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Gene action of drought tolerance and achene yield related traits in sunflower (*Helianthus annuus L.*)

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A diverse sunflower germplasm which were collected from national and international organizations were evaluated under Polyethylene Glycol (PEG-6000) mediated drought stress in petri dish and also through *in vitro* culture. Selected tolerant and sensitive accessions were crossed in Line×Tester fashion and resultant F1 along with their parents were evaluated for drought tolerance in field and PEG mediated drought in lab. Data were recorded on morphological and physiological parameters. Genetic variation among the entries under normal and drought stress treatments indicated that this breeding material may be used for the development of drought tolerant types. Combining ability analysis exhibited variable direction and magnitude of General Combining Affects (GCA) among line and testers and specific Combining Ability Affects (SCA) among crosses. The lines A-23, G-33 and 017583 and testers HA-133 and 017577 were best general combiners under normal and drought stress treatments. Results of SCA indicated that crosses G G-61×017577, A-79×CM-621, A-48×CM-621 were best specific combiners. Crosses G-61×HA-124 and A-48×HA-341 had also mid parent, better parent and commercial heterosis for various traits under treatments. Additive type of gene action was observed for germination percentage, days to 50% flowering, days to 50% maturity, stem diameter and oil content while other traits showing non-additive gene action. Best cross combinations were also FISH (fluorescence *in situ* hybridization) and GISH (Genomic *in situ* hybridization). Reasons were identified at chromosome level, why two different species of sunflower cannot hybridize. Association of traits based on correlation and path analyses suggested that seedling fresh weight, dry weight and hundred achene weight can be used as criteria for selection of sunflower for drought tolerance and high achene yield.

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