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Inheritance Studies for Grain Yield and It's Attributes in Maize through Combining Ability Analysis

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Abstract **Original Research Article**

Present study was conducted during growing seasons 2018 and 2019 to explore the genetic makeup of five maize inbred lines: Elp-426, Elp-433, Elp-612, Elp-326 and Elp-780. Analysis of variance revealed highly significant differences for the quantitative traits like grain yield, cob length, rows per cob and number of grains per row. GCA was highly significant for cob length and rows per cob while significant for grain yield and number of grains per row. SCA was highly significant for grain yield, number of grains per row and rows per cob while it was significant for cob length. GCA / SCA ratio was greater than unity indicating that additive gene action had major contribution in the inheritance of these characters. Elp-433 was the best general combiner for grain yield, rows per cob and number of grains per row. Elp-426 and Elp-326 were good general combiners for grain yield and cob length. Elp-326 X Elp-780 was the best specific combination for grain yield, rows per cob and number of grains per row. Elp-426 X Elp-433 showed promise for all the metric traits studied. The crosses Elp-426 X Elp-780, Elp-433 X Elp-326, Elp-426 X Elp-612, Elp-612 X Elp-326 and Elp-433 X Elp-612 also exhibited worth regarding grain yield and some of its attributes. These findings clearly indicated that the experimental material had sufficient variability which can successfully be used to boost yield by gene pyramiding through recurrent selection.

Keywords: CAA, Inheritance, maize.

INTRODUCTION

It is challenging to feed the ever increasing human population. Although the yield of grain crops has been increased many folds over the past, still there is need to achieve sustained food production. Maize crop is one of the important cereals. It has highest yield potential [1]. Much of its potential has been explored during recent years by improving its genetics. It can be exploited further to increase its per acre yield. For this purpose a comprehensive knowledge of maize inheritance is crucial. Combining ability analysis is one of the commonly used tools to look in to the genetic behavior of the crop plants.

Both additive and non additive gene interactions have been reported by researchers like [2, 1, 3-10]. Such knowledge helps breeders in selecting genetically superior crop plants as well as the best breeding procedure. Present experiment was conducted to determine the genetic value of five maize inbred lines viz; Elp-426, Elp-433, Elp-612, Elp-326 and Elp-780.

MATERIAL AND METHODS

The experimental material was planted at Maize Breeding Sub Station Chharrapani (Murree) Pakistan. All possible crosses were made, harvested and were sown during next growing season on 25-03-2019. Data were recorded for grain yield, cob length, number of rows per cob and number of grains per row.

Analyses of variance were conducted for all the quantitative traits following [11] technique. All the parameters were highly significant (Table-1).

The analyses of general combining ability (GCA) and specific combining ability (SCA) were carried out using [12] technique, Method I model II.

RESULTS AND DISCUSSION:

Highly significant differences were observed for all the characteristics studied (Table-1). GCA mean squares were highly significant for cob length and rows per cob and significant for rest of the traits (Table-2). SCA mean squares were highly significant for grain

yield, rows per cob and number of grains per row and significant for cob length only. Reciprocal mean squares were highly significant for all the characters under investigation. Elp-433 was proved the best general combiner for grain yield, rows per cob and grains per row. Elp-426 and Elp-326 were good general combiners for grain yield and cob length only (Table-3).

Elp-326 X Elp-780 was the best specific combination for grain yield, rows per cob and grains per row. Elp-426 X Elp-433 showed promise for all the parameters under study (Table-4). The crosses Elp-426 X Elp-780, Elp-433 X Elp-326, Elp-426 X Elp-612, Elp-612 X Elp-326 and Elp-433 X Elp-612 also exhibited worth regarding grain yield and some of its attributes.

Some superior reciprocals like Elp-780 X Elp-433, Elp-780 X Elp-426, Elp-326 X Elp-426, Elp-326 X Elp-433, Elp-612 X Elp-426 and Elp-326 X Elp-612 were also noticed for grain yield and some of its attributes (Table-5). Both parents of the cross Elp-426X Elp-433 were good general combiners for grain yield and its related traits. Rest of the above crosses involved at least one good general combiner.

Table-1: Mean squares for grain yield, cob length, rows per cob and number of grains per row in 5x5 diallel cross in maize

SOV	df	Grain Yield	Cob Length	Rows per cob	Number of grains per row
Replications	1	10981	2.0833	0.18750	2.521
Crosses	24	3589331**	16.9585 **	5.35343 **	112.102**
Error	24	50361	0.3299	0.09635	0.332

*significant and ** highly Significant at 5 % and 1 % level, respectively.

Table-2: Combining ability mean squares for grain yield, cob length, rows per cob and grains per row in 5x5 diallel cross in maize

SOV	Df	Grain Yield	Cob Length	Rows per cob	Grains per row
GCA	4	8393653.788 *	71.99872449**	53.33429**	296.1079*
SCA	10	1943930.71**	6.73 *	2.25 **	59.41**
Reciprocals	10	1499251.78**	10.03**	2.81**	58.11**
Error	24	402890.33	2.64	0.77	2.66

*significant and ** highly Significant at 5 % and 1 % level, respectively.

Table-3: GCA effects for grain yield cob length, rows per cob and Number of grains per row in 5x5 diallel cross in maize

Inbred Lines	Grain Yield	Cob Length	Rows per cob	Number of grains per row
Elp-426	341.45	0.75	0.37	0.58
Elp-433	495.65	0.50	0.62	2.48
Elp-612	-220.90	-0.77	-0.43	0.03
Elp-326	55.45	0.65	0.22	0.33
Elp-780	-67.65	-1.13	-0.78	-3.42
SE	45.01	0.75	0.37	0.58

Table-4: SCA effects for grain yield, cob length, rows per cob and number of grains per row in 5x5 diallel cross in maize

Crosses	Grain Yield	Cob Length	Rows per cob	Number of grains per row
Elp-426 x Elp-433	1053.65	2.40	1.03	4.17
Elp-426 x Elp-612	494.20	-0.58	-0.17	3.62
Elp-426 x Elp-326	-377.40	-2.38	-0.57	-3.68
Elp-426 x Elp-780	854.95	0.40	0.43	3.07
Elp-433 x Elp-612	31.00	0.80	-0.17	0.22
Elp-433 x Elp-326	808.90	1.50	1.18	7.79
Elp-433 x Elp-780	-599.25	-1.85	-0.82	-4.96
Elp-612 x Elp-326	313.45	-0.73	0.23	0.24
Elp-612 x Elp-780	-365.95	-1.95	-0.77	-4.51
Elp-326 x Elp-780	1068.45	1.00	1.58	5.82

Table-5: Reciprocal Effects for grain yield, cob length, rows per cob and number of grains per row in 5x5 diallel cross in maize

Crosses	Grain Yield	Cob Length	Rows per cob	Number of Grains per row
Elp-433 x Elp-426	-42.25	0.00	0.00	3.00
Elp-612 x Elp-426	204.75	0.25	0.25	-1.00
Elp-612 x Elp-433	-308.25	3.38	2.00	8.00
Elp-326 x Elp-426	1141.00	3.38	2.00	8.00
Elp-326 x Elp-433	835.50	1.88	0.00	1.50
Elp-326 x Elp-612	170.00	4.00	2.00	5.63
Elp-780 x Elp-426	1156.25	2.13	1.00	9.13
Elp-780 x Elp-433	1647.25	-0.50	0.00	-0.38
Elp-780 x Elp-612	-692.50	-1.50	0.00	-3.88
Elp-780 x Elp-326	-893.75	-0.88	-1.00	-4.50

Table-6: Variance Components for grain yield, cob length, rows per cob and number of grains per row in 5x5 diallel cross in maize

Variance Components	Grain Yield	Cob Length	Rows per cob	Number of grains per row
Vg	-3645.89	-0.05	0.02	-0.54
Vs	917285.94	2.44	0.88	33.78
Vr	548180.72	3.69	1.02	27.73
Ve	402890.33	2.64	0.77	2.66

CONCLUSION

Table 2 revealed that both additive and non additive gene actions had their role in the inheritance of grain yield and its related characters as GCA and SCA mean squares were significant or highly significant for all the traits studied. This fact was also supported by variance components. However larger SCA components for grain yield and grains per row advocated non additive gene action for the physiology of these characters. Present findings are in accordance with [1, 3-10].

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