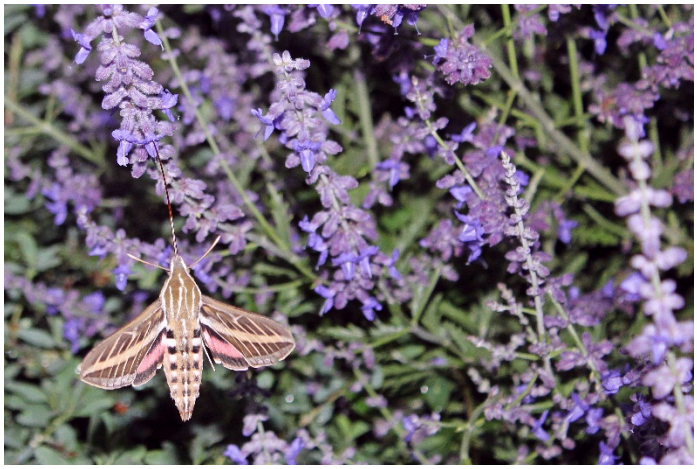
Out-Crossing Achieved by Wind, Insect, and Plunger Pollination—Say What?



By Cindy Murray

Edited by Lisa Miller

I believe most of us have a sense of what genetic engineering is all about—a method of inserting one or more genes of one species or individual into the chromosomes of another to gain a desired trait or traits. For example, The International Rice Research Institute is developing a genetically engineered “golden rice” containing a significant amount of beta carotene to stave off vitamin A-deficient blindness of people in developing nations.

But did you know that people have been manipulating plant genes for thousands of years? In point of fact, many of our modern crops are the result of early farmers and plant breeders crossbreeding plants for the purpose of creating the few

near-perfect plants that bear the combined desired traits of them all. Modern-day corn is the result of 9,000 years of selective breeding of corn's forebearer, teosinte, a wild grass native to Mexico and Central America.

How about plants themselves? Do they "know" that mixing genes of two plants can bestow their progeny with traits to better overcome environmental stressors such as drought or even fire? In a sense they do, by avoiding self-pollination, and it's termed out-crossing. I'll walk you through some keen ways they do so.

Plunger Pollination

Plunger pollination is employed by members of the sunflower/aster and bellflower families. First the stamens (male parts of the flower) fuse together to form a pollen-lined tube around the immature style (the tube connecting the stigma at the top and the ovary at the bottom). As the style lengthens, it sends specialized filaments upwards, pushing pollen granules out of the tube where insects will pick them up to be transferred to a different flower of the same species. Once this takes place, the stigma becomes sticky and receptive to non-self-pollen carried by insects, thus setting the stage for cross-pollination.

Wind Pollination

Northern Arizona is home to an abundance of wind-pollinated native and introduced plants like cone-bearing trees, junipers, grasses, aspen, and weeds like ragweed. This pollination strategy is quite efficient in out-crossing. (It can be a bit of a problem for us humans when prodigious amounts of pollen are released and blown far and wide. I, for one, am allergic to several of these.)

Insect Pollination

While bees can't see the color red, they readily detect colors along the spectrum from orange to ultraviolet. Some plants and bees have co-evolved with certain pollinators to lure them into the center of a flower offering the bee's preferred pollen or nectar. These flowers often achieve out-crossing by decorating themselves with ultraviolet, wavelengths visible to bees much like neon lights appear to us.

Who would guess beetles are the oldest pollinators on the planet? In ancient times and today, cycads were fertilized by beetles. Flowers that have co-evolved with

beetles often make massive amounts of pollen to ensure out-crossing is achieved. Having poor eyesight but a good sense of smell, beetles are attracted to fragrant white, cream, yellow, or green flowers with visible anthers and stigmas. Beetles are dubbed “mess and soil” pollinators, because they munch their way through flower parts, defecating along the way, to attain their feast of pollen.

Many moths fertilize night-blooming flowers, which they customarily locate through their keen sense of smell. Some yellow-flowered columbines, including those native to Northern Arizona, have co-evolved with hawk moths. These columbines achieve outcrossing by offering nectar at the bottom of long tube-shaped nectaries. Since hawk moths have very long proboscises, they are able to reach the nectar, while inadvertently depositing pollen from a previously visited flower. Short-tongued pollinators cannot do this. This gives the moths a reliable source of energy-rich nectar, necessary fuel for their hovering needs.

Some flowers, like certain orchids, may be monogamous, meaning they can only be pollinated by a particular species. I tend to think this is an evolutionary dead-end, because that one species could become extinct.

To ensure outcrossing is achieved, most flowering plants, like dandelions, are able to be fertilized by a variety of pollinators, although they often expend a considerable amount of energy producing nectar to lure them in. I find a plethora of insect species on my apple, plum, peach, and cherry trees, and I feel gratuitous towards them whenever I sink my teeth into a juicy peach.