a little conference" in the hotter water.

The worms survived for as long as seven hours at 122 degrees Fahrenheit (50 degrees Celsius), and would spend as long as 15 minutes at 131 degrees Fahrenheit (55 degrees Celsius). Water of 140 degrees Fahrenheit (60 degrees Celsius) killed them.

These temperatures are far hotter than anything most animals can survive. Other researchers have found desert fire ants die at 131 degrees Fahrenheit (55 degrees Celsius) and a hot tub, for instance, ranges from 100 degrees Fahrenheit (38 degrees Celsius) to 105 degrees Fahrenheit (40 degrees Celsius).

Desert air is often hotter but water conducts heat much more efficiently than air does.

Girguis said the experiment answered a key question about the physiology of the worms.

The cells of complex animals all rely on structures called mitochondria, which provide power to the cells. Mitochondria start to break down at temperatures of 122 to 131 Fahrenheit (50 to 55 degrees Celsius), Girguis said. The worms may skate on the borderlines of this limit but do not break it.

They almost certainly have multiple other adaptations, he said, including heat-tolerant enzymes in their cells.

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