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IDENTIFICATION OF NOVEL VARIANTS IN INTERSPECIFIC DERIVATIVES OF *Helianthus divaricatus* AND CULTIVATED SUNFLOWER

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INTRODUCTION

Wild *Helianthus* species serve as potential sources for several desirable characteristics such as resistance to biotic and abiotic stresses, cytoplasmic male sterility, fertility restorer genes and oil quality (Thompson *et al.*, 1981; Seiler, 1992). Among the wild sunflowers, *H. divaricatus* - a diploid perennial of the section *Divaricati* - assumes importance owing to its tolerance to diseases like *Plasmopara halstedii* and *Diaporthe helianthi* (Korell *et al.*, 1996) and its crossability to cultivated sunflower (Nikolova and Christov, 1990). Screening of *Helianthus* species for resistance to leaf spot incited by *Alternaria helianthi* (Hansf.) Tubaki et Nishihara revealed *H. divaricatus* as a useful source against this pathogen (Sujatha *et al.*, 1997). In an attempt to transfer this trait to cultivated sunflower, interspecific hybridization between cultivars and *H. divaricatus* was undertaken. The F_1 hybrids were highly fertile with formation of 17 regular bivalents. The dominance of wild characters *viz.*, branching, and pointed bracts was observed in the F_1 and BC_1 generations. At BC_2, phenotypically superior plants were selected and intermated to avoid narrowing down of the variability for the polygenically controlled trait like resistance to *Alternaria*.

The interspecific derivatives possessed distinct plant type. The plants were short statured with slender stems. Leaves and stems were smooth and non-pubescent. Leaves were thick, leathery and ovate, petioles were short and floral bracts were pointed. The plants revealed field tolerance to *A. helianthi*. Interestingly, continuous sib-mating of the plants for two generations resulted in identification of two novel phenotypes *viz.*, plants producing 1) white pollen and 2) double heads which were not present in the populations of the parental species.

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Figure 1: Novel phenotypes from the interspecific derivatives of H. divaricatus and cultivated sunflower. a) white pollen, b) typical Y-type branching in double-headed sunflower and c) double-headed sunflower

WHITE POLLEN

Pollen produced was pure white and in abundance, turning cream at drying (Figure 1a). Invariably, the white pollen producing plants possessed lemon yellow coloured ray florets unlike the plants that segregated for yellow pollen which had normal yellow ray florets. Characterization of white pollen in petunia revealed the inability of the pollen to germinate *in vivo* and *in vitro* (Taylor and Jorgensen, 1992). However, the white pollen in sunflower was viable, highly fertile, functional and germinated readily *in vivo*. Sister plant mating and selfing of white pollen producing plants resulted in the development of lines breeding true for this trait. Appearance of such phenotype after 2 generations of sib-mating indicates the presence of genes in heterozygous condition. Crossing of the white pollen lines with yellow pollen producing cultivars (in both directions) resulted in F_1's producing yellow pollen indicating the recessive nature of white pollen. Most of the white pollen variants are governed by stable recessive alleles. Similarly, the white pollen color reported in the mutant of a male sterile restorer line C8711 of sunflower was found to be under the control of a monogenic recessive gene (Qiao *et al.*, 1993). White pollen could probably be due to flavonoid deficiency and serves not only as a genetic marker but also as a useful model in gene regulation studies.

DOUBLE-HEADED SUNFLOWER

The double-headed sunflowers possessed typical Y-type branching (Figure 1b) and produced two equal sized heads (Figure 1c). The division occurs exactly during the transformation from vegetative to floral morphogenesis stage. There were no differences in qualitative traits between single- and double-headed sunflowers except for flowering which was delayed by 2-3 days in the double-headed types. The capitula were flat and the number of florets in each of the flower head in double headed sunflower was equal to those in single headed sunflower. Both the male and female gametes were fertile and functional. These plants were selfed, sib-mated and cross pollinated with other types to understand the genetic control of this trait and also to stabilize the trait in the lines which could certainly play a crucial role in enhancing the productivity per unit area.

Wild *Helianthus* species have contributed valuable genes to the improvement of cultivated sunflower. Nikolova and Christov (1990) reported great genetic diversity of phenotypes in the F_1 and BC_1 genotypes for plant height, branching, head diameter, leaf size, disk color, etc. from the same cross combination. Most of the variation reported by them is often seen in crosses between wild and cultivated sunflowers. Novel phenotypes as observed in this study were not reported probably due to the use of different accessions or due to the confinement of their study up to BC_1 generation. The present study shows that wild sunflowers besides being a source for various economic attributes preserve large genetic variability in them that can be exploited for further improvement of this crop.

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