

Plant Genomics

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Genomics to detect and measure departures from autogamy in domesticated tomato

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Evidence that genes exist in cultivated tomato germplasm that promote outcrossing was obtained during the course of a traditional breeding program, specifically the recapitulation of the iconic variety 'Rutgers'. This open-pollinated variety was bred during 1926-1932 and released publically in 1934. Following an impressive run as an enormously popular world-wide fresh market and processing variety in the mid-10th century, 'Rutgers' was rendered obsolete by emerging F1 hybrid varieties and new processing methods and varieties. We (Rutgers University and the Campbell Soup Co.) sought to recapitulate an updated version of 'Rutgers' starting in 2010, using the same general approach (modified pedigree program) as the original 1934 release that culminated in the development of 'Rutgers 250', an open-pollinated garden variety released in 2016. The new variety possesses vine and fruit attributes that transcend the range embodied by the seminal parents, 'JTD' and 'Marglobe' (both prominent heirloom varieties from the early 20th century). When we contrasted 'Rutgers 250' with the parents with respect to SSR genotypes, we discovered many non-parental configurations and hypothesized that an outcrossing event occurred at or about the F2 that introduced some of the genes that were selected during the breeding program and present in the finished variety. We discovered in 2015 that the parental variety 'JTD' exhibited exerted stigmas, a trait common to wild outcrossing populations, while flowers of 'Marglobe' were inserted. All F1 individuals were exerted, suggesting the presence of dominant allele interaction. The F2 is currently under study. The total array of breeding germplasm in our program was subsequently screened for presence of exerted stigmas. Nine of 165 populations grown out in summer 2015 exhibited flowers with at least 50% exerted stigmas, or 5.45%. Most others were totally devoid of exerted stigmas. This strongly suggests that genes that profoundly affect mating system may be present in tomato breeding programs and that the presumption of autogamy should be verified before and during breeding efforts that include uncontrolled mating.

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