

A UNIQUE CYTOPLASMIC-NUCLEAR INTERACTION CAUSING SUNFLOWER PLANTS WITH REDUCED VIGOR AND THE GENETICS OF VIGOR RESTORATION

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ABSTRACT

Plants with pale yellow leaves and reduced vigor were observed in backcross progenies of inbred line HA 89 or HA 410 in the cytoplasms of 12 perennial *Helianthus* species, but not in the cytoplasms of annual *H. niveus*, *H. praecox*, *H. anomalus*, and *H. neglectus*. Segregation ratios of normal (N) to reduced-vigor (RV) plants in testcrosses and self-pollination of heterozygous normal plants, respectively, suggested that single dominant gene (*V*) controls vigor restoration. A high frequency of vigor restoration genes was found in 11 cultivated sunflower lines, with the exception of HA 89, HA 410, RHA 801, and Seneca. Testcross progenies of the half-diallel crossed F1s among HA 271, HA 234, VNIIMK, Armavir, Issanka, and HA 821 onto the RV cmsRIG1 were all normal, suggesting that all these lines possess the same *V* gene. Extensive use of *H. tuberosus* in early sunflower breeding programs might explain the presence of *H. tuberosus* *V* gene in many cultivated sunflowers, and the possible selective advantage of the *V* gene. A new *V* gene derived from *H. giganteus* was identified, which differed from the *V* gene commonly existing in cultivated lines. Other *V* genes derived from *H. hirsutus* and *H. salicifolius* will be compared among all the *V* genes. The *V* gene commonly existing in cultivated lines has been mapped to the linkage group 7 of the sunflower genome using SSR markers. The tightly linked markers will help select for normal vigor progenies when using perennial *Helianthus* cytoplasms in a breeding program

Key Words : sunflower, cytoplasmic-nuclear interaction, reduced vigor, wild perennial *Helianthus*