Scientists unlock clues for tailoring corn plant for food, energy needs

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(PhysOrg.com) -- Scientists have long known that the offspring of two inbred strains tend to be superior to both their parents. Now, a team of researchers including a University of Florida geneticist has discovered clues to why that might be the case for one of the most important crops in the world: corn.

The result could boost scientists' ability to custom-tailor corn for specific traits, such as high protein content for human consumption or high glucose content for biomass fuel.

"An understanding of the combination of genetic factors that result in superior performance will influence future breeding programs, which will produce higher yield or improved quality crops to meet the demands of an energy and nutrition hungry world," said Brad Barbazuk, a UF assistant professor in biology and member of the UF Genetics Institute.

The findings are set to appear in the Nov. 20 issues of *Science* and *PLoS Genetics.*

With help from the newly released DNA sequence of the common corn strain known as B73, Barbazuk, and colleagues from the University of Minnesota, Iowa State University and Roche NimbleGen, compared the genetic sequence of B73 with that of a second strain, Mo17.

The scientists discovered an astonishing abundance of two kinds of structural variations between the pair: differences in the copy number of multiple copies of certain stretches of genetic material, and the presence of large segments of DNA in one but not the other. In fact, at least 180 genes appear in B73 that aren't found in Mo17.

Nathan Springer, an associate professor of plant biology at the University of Minnesota's College of Biological Sciences and the lead author of the PLOS Genetics paper, suspects that Mo17 likely has a similar number of genes that B73 lacks.

"The genomes of two corn strains are much more different than we would have thought," Springer said. "What struck us is how many major changes there are between two individuals of the same species."

The researchers think that this diversity, which is almost as great as the difference between humans and chimpanzees, is what's behind the superiority of hybrids. When the genetic material from the two very different parents combine, the offspring ends up with more expressed traits than either parent - the best of both worlds, gene-wise.

"Hybrid offspring are probably benefiting from obtaining the genes unique to each inbred parent in addition to unique combinations of favorable alleles." Barbazuk said.

In addition, the analysis revealed large regions of low diversity.

"There are large segments that are essentially invariant between the two inbreds," he said. "Some of these sections may have lost diversity as result of selection during the domestication of maize from its ancestor, teosinte, approximately 10,000 years ago."

The findings are important because corn is important.

Domesticated some 10,000 years ago, the crop produces billions of bushels of food, feed, and fuel feedstock each year in the United States alone. If scientists understand the molecular underpinnings of hybrid vigor, Springer said, they can potentially produce true-breeding lines of corn with specific traits for specific uses. That means better use of land, fertilizer, fuel, and other inputs needed to grow crops, and, ultimately, less environmental impact than might otherwise accrue as we work to meet the needs of a growing population.

Provided by University of Florida (news : web)

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