Size and positioning of floral anthers facilitates

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Unlike moths and butterflies that are often brilliantly colored to warn potential predators that they carry toxins, flowers and the fruits they produce have brilliant colors and unusual shapes because they want to attract the attention of pollinators and frugivores who will disperse their pollen and seed, thus guaranteeing the next generation.

In their work, Dr. Endress and his colleagues found that the sizes and positioning of the anthers facilitates pollen collection by buzz-pollinating bees. The male floral structures, anthers, release the pollen gradually, like tiny gumball dispensers. All of these characteristics--size, shape, placement, and timing—may be controlled by networks of genes as well as by regulatory sequences that do not encode proteins. Slight changes in these networks or in the non-coding sequences can change the developmental pattern of a flower and thus its morphology—either dooming it if its pollinators can no longer “fit” properly or guaranteeing the success of the species if it acquires new pollinators. This type of information is becoming ever more critical as we struggle to understand, maintain, and modify the plant and pollinator systems that we depend on for life.

Evo-Devo, or the linking of evolution and development is a shift in the paradigm of how organisms evolved and diversified. In a symposium at the joint annual meeting of the American Society of Plant Biologists and the Botanical Society of America (July 7-11), Dr. Peter Endress of the Institute of Systematic Botany at the University of Zurich will present his work on the functional architecture of flowers and the role of development in floral evolution.

Charles Darwin, who observed closely the productions of breeders of pigeons, dogs, and flowers, understood that explaining the evolution and diversity of living organisms, from mosses to elephants, would require an understanding of development. In his presentation at a joint ASPB and BSA symposium on evolutionary development at the annual meeting in Chicago (July 9, 2007, 2PM) Dr. Peter Endress will address the need to compare developmental patterns across many taxa of flowering plants to gain insight into flower evolution. In a study reported in the International Journal of Plant Science, Dr. Endress and his coauthors Brigitte Marazzi and Elena Conti, compared floral structures across numerous species of the genus Senna in the pea family. These flowers are specialized to be pollinated by bees that release the pollen through vibrations caused by their buzzing. Endress and his coworkers found a diversity of floral structures that may represent different strategies for pollen dispersal, even in the same genus.

The diversification of flowering plants on earth about 130 million years ago had a profound effect on the evolution of many other kinds of organisms like insects, birds, and mammals, who became the pollinators and consumers of those plants, thus ensuring the continuity of both the plant and its animal partner. Scientists are beginning to understand just how intimate and important these interactions are, as both plants and pollinators are threatened by extinction due to habitat loss and pollution from human activities. The recent alarm over the collapse of honeybee colonies has underscored the importance of insect pollinators not only to crops consumed by humans but also to plants that support the ecosystems we depend on.

Flower architecture has great evolutionary and economic importance. Minute differences in the size and placement of the male and female reproductive parts of a flower can determine how those flowers are pollinated--by insects, birds, animals, wind, or the flowers themselves. Genetic programs determine how the embryos will grow, when the fruit opens to disperse the seed, how the fruit is positioned to attract potential dispersers or when it falls to the ground. The method and timing of pollen dispersal from a plant can determine whether or not a plant modified to resist an insect pest will also have an effect on other more beneficial insects. Scientists are racing to understand these minute differences and interactions, even as habitat loss and climate change threaten the existence of many plants as well as their pollinators. The Floral Genome Project is a consortium of labs in the United States and abroad whose goal is to construct a database that will contain comparative data on the expression patterns for a large number of genes across many different families of flowering plants.

Starting with Linnaeus, plants and animals were formally classified on the basis of their physical characteristics—their morphology. With the revolution in DNA sequencing, or genomics, plants and animals are also classified on the basis of their gene sequences. These two areas of systematics often produced conflicting results, but as more genomes are sequenced and the functions of numerous genes studied, both zoologists and plant biologists have begun to understand that gene sequences alone cannot explain diversity. Within the last few years, scientists have begun to identify groups of genes, called networks, which control complex programs that determine an organism’s final form. In addition, the parts of the genome that do not code for proteins, the non-coding regions, are assuming greater importance in explaining the diversity found in different species of plants and animals.

Source: American Society of Plant Biologists

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