GENE ACTION AND GENETIC MARKERS AS ASSISTED SELECTION FOR DROUGHT TOLERANCE IN GRAIN SORGHUM

By

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ABSTRACT

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This investigation was conducted at Giza and Shandaweel Research Stations of the Field Crops Research Institute (FCRI), Agricultural Research Center (ARC), Egypt, in the seasons from 2011 to 2013. The study aimed to estimate some genetic parameters for grain yield and some related yield traits, using the six populations, *i.e.* P_1, P_2, F_1, F_2, BC_1 and BC_2 of two grain sorghum (*Sorghum bicolor* L. Moench) crosses, *viz.* ICSB-88005 × MR-812 (Cross 1) and ICSB-37 × ICSR-93002 (Cross 2). P_1, P_2, F_1, F_2, BC_1 and BC_2 of the two crosses were evaluated under two levels of watering [100 and 50% ET] in two separate experiments. Data regarding backcrosses and $F_{2's}$ under normal watering were not recorded due to the dissimilarity of its genetic make-up with those under drought. The investigation also amid to study the relationships between the results of ISSR-PCR, RAPD-PCR and field results in an attempt to develop molecular markers for drought tolerance.

Results of analysis of variance indicated significant differences among the studied generations of each cross for studied traits. The genetic variances within F_2 population were also found to be significant for all the studied traits in the two crosses, therefore genetic parameters were estimated.

Some of the scaling test values of A, B, C and D were significant for different studied traits, suggesting the presence of non-allelic interaction. F_2 deviation (E1) and backcross deviation (E2) were significant, with few exceptions, retiring the contribution of epistatic gene action in the inheritance of the studied traits.

Results of generation mean analysis showed that the dominance × dominance (dd) type of epistatic gene action, followed by the additive (a) gene effects and the additive × dominance (ad) type of epistatic gene action contributed with the large part of genetic component controlling the inheritance of the studied traits compared to and the dominance gene effect (d) and the additive × additive (aa) type of epistatic gene effect. Heritability estimates in the broad sense under drought conditions ranged from 68.95% for no. of green leaves/plant in cross I to 86.09% for days to heading in cross II. Heritability estimates in the narrow sense ranged from 19.14% for plant height to 59.21% for panicle width in cross II.

The expected genetic advances as percentage of the F2 mean (Δg %) for the studied traits under drought conditions ranged from 3.03% for days to heading to 28.72% for panicle width in cross II. Results of path coefficient analysis revealed that 1000-grain weight, panicle weight and panicle length proved to be the major grain yield contributors.

Concerning genetic markers studies, the primers A-11, B-20, C-01, HB-11, HB-12 and HB-13 showed close relationship for drought tolerance segregates in the F_2 generation and thus they could be used as marker assisted selection for drought tolerance. Therefore, the ISSR-PCR and RAPD-PCR analysis could be considered as reliable molecular markers associated with drought tolerance in grain sorghum that can be utilized during breeding programs *via* marker-assisted selection.

Key words: Grain sorghum (*Sorghum bicolor* (L). Moench), Six populations, Drought tolerance, Scaling test, Gene action, Heritability, Genetic advance, Correlation, Path coefficient, ISSR-PCR and RAPD-PCR.

CONTENTS

LIST OF TABLES

LIST OF FIGURES