It's a gas: New discovery may lead to heartier, high-yielding plants

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In a research report published in the November 2009 issue of the journal *Genetics*, scientists show how a family of genes (1-aminocyclopropane-1-carboxylate synthase, or ACS genes) are responsible for production of ethylene. This gas affects many aspects of plant development, and this information lays the foundation for future genetic manipulation that could make plants disease resistant, able to survive and thrive in difficult terrain, increase yields, and other useful agronomical outcomes. This discovery was made with the weed *Arabidopsis thaliana*, but it will be applicable to plants used in agriculture.

"I hope that this work will provide insights into how a set of genes work together like a finely tuned symphony to regulate plant growth because we may be able to use such knowledge to engineer plants more suited to our changing world," said Athanasios Theologis, a senior scientist at the Plant Gene Expression Center of the U.S. Department of Agriculture and the senior researcher involved in the work. "This is critically important because as the human population grows, we may need to produce more food in the same or in less space."

To understand the function and regulatory roles of each ACS gene in ethylene production during plant development, scientists from Theologis' laboratory analyzed the essential and nonessential roles of each of the family of Arabidopsis ACS genes. They found that while loss of any single ACS gene had no visible effect on the plant, it did affect the activity of other genes in the family. They grew different plants that had

different combinations of these genes "turned on" and "turned off" and found that the members of this gene family have different but overlapping functions in plant development, such as growth, flowering time, gravitostimulation, and disease resistance.

"Ethylene gas is best known for causing fruit to ripen," said Mark Johnston, Editor-in-Chief of the journal *Genetics*, "but the molecule is critical to development and growth of plants. By revealing how plants regulate the amount of ethylene they produce, this study gives scientists an entirely new genetic approach for developing heartier, more productive crops. This is becoming increasingly important as our planet warms and our population grows."

More information: Atsunari Tsuchisaka, Guixia Yu, Hailing Jin, Jose M. Alonso, Joseph R. Ecker, Xiaoming Zhang, Shang Gao, and Athanasios Theologis. A Combinatorial Interplay Among the 1-Aminocyclopropane-1-carboxylate Isoforms Regulates Ethylene Biosynthesis in Arabidopsis thaliana. doi: 10.1534/genetics.109.107102

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