A gene for sexual switching in melons provides clues to the evolution of sex

August 7 2008

A newly discovered function for a hormone in melons suggests it plays a role in how sexual systems evolve in plants. The study, conducted by French and American scientists, appears in the latest issue of the journal *Science*.

Scientists from several French institutions, led by Abdel Bendahmane of the National Institute for Agricultural Research (INRA), isolated the melon sex determination gene and determined its function. As part of this collaborative effort, New York University biologists Jonathan Flowers and Michael Purugganan, who are part of NYU's Center for Genomics and Systems Biology, conducted the evolutionary analysis of the study

Because plants' sexual systems are varied—species may possess various combinations of male, female, or hermaphrodite systems—their evolution has long been of interest to scientists. This is especially the case in melons, whose sexual system—andromonoecy—carries both male and bisexual flowers and appears to have evolved recently. In this study, the researchers sought to understand what determines the recent formation of melons' new sexual system.

"If we can understand how different sexual systems in plants have evolved, we can then begin to understand how sex in general evolves," explained Purugganan.

The researchers focused on the role played by the hormone ethylene,

which is known to help fruit ripen. The French group determined that an enzyme involved in making this gaseous hormone is also involved in the evolution of the sexual switch of female flowers to hermaphrodites. The finding links hormone levels to sex determination in flowers.

The scientists also sought to determine if the change in ethylene levels, and therefore the resulting sexual system, was the result of evolutionary selection. The key was in looking at the ethylene enzyme gene, called CmACS-7, which had the mutation that causes the sex change in melons.

After examining the molecular diversity in this gene, comparing it with other genes in the melon genome, and using mathematical modeling, the researchers concluded that the level of molecular variation at the sex determining ethylene enzyme gene was unlikely to have occurred by chance. Instead, the pattern was consistent with evolutionary selection favoring the sex switch mutation in melons.

"Humans and other mammals generally have only two sexes – males and females," observed Purugganan. "But other species, including plants, can evolve bewildering arrays of sexual combinations."

This study, he suggests, provides us with new insights into the molecular basis for sex determination and allows us to understand the advantages of different sexual systems.

Source: New York University