UC SANTA BARBARA

THE Current

November 17, 2011
Gail Gallessich

Study of Flower Petals Shows Evolution at the Cellular Level

A new study of flower petals shows evolution in action, and contradicts more that 60 years of scientific thought.

The findings are reported by a scientist from UC Santa Barbara and a research team from Harvard University in the Proceedings of the Royal Society B this week.

Columbine flowers, known as Aquilegia, evolved several lengths of petal spurs that match the tongue lengths of their pollinators, including bees, hummingbirds, and hawkmoths. The petal spurs are shaped like a tubular pocket and contain nectar at the tip. The spurs grow from 1 to 16 centimeters in length, depending on the species.

The research team discovered that longer spurs result from the lengthening of cells in one direction, called anisotropy, and not from an increased number of cells. This finding contradicts decades of scientific thinking that assumed the elongated petals form via continued cell divisions.

"When we went in and looked at this in detail, we found that even the super-long-spurred flower doesn't differ much in cell number from the short-spurred one," said Scott A. Hodges, professor in the Department of Ecology, Evolution, and Marine Biology at UCSB.

He said that most studies of shape, particularly of leaves and of some flower parts, have focused their attention primarily on genes controlling cell division. "What this study is saying is that you don't want to just look at those kinds of characteristics; here's this whole other way to produce a tremendous amount of shape diversity without involving cell divisions," said Hodges.

In long-spurred plants, the spurs reach the same length at the same point in time as the short-spurred flowers, but they keep on growing, said Hodges. The rest of the flower has to wait for the spurs to lengthen. Until then, the pollen can't be released and the ovules are not ready to be fertilized. The flower has to stop that part of development while the spurs grow. Then, almost a week later, those flowers become reproductive, after the spurs have grown longer.

The evolution of petal spurs in columbines is considered a textbook example of adaptive radiation. Like Darwin's finches, over time, the columbines evolved a variety of species to exploit different ecological niches. The short-spurred columbines can be easily pollinated by bees. Hummingbirds have long beaks and tongues and can pollinate flowers with spurs of medium length. Hawkmoths have very long tongues and can pollinate columbines with the longest spurs, such as Aquilegia longissima.

In addition to Hodges, the co-authors are Joshua R. Puzey, Sharon J. Gerbode, Elena M. Kramer, and Lakshminarayanan Mahadevan, all from Harvard University.

Related Links

Scott Hodges: Current Research

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.