FLUCTUATING EXPRESSION FOR STERILITY IN CYTOPLASMIC MALE STERILE GRAIN SORGHUM LINES UNDER HIGH TEMPERATURE CONDITIONS

By

WALAA YASEEN SAAD YASEEN

B.Sc. Agric. Sci. (Plant Breeding and Propagation Technology), Fac. Agric., Cairo Univ., 2009

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APPROVAL SHEET

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ABSTRACT

The objectives of the present study were: (i) to estimate the effect of elevated temperature on the percentage of pollen sterility of cytoplasmic male sterile (CMS) A-lines and agronomic and yield traits of B-lines of grain sorghum (ii) to identify the A-lines that exhibit perfect or nearly perfect pollen sterility under elevated temperature and those exhibit fluctuation to fertility, (iii) to estimate heritability and genetic advance from selection for studied traits and (iv) to assess sorghum B-lines for yielding stability and adaptability. Twenty five CMS grain sorghum A-lines and their counterpart B-lines were evaluated under six environments differing in temperatures (Giza and Shandaweel in two years and two planting dates in Giza), using a randomized complete block design with three replications in each experiment. Results showed that across all A-lines, percentage of sterile pollen decreased as temperature increased; from 89.6% at maximum temperature of 35.2^{o}C (at Giza 2012, 1st planting date) to 86.9% at maximum temperature of 40.8^{o}C (at Shandaweel 2013). The tested A-lines for pollen sterility percentage were classified into five classes; 1st class showing 100% sterility (five lines), 2nd showing from ≥ 99 to <100% (five lines), 3rd showing from ≥ 98 to < 99% (six lines), 4th showing from ≥ 96 to < 98% (six lines) and 5th showing only < 26% (three lines). The latter three A-lines were considered to be converted into nearly male fertile lines under all temperature conditions and therefore should not be used anymore as seed parents in the sorghum hybrid breeding programs. Grain yield/plant and plant height traits indicated high heritability associated with high genetic advance from selection. Giza location (2nd planting date) was better environment than Shandaweel location in getting higher gain from selection. The two B-lines (ICSB-8001) and (BTX-407) displayed above average grain yield/plant (GYPP), regression coefficient (b_i) value near unity and non-significant deviation from regression (S^2_d) value near zero, indicating that these two genotypes are stable and widely adapted to different environments. Based on AMMI model, BTX TSC-20 followed by ICSB -1808 showed both high yielding and stability across the test environments. Based on GGE-biplot method, BTX TSC-20 was the winning genotype for the mega-environment which consists of E1 and E3, ICSB -14 (G 3) for the mega-environment (E2 and E4), while BTX 2-1 (G20) for E5 mega-environment, ICSB -88003 (G12) and ICSB-70 (G6) for the mega-environment E6.

Key words: Grain sorghum, CMS lines, Pollen sterility, Elevated temperature, G × E interaction, Environment, Stability, adaptability.

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