Estimation of Gene Action and Variance Components of Some Reproductive Traits of Rice (*Oryza sativa L*) Through Line x Tester Analysis

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Abstract

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Material and methods

To study combining ability e ects of developedcmS and restorer lines an experiment was carried out at the experimental farm, Department of Genetics and Plant Breeding, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur during Aman and Boro following RCBD design in three replications. Five knowncmS lines and sixteen developed R-lines were considered for through line x tester analysis. Analysis of variance for general and speci c combining ability (gca and sca) were estimated according to line x tester method [4] Five female parents i.e., IR 58025A, BRRI 1A, GAN46A, IR 68888A and IR 62820A and sixteen male parents i.e., RG-BU08-001R, RG-BU08-002R, RG-BU08-005R, RG-BU08-006R, RG-BU08-007R, RG-BU08-013R, RG-BU08-016R, RG-BU08-018R, RG-BU08-025R, RG-BU08-034R, RG-BU08-038R, RG-BU08-046R, RG-BU08-057R, RG-BU08-063R, RG-BU08-097R and RG-BU08-105R were used in the experiment. Data were collected from 10 hills of each genotype on 10 randomly selected individual plant basis were plant height, days to 1 owering, days to 80% owering, days to maturity and grain yield (ton/ha). Data obtained for each character was subjected to the analysis of variance following three replicated randomized complete block design by using GENSTAT program.

Results and Discussions

Results from combined ANOVA

Plant height is considered as an important character to select a hybrid. Highly signi cant variances were found for male (2694.95**), female (1381.70**) and parents (529.05*) indicating the contribution of male, female and parents. e linear non-signi cant relationship between female vs male (56532.15^{ns}) indicates the reliability of the crosses to go through heterosis breeding. Signi cant contribution of female in hybrid (3191.60**) was estimated followed by male in hybrid (3139.24**). While parent vs hybrid (646.91**) was found highly signi cant. Observed signi cant di erences between parents and hybrids. Signi cant gca variances along with additive variance component (12.82*) indicates the accessibility of additive gene action Degree of dominance (0.40937) was found negative which reveals that regression lines passing below the origin i.e. this character is responsible for over dominance (Table 1). e progenies also found the

Sl no	Parents/F_1s	Status	Sl no	Parents/F_1s	Status

similar contribution of lines was found signi cant (13.77**) indicating preponderance of fertile genes among the lines followed by (3.73*)

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performances also recorded similar results supported parents RG-BU 08-005R (97.67, 107.07, 133.44 days), RG-BU 08-006R (99.34, 108.34, 133.47 days), RG-BU 08-007R (101.67, 109.01, 133.02 days), RG-BU 08-097R (96.67, 108.34, 135.31 days) and GAN 46A (103.60, 113.40, 135.94 days). ese facts indicated that the above parents possessed more negative alleles for the decreasing the life cycle. Compared to BRRI than29 of? these parents matured 27 ± 2 days earlier. So, RG-BU 08-005R, RG-BU 08-006R, RG-BU 08-007R and RG-BU 08-057R might be used in the heterosis breeding. As general combining ability (gca) e ects found signi cant negative and their perse performances were comparatively lower; therefore, these parents might be used as suitable parents to develop short duration hybrid variety. ese ndings are in accordance with Won & Yoshida 2000 Signi cant positive gca e ects was found in pollen parents RG-BU 08-002R (0.879**), RG-BU 08-005R (0.439*), RG-BU 08-006R (1.069**), RG-BU 08-007R (0.449*), RG-BU 08-013R (0.449*), RG-BU 08-016R (0.449*), RG-BU 08-034R (0.909**) and positive general combining ability e ects ofcmS parents IR 58025A (0.074**) and IR 68888A (0.346**). Perse performances revealed that among 21 parents (16 pollen parents and 5cmS parents) seven pollen parents RG-BU 08-002R (5.98 t/ha), RG-BU 08-005R (5.54 t/ha), RG-BU 08-006R (6.71 t/ha), RG-BU 08-007R (5.55 t/ha), RG-BU 08-013R (5.55 t/ha), RG-BU 08-016R (5.55 t/ha), RG-BU 08-034R (6.01 t/ha) and 2 cmS lines IR 58025A (2.40 t/ha) and IR 68888A (2.66 t/ha) were superior to others. ese facts indicated that among 21 parents these nine parents possessed more positive alleles for the increase of grain yield. Observed good general combinercmS lines for grain yield along with other yield contributing characters in rice. So among the male parents, RG-BU 08-002R, RG-BU 08-005R, RG-BU 08-006R, RG-BU 08-007R, RG-BU 08-013R, RG-BU 08-016R and RG-BU 08-034R were the best general combiner due to highly signi cant positive gca e ects. On the other hand RG-BU 08-025R (-2.141**, 2.96 t/ha), RG-BU 08-038R (-0.431*, 4.67 t/ha), RG-BU 08-046R (-0.341*, 4.76 t/ha), RG-BU 08-057R (-1.231*, 3.87 t/ha), and RG-BU 08-097R (-1.311*, 3.79 t/ha) as well ascmS parents IR 62829A (-0.154**, 2.16 t/ha) and BRRI 1A (-0.184**, 2.13 t/ha) showed highly signi cant negative general combining ability e ects found similar results while studying gca e ects in rice [18-20].

Estimation of speci c combining ability (SCA) e ects

e speci c combining ability e ects of the trait plant height is considered as an important character to select a hybrid. e crosses of IR58025A showed signi cant positive speci c combining ability e ects with RG-BU08-006R & RG-BU08-034R. As these crosses showed highly signi cant positive sca e ects and above average perse performances, might not be selected as suitable hybrid. e crosses of GAN46A also found signi cant positive sca e ects and above average perse performances with RG-BU08-007R, RG-BU08-018R & RG-BU08-105R. e crosses of IR68888A showed signi cant positive sca e ects and above average perse performances with RG-BU08-002R, RG-BU08-006R, RG-BU 08-018R and RG-BU08-016R which can be considered as good speci c combination for tallness. As the above crosses showed positive sca e ects which could be used as above average combinations for tall stature. ese results are in line with the ndings of. Good speci c combinations for tallness were evolved from high x high, general combiner parents. Low × above average general combiner parents produced above average speci c combination for tall plant height in the rest of the crosses also found similar ndings [13-15]. Out of 80 test crosses een crosses showed signi cant negative sca estimates for days to rst owering and sixteen crosses showed signi cant negative sca estimates for days to 80% owering. Out of 80 crosses twenty crosses showed signi cant negative sca estimates for days to maturity, where seven with IR 58025A, two with GAN46A, six with IR 62829A, two with IR 68888A and three with BRRI 1A. In all the cases it was observed that maximum number of crosses were found showing signi cant negative sca estimates with IR 58025A. e F_1s crosses of IR 58025A with seven restorer lines showed signi cant negative sca estimates for days to rst owering, six for days to 80% owering and seven for days to maturity (Tables 4,5).

Line / Testers	Plant height									
	IR 58025A		GAN 46A		IR 62829A		IR 68888A		BRRI 1A	
	Sij effect	mean	Sij effect	mean	Sij effect	mean GAN46A		IR 6*3.74 0 Td (GAN 46A500 l 8.c90 0 0 1 155.4		

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gca variances along with additive variance component for reproductive traits indicated the accessibility of additive gene action. Degree of dominance were found negative for most of traits which reveals that regression lines passing below the origin i.e., this character are responsible for over dominance. e linear non-signi cant relationship between female vs male indicates the reliability of the crosses to go through heterosis breeding. e contributions of lines were found signi cant, indicating preponderance of dominant genes among the lines with tester. e signi cant interaction of line x tester indicated higher estimates for sca variances. Four restorer lines showed signi cant negative e ects for days to 1st owering, 80% owering and days to maturity. ree pollen parents and one cm S line, showed signi cant positive gca e ects for pollen fertility while six pollen parents showed signi cant positive e ects for spikelets fertility but two pollen parents showed signi cant positive gca e ects for both panicle and stigma exertion rate. e estimated gca e ects of parents indicated that ve pollen parents contributed highly signi cant negative e ects for plant height which were responsible for dwar ng character. Fi een crosses showed signi cant negative sca estimates for days to rst owering, sixteen crosses for days to 80% owering and twenty crosses for days to maturity. Among 80 crosses y two crosses showed signi cant positive sca e ects along with above average perse performances for grain yield.

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