Simple genetic mechanism may be behind the origin of species

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(PhysOrg.com) -- Some of the secrets behind the emergence of new species have been uncovered in a genetic study, conducted in collaboration with bioscientists at The University of Nottingham.

Almost all plant species are known to have cross-breeds that sometimes produce infertile offspring. Now for the first time the team, led by the French National Institute for Agricultural Research, INRA-Versailles, has identified a simple genetic mechanism that may explain why this happens. The results have been published in the journal Science.

Professor Malcolm Bennett, Biology Director for the Centre for Plant Integrative Biology and Head of Division of Plant and Crop Sciences at The University of Nottingham said: “As plants evolve, their genes may get copied, moved around the genome, and inactivated. This will reduce the possibilities for fertile cross-breeds and, over time, may result in the emergence of distinct species. We're delighted that this study demonstrates this process in action.”

The study explains why the offspring of some cross-breeds are not viable and indicates a potential mechanism for the formation of sub-species in supposedly identical populations.

The researchers, specialists in the genetics of the model plant Arabidopsis thaliana, first noted that
offspring of the cross between two of the plant's natural strains, Columbia (Col) and Cape Verde Island (Cvi), did not fully obey

Mendel's Laws of Inheritance. Researchers found that in specific genetic combinations of two parent genomes, some did not produce offspring at all.

Further investigation showed that a gene called HPA is carried by chromosome 1 in the Cvi strain, but in the Col strain a second copy is also found on chromosome 5. As the Col strain evolved, the copy of HPA on chromosome 1 became inactive. As a result, the two strains of Arabidopsis now have their functional HPA genes on different chromosomes. The HPA gene is responsible for the production of histidine, an essential amino acid that is necessary for reproduction to take place.

Embryos that inherit one inactive HPA gene from chromosome 1 of a Cvi parent and another from chromosome 5 of a Col parent cannot produce histidine and fail to develop.

If the gene isn't present the two different strains become incompatible, making it impossible for parent plants to produce offspring. Researchers were able to confirm this after observing that plants watered with a histidine solution were able to produce embryos that developed normally.

Provided by University of Nottingham