

Meet Madagascar's oldest animal lineage, a whirligig beetle with 206-million-year-old origins

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H. milloti dorsal habitus. Credit: KU News Service

There are precious few species today in the biodiversity hotspot of Madagascar that scientists can trace directly back to when all of Earth's continents were joined together as part of the primeval supercontinent

Pangea.

But a new study in the journal *Scientific Reports* suggests the Malagasy striped whirligig beetle *Heterogyrus milloti* is an ultra-rare survivor among contemporary species on Madagascar, boasting a genetic pedigree stretching back at least 206 million years to the late Triassic period.

"This is unheard of for anything in Madagascar," said lead author Grey Gustafson, a postdoctoral research fellow in ecology & evolutionary biology and affiliate of the Biodiversity Institute at the University of Kansas. "It's the oldest lineage of any animal or plant known from Madagascar."

Gustafson and his co-authors' research compared the living striped whirligig found in Madagascar with extinct whirligig beetles from the fossil record. They then used a method called "tip dating" to reconstruct and date the family tree of whirligig beetles.

"You examine and code the morphology of extinct species the same as you would living species, and where that fossil occurs in time is where that tip of the tree ends," he said. "That's how you time their evolutionary relationships. We really wanted the fossils' placement in the tree to be backed by analysis, so we could say these are the relatives of the striped whirligig as supported by analysis, not just that they looked similar."

Gustafson noted one major hurdle for the team was the "painful" incompleteness of the [fossil record](#) for establishing all the places where relatives of the striped whirligig beetle once lived.



Credit: University of Kansas/Gray Gustafson

"All of the fossils come from what is today Europe and Asia—we don't have any deposits from Madagascar or Africa for this group of insects," he said. "But they likely were very widespread."

Today, whirligig beetles are a family of carnivorous aquatic beetles with about 1,000 known species dominated by members of a subfamily called the Gyrininae. But the Gyrininae are young upstarts compared with the striped whirligig beetle, the last remaining species of a group dominant during the time of the dinosaurs. This group according to Gustafson was decimated by the same asteroid impact that cut down the dinosaurs and caused the Cretaceous-Paleogene extinction event.

"The remoteness of Madagascar is what may have saved this beetle," Gustafson said. "It's the only place that still has the striped whirligig beetle because it was already isolated at the time of the Cretaceous-Paleogene extinction event—so the lineage was able to persist, and now it's surviving in a marginal environment."

Even today, the ageless striped whirligig beetle keeps its own company, preferring to skitter atop the surface of out-of-the-way forest streams in southeastern Madagascar—not mixing with latecomers of the subfamily

Gyrininae who have become the dominant whirligig beetles on Madagascar and abroad.

Indeed, Gustafson is one of the few researchers to locate them during a 2014 fieldwork excursion in Madagascar's Ranomafana National Park.

"This one is pretty hard to find," he said. "They like these really strange habitats that other whirligigs aren't found in. We have video of them in a gulch in a mountain range clogged with branches and debris—there are striped whirligigs all over it."

Unfortunately, the KU researcher said the remote habitats of the striped whirligig beetle in Malagasy national parks were threatened today by human activity on Madagascar.



Mesogyrus anatiquus, the heterogyrine whirligig, spins about the water surface.
Credit: Trevor Fristoe

"It's a socioeconomic issue," Gustafson said. "In the national park where first specimens of the striped whirligig beetle were discovered, there are local people who use the forest as a refuge for zebu cattle because they're concerned about zebu being robbed. Their defecation can disturb the nutrient lode in aquatic ecosystems. Part of the problem is finding a way for local people to be able to make their livelihood while preserving natural ecosystems. But it's a hard balance to strike. A lot of original forest cover also has been slashed and burned for rice-field patties to feed people."

Gustafson hopes the primal origins of the striped whirligig beetle can draw attention to the need for protecting aquatic habitats while conceding that [conservation efforts](#) usually are aimed at bigger and more cuddly species, like Madagascar's famous lemurs, tenrecs and other unique carnivorans.

"One of the things that invertebrate species suffer from is a lack of specific conservation efforts," he said. "It's usually trickle-down conservation where you find a charismatic vertebrate species to get protected areas started. But certain invertebrates will have different requirements, and right now invertebrate-specific conservation efforts are lacking. We propose the striped whirligig beetle would make for an excellent flagship [species](#) for conservation."

More information: Grey T. Gustafson et al, Tip-dated phylogeny of whirligig beetles reveals ancient lineage surviving on Madagascar, *Scientific Reports* (2017). [DOI: 10.1038/s41598-017-08403-1](https://doi.org/10.1038/s41598-017-08403-1)

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