Scientists find unexpected key to flowering plants' diversity

July 28 2008

By hand pollinating the rare vine Austrobaileya, whose flower is seen here, University of Tennessee, Knoxville, researcher Joe Williams uncovered new information about the origins of flowering plants' incredible diversity. Image: Joe Williams/University of Tennessee, Knoxville

What began with an off-the-cuff curiosity eventually led Joe Williams to hang from the limbs of a tree 80 feet above the soil of northeastern Australia.

The things Williams, a University of Tennessee, Knoxville, researcher found there may help explain the amazing diversity in the world's

flowering plants, a question that has puzzled scientists from the time of Charles Darwin to today.

Williams' findings, published online this week by the *Proceedings of the National Academy of Sciences,* show that the ability of flowering plants -- known as angiosperms -- to quickly and efficiently move sperm from pollen to egg through a part of the plant was the key to their evolutionary diversity.

His curiosity was based in the time it takes from when pollen lands on a plant to the time that its' seed is fertilized. Williams noticed a recurring theme in the research papers he read:

"They would usually describe how fertilization was occurring, but they never tell you much about timing," said Williams, an assistant professor of ecology and evolutionary biology at UT Knoxville.

For a seeded plant to fertilize, pollen that lands on the flower must grow a tube to carry sperm to the egg. In non-flowering plants, the pathway is usually short, because the pollen tube must destroy cells in its path, which is a time-consuming process. In flowering plants, though, pollen tubes are able to cover longer distances to the egg by essentially "squeezing" between cells. It is a trait that Williams says is vital to their diversification.

"The longer a plant takes to fertilize, for the pollen to reach the egg," said Williams, "the more chance there is for it to die."

When he studied the data he had collected through the years, Williams found that older lineages of flowering plants -- those on lower branches of the angiosperms' evolutionary family tree -- grew shorter tubes of pollen than those that went on to evolve into the diverse array of flowering plants that exist today.

That's what brought Williams to a harness in the rainforest of Australia. To confirm what he found in the data analysis, he pollinated -- by hand -- an ancient vine known as Austrobaileya that grows high in the canopy. He chose that plant, along with another plant found only on the Pacific island of New Caledonia and a water lily that grows high in the Colorado mountains, to test because they developed as species early in flowering plants' evolution.

He found that, when compared to more recently evolved species of angiosperms, the older plants grew shorter pollen tubes and took longer to do so than more diverse modern species. According to Williams, this indicates that these pollen tubes likely played a previously unknown role in spurring the evolution of the roughly 250,000 species of flowering plants we see today.

"As these plants gained the ability to grow pollen tubes faster and over longer distances," said Williams, "It gave them the ability to develop the much larger and more complex flowers as well as deeper ovaries with more seeds -- that is to say, larger fruits -- that we see around us today."

Source: University of Tennessee at Knoxville