Evolutionary benefits of sex in difficult places

June 14 2012

(Phys.org) -- University of Auckland scientists have provided the first experimental explanation of how sexual reproduction helps species adapt in challenging real-world environments, solving a classic conundrum in evolutionary biology.

“According to classic evolutionary theory, sexual reproduction should actually retard species’ ability to adapt to complex environments and in the long run prevent the evolution of new species,” explains lead researcher Dr Mat Goddard. “But in the real world, sex is a highly successful strategy that doesn’t prevent new species from evolving, so what we see in nature doesn’t tally with the theory. Our experimental work provides the first explanation for this and supports an alternate evolutionary theory.”

As organisms adapt to environmental challenges they accumulate genetic changes that help them survive. Since sexual reproduction produces offspring with a mix of genes from both parents, in theory, sex between organisms adapting to different environments should be detrimental. It would produce offspring poorly adapted to either environment because helpful genes are diluted and, according to classic theory, genes that are beneficial in one situation are detrimental in another.

To test the theory the researchers developed special yeast that could be switched from asexual to sexual forms. Two groups of yeast grown in different environments were allowed to sexually reproduce, to see whether this slowed the species’ simultaneous adaptation to both

environments as predicted by the theory.

In fact, sexual reproduction proved advantageous, allowing more rapid adaptation to both environments even when there was interbreeding between the two groups. The results were consistent with a little-known alternate theory, which states that genes that confer a benefit in one environment are not necessarily detrimental in another and would therefore not disadvantage the offspring of mixed parents.

“If the classic theory were true, then any breeding between groups of organisms adapting to different environments would dramatically slow their evolution. So to explain how new species evolve, classical theorists have had to come up with all sorts of convoluted scenarios, like the emergence of ‘magic genes’ for mate choice to prevent sexual reproduction between populations,” says Dr Goddard.

“Our work is much more consistent with what we see in the real world. It supports an alternate theory, in which organisms adapting to different environmental niches can live alongside one another and interbreed occasionally but this doesn’t compromise their evolution or the eventual development of new species, in fact sex enhances this process.”

The research was funded by a Marsden grant and a University of Auckland PhD scholarship to Jeremy Gray, and has been published online today in the journal *Ecology Letters*.

Provided by University of Auckland