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# COMBINING ABILITY FOR YIELD AND ITS COMPONENTS IN BLACKGRAM (*VIGNA MUNGO* L. HEPPER)

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## ABSTRACT

**Combining ability analysis was done using 20 $F_1$s and 20 $F_2$ families obtained from a 5 x 5 diallel mating design for yield and its components, viz. clusters/plant, pods/plant, total dry matter, grain yield, harvest index, and 100-grain weight. Highly significant gca, sca and reciprocal variances were observed in both $F_1$ and $F_2$ generations for all the characters studied. The gca : sca variance ratio and the estimates of gca effects were similar in $F_1$ and $F_2$ generation for all the characters except for pods/plant. CO 4 and CO 5 were good general combiners for clusters/plant, total dry matter production, grain yield and 100-grain weight; UG 135 and UG 191 for high harvest index; and T 9 for clusters/plant.**

**Key words:** Blackgram, *Vigna mungo*, combining ability.

Low yield in blackgram may be attributed to the poor harvest index when compared to the cereal crops like wheat. Locally available varieties are high in dry matter production and low in harvest index, while the varieties developed in North India have high harvest index, but poor in dry matter production under Tamil Nadu conditions. An attempt has been made in the present investigation to explore the possibilities of combining these characters by studying the $F_1$ and $F_2$ generations of a 5 x 5 diallel.

## MATERIALS AND METHODS

Five parents, namely, CO 4, CO 5, UG 135, UG 191 and T 9, varying in dry matter production, harvest index, and their related components, were crossed in all possible combinations to make 20 crosses. Forty five entries comprising 20 $F_1$s, 20 $F_2$s and 5 parents were sown in randomised block design with three replications. Parents and $F_1$s were raised in single rows and $F_2$s in 10 rows each of 3 m length in each replication with the spacing of 45 cm between rows and 10 cm between plants. Observations were recorded on five random

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plants in hybrids and 50 plants in $F_2$s in each replication for five quantitative traits and harvest index calculated (Table 1). The replication mean values were utilised for statistical analysis. Combining ability analysis was done according to Method I, Model I of Griffing [1].

## RESULTS AND DISCUSSION

The differences among parents and hybrids were significant in respect of all the characters. Combining ability analysis showed highly significant gca and sca variances in both $F_1$ and $F_2$ generations for all characters, indicating the presence of additive as well as nonadditive gene effects in the parents and hybrids for these characters. However, the gca : sca variance ratio suggested predominance of additive gene action in respect of clusters/plant, total dry matter, grain yield/plant, harvest index, and 100-grain weight, and nonadditive gene action for pods/plant. Significant reciprocal differences were observed for all the characters in both generations, indicating the role of cytoplasmic genes in the control of these characters in this crop.

The gca estimates indicated that the parents CO 4 and CO 5 were good general combiners for grain yield, clusters/plant, pods/plant, total dry matter and 100-grain weight. T 9 was a good general combiner for grain yield, clusters/plant, pods/plant and harvest index, while UG 135 and UG 191 were good general combiners only for harvest

**Table 1. Desirable parents with their gca and per se performance in blackgram**

| Character | Generation | Parents with high gca and per se performance |
|---|---|---|
| Clusters/plant | $F_1$ | CO 4 (0.60, 12.70), CO 5 (1.63, 18.70), T 9 (0.93, 16.00) |
| | $F_2$ | CO 4 (0.40, 12.70), CO 5 (1.12, 18.70), T 9 (0.32, 16.00) |
| Pods/plant | $F_1$ | CO 5 (4.66, 48.70), T 9 (8.22, 50.70) |
| | $F_2$ | CO 4 (2.66, 42.00), CO 5 (1.87, 48.70), T 9 (1.65, 50.70) |
| Dry matter yield/plant (g) | $F_1$ | CO 4 (4.44, 27.80), CO 5 (5.18, 28.60) |
| | $F_2$ | CO 4 (4.37, 27.80), CO 5 (2.42, 28.60) |
| Grain yield/plant (g) | $F_1$ | CO 4 (1.33, 9.10), CO 5 (1.37, 10.10) |
| | $F_2$ | CO 4 (1.10, 9.10), CO 5 (0.55, 10.10) |
| Harvest index (%) | $F_1$ | UG 191 (0.19, 41.0), T 9 (0.12, 40.0) |
| | $F_2$ | UG 135 (0.22, 40.0), UG 191 (0.11, 41.0) |
| 100-grain weight (g) | $F_1$ | CO 4 (2.95, 5.39), CO 5 (1.99, 4.86) |
| | $F_2$ | CO 4 (2.91, 5.39), CO 5 (1.00, 4.86) |

Notes. Values in parentheses are gca and per se performance, respectively.

All gca values significant at 1% level.

**Table 2. Crosses with maximum sca effects in $F_1$ and $F_2$ generations for seed yield and their performance for other traits and gca effects of blackgram parents**

| Generation | Cross | Yield per plant (g) | Gca effects P1 | Gca effects P2 | Sca effects | Other characters with significant sca effects |
|---|---|---|---|---|---|---|
| $F_1$ | CO 4 x UG 135 | 12.75 | $1.33^{**}$ | $-1.56^{**}$ | $1.52^{**}$ | Harvest index |
| | CO 4 x T 9 | 16.75 | $1.33^{**}$ | 0.26 | $3.18^{**}$ | Clusters/plant, pods/plant, total dry matter |
| | CO 5 x UG 135 | 13.55 | $1.37^{**}$ | $-1.56^{**}$ | $2.28^{**}$ | Pods/plant, total dry matter |
| | CO 5 x T 9 | 14.90 | $1.37^{**}$ | 0.26 | $1.78^{**}$ | Pods/plant, total dry matter 100-grain weight |
| | UG 135 x UG 191 | 9.85 | $-1.56^{**}$ | $-1.42$ | $1.36^{**}$ | Pods/plant, total dry matter 100-grain weight |
| $F_2$ | CO 4 x UG 191 | 11.18 | $1.10^{**}$ | $-0.87^{**}$ | $2.63^{**}$ | Clusters/plant, pods/plant, total dry matter |
| | CO 4 x T 9 | 9.91 | $1.10^{**}$ | $-0.16$ | $0.65^{*}$ | Clusters/plant, total dry matter |
| | CO 5 x UG 135 | 7.91 | $0.55^{*}$ | $-0.61^{**}$ | $2.41^{**}$ | Clusters/plant, pods/plant, total dry matter, harvest index |

$^{*,**}$Significant at 5%, 1% levels, respectively.

index (Table 1). A multiple crossing programme involving these parents would offer good scope for improving yield by combining the total dry matter and harvest index. A good degree of correspondence between the gca estimates in $F_1$ and $F_2$ generations indicates the possibility of postponing the combining ability studies to $F_2$ generation to obtain more reliable information, where the problem of producing sufficient quantity of hybrid seeds is evident [2].

A perusal of the sca values and *per se* performance of the hybrids (Table 2) indicates that the crosses CO 4 x CO 5, CO 4 x T 9, CO 5 x UG 135, CO 5 x T 9, UG 135 x UG 191 and CO 4 x UG 191 produced superior and potential hybrids. The parents involved in these hybrids were either high x high (H x H) or high x low (H x L) with regard to gca effects except for one cross which involved L x L parents. In case of H x H gca crosses, there are possibilities of complementary epistatic effect acting in the direction of additive effects of the good combiners [2]. The crosses of H x L gca group with the expression of positive sca effects may be due to the dominant x recessive interaction, expected to produce desirable segregates [3]. In the case of L x L crosses, with high sca, nonadditive type of variation can be exploited by multiple crosses followed by intermating among desirable segregates.

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