Lichen evolved on two tracks, like marsupials and mammals

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Lichen, those drab, fuzzy growths found on rocks and trees, aren't as cuddly and charismatic as kangaroos or intriguing as opossums, but they could be a fungal equivalent, at least evolutionarily.

A Duke research team has found that lichen that seem identical in all outward appearances and produce the same internal chemicals are in fact two different species, one living in North America and one in Australia. They're an example of "convergent evolution," in which two species evolve separately but end up looking very similar, like the Tasmanian wolf and the American wolf.

The lichens developed the same adaptations to survive and thrive in vastly different regions of the world. Since they show the same evolutionary patterns as marsupials and mammals, but are easier to study, they could become model organisms to further probe how mammals and other groups of organisms evolve, said Duke biologist Brendan Hodkinson.

"Lichen can often seem dull and uncharismatic, but these two species turned out to be quite intriguing," said Hodkinson, a graduate student in the lab of Duke lichenologist François Lutzoni. "They're like sugar gliders and flying squirrels or wombats and groundhogs. They're fungal examples of convergent evolution."

Scientists originally labeled specimens from both continents *Xanthoparmelia tasmanica*, which, like all lichen, is a type of fungus that

"farms" algae. The lichen specimens were thought to be one species because they shared the same body plan and produced the same chemicals.

But given the lichens' geography and the natural history of other species, some scientists still questioned whether the organisms were truly identical, even though previous tests showed that they were.

When the question came up again in 2009, Hodkinson and James Lendemer of the New York Botanical Garden gathered lichen samples from North America and Australian specimens preserved in herbariums at Duke and the New York Botanical Garden to find out. They studied the organisms' body structure and chemical composition and also found no difference.

But then the lichenologists looked at the organisms' DNA, which nobody had done before.

Hodkinson and Lendemer used this analysis and computer modeling of the lichens' evolution to digitally reconstruct a family tree. The tree clearly showed that the Australian lichen evolved on a branch completely separate from the North American lichen, suggesting that the organisms are separate species.

The lichenologists describe their work and rename the North American lichen species *Xanthoparmelia hypofusca*, following past lichen literature, in a paper that appears in the latest issue of the journal *Bibliotheca Lichenologica*.

Hodkinson added that lichen are important for another reason. Like canaries in a noxious coal mine, lichen die when the air is unhealthy. Scientists have already seen some species disappear in Europe since the beginning of the Industrial Revolution. A few were hardy and came back

when air quality improved, but "we may not always be that lucky and we could see some lichen go the way of the Tasmanian wolf -- extinct," he said.

Provided by Duke University