Kansas state flower receives scientific attention

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Anyone who has seen Kansas prairies in late summer to early fall can attest to the abundance of sunflowers decorating fields and lining roadways, giving Kansas the well deserved nickname, the Sunflower State.

Despite its beauty, the sunflower is more than just a pretty flower. To scientists, such as Mark Ungerer, assistant professor in the Division of Biology at Kansas State University, it is a prime example of the unique adaptability of plants.

In March, the National Science Foundation awarded Ungerer a $610,000 grant to continue his research on the genomic evolution of three species of hybrid sunflowers: anomalous sunflower, Desert sunflower and Pecos sunflower. The independent origins of these three hybrid species, from the same two parents, the common sunflower and Plains sunflower, raised some intriguing questions for Ungerer that inspired his grant proposal.

As Ungerer reviewed the genetic data from all five species of sunflowers he noticed something weird. The two parental species and the three hybrid species all have 34 chromosomes, but the genomes, the entire hereditary information encoded in DNA, of the hybrid species is far larger.

"What is strange is that the hybrid species have about 50-75 percent more DNA than the parental species and that doesn't make sense, given

what we know about their origins. If they all have the same number of chromosomes how could they possibly have more DNA" Where did it come from"" Ungerer asked.

Given that all three hybrid species grow in extreme environments, Ungerer hypothesizes that environmental stress may have caused the activation of a typically inactive class of transposable elements of DNA, called long terminal repeat retrotransposons.

"These elements are DNA sequences related to infectious retroviruses and are capable of multiplying and inserting copies of themselves into new positions in their host genome. Because of their replicative abilities, long terminal repeat retrotransposons, when activated, can result in massive genomic expansion and restructuring," Ungerer said.

"We are trying to understand the circumstances that caused retrotransposons to become active and proliferate in these sunflowers and the evolutionary and ecological consequences of these proliferation events," Ungerer said. He also noted that retrotransposons are not just found in sunflowers but in virtually all plants and animals, even humans. In his grant proposal , Ungerer said knowledge of the causes and consequences of this activation could deeply impact our understanding of the role of these genetic elements in organism evolution.

During the course of his three year study, Ungerer will be testing his theory using the controlled greenhouse environments available at K-State to mimic possible environmental stresses on early generation hybrids from the two parental species. Ungerer also will be collecting samples from wild sunflowers in hybrid zones throughout Kansas, Nebraska, Colorado, Utah, Arizona and New Mexico.

Source: Kansas State University