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Some Species Evolve Side by Side
By Larry O'Hanlon, Discovery News

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Feb. 14, 2006 — Modern genetics has uncovered new species evolving in situations that would even impress Darwin.

The current journal *Nature* features two different cases — involving palm trees and lake fish — in which genetics have shown single species splitting into two new species while living side by side.

The most common sort of evolution is thought to happen when different groups of the same species are separated by some physical barrier, and then adapt to different environments without any chance of interbreeding.

Eventually the populations diverge and adapt to differing lifestyles so much they canâ€™t successfully interbreed. Thatâ€™s what biologists call allopatric speciation.

But the two new cases are strong candidates for the more subtle "sympatric" speciation, in which something as simple as flowering at a different time of year or preferring a different type of food can eventually lead individuals of the same species living side-by-side to evolve away from each other and create new and different species.

That appears to be what happened with the two palm tree species on small, 6.9 million-year-old Lord Howe Island, a volcano poking out of the Pacific Ocean some 400 miles off the coast of Australia.

"Flowering time has been the main driver of sympatric speciation," said Vincent Savolainen, Botanist for the Royal Botanic Gardens, Kew, in the U.K.

Savolainen and his colleagues studied the two species of Howea palm trees on Lord Howe Island and have concluded the trees diverged to take advantage of different kinds of soils.

Howea forsteriana, the thatch palm, prefers alkaline soils. *Howea belmoreana*, the curly palm, prefers neutral or acidic soils.

But it was probably when the two palms started flowering at different times that they really made the break.

Today, the two species open their flowers six weeks apart. That makes it virtually impossible for them to interbreed and much easier for the species to drift apart.

Based on genetic evidence, the two trees diverged from a common ancestor just one million years ago, said Savolainen. Since then the two palms have become visibly different, as well, with the flowers of the thatch palmâ€™s flowers containing many spikes and its leaves straight and leaflets drooping.

The curly palmâ€™s flowers have only one spike and the leaves are curved, with leaflets aimed upward.

A similar thing happened with the two species of Midas cichlid fish living in a small isolated crater lake in Central America.

"Crater Lake Apoyo in Nicaragua provides an exceptionally clear situation for testing sympatric speciation," reports Marta Barluenga and colleagues at the University of Konstanz, Germany.

The lake is less then three miles wide, deep, only 23,000 years old, and hasnâ€™t any place for fish to hide from each other.

As in the case of the palm trees, the genes of the distinctly different-looking fish indicate they diverged from a common ancestor just 10,000 years ago. What seems to have separated the cichlids into two species, however, is food.

Stomach contents of fish show that one species prefers foods found in the open upper waters, while the other species dines on the bottom waters.

Their jaws have even adapted to the different eating preferences, increasing the visible difference between the species.

The discovery in Lake Apoyo is particularly important because there are many cichlid fish in African lakes that are suspected of evolving sympatrically, but are much harder to study, wrote Barluenga.

"Weâ€™ve always said cichlid fish must be this way," said Carol Tang, a research associate and associate director of public programs at the California Academy of Sciences.

But, she said, it has taken the latest genetics, combined with good old-fashioned field exploration, to really prove the case.

"I am impressed," said biologist David Wake of the University of California at Berkeley.

Previous work on cichlid fishes in African lakes hadn't made as solid a case for sympatric speciation, partially because many African lakes are more complicated places where fish have a harder time avoiding interbreeding before they become truly new species, he said.

"This is not an issue here where there is clear evidence of 'biological species' that differ in ecology," he said.

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