A big bunch of tomatoes?

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Why do poppies and sunflowers grow as a single flower per stalk while each stem of a tomato plant has several branches, each carrying flowers? In a new study, published in this week's issue of the open access journal *PLoS Biology*, Dr. Zachary Lippman and colleagues identify a genetic mechanism that determines the pattern of flower growth in the Solanaceae (nightshade) family of plants that includes tomato, potato, pepper, eggplant, tobacco, petunia, and deadly nightshades. Manipulation of the identified pathway can turn the well known tomato vine into a highly branched structure with hundreds of flower-bearing shoots, and may thereby result in increased crop yields.

While the development of individual flowers is well understood, the molecular mechanisms that determine the architecture of inflorescences - flower-bearing shoots - are not. The way that inflorescences branch determines the number and distribution of flowers; in peppers (capsicum) inflorescences do not branch, so flowers are singular; in tomatoes, inflorescence branching is repetitive and regular, forming a zigzagged vine The tomato mutants anantha (an) and compound inflorescence (s) have long been known to produce large numbers of branches and flowers, and the new work elucidates the underlying genetics.

Dr. Lippman, and a team of researchers drawn from three institutions in Israel, investigated inflorescence branching by studying these mutant tomato plants. They identified the genes responsible: the anantha (AN) and compound inflorescence (S) genes. S is a member of the well known homeobox gene family, which plays a crucial regulatory role in

patterning both animals and plants. Lippman et al. have shown that manipulation of these genes in tomato plants can dramatically alter the architecture and number of inflorescences, and that altered activity of AN in pepper plants can stimulate branching. Variation in S also explains the branching variation seen in domestically grown tomato strains.

The two genes work in sequence to regulate the timing of development of a branch and a flower – so, for example, slowing down the pathway that makes a flower allows for additional branches to grow. While this study by Lippman et al. focuses on variations in particular nightshades, the insight leads to a new understanding of how many plants, such as trees, control their potential to branch.

Citation: Lippman ZB, Cohen O, Alvarez JP, Abu-Abied M, Pekker I, et al. (2008) The making of a compound inflorescence in tomato and related nightshades. PLoS Biol 6(11): e288. doi:10.1371/journal.pbio.0060288
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