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ESTIMATION OF HETEROSIS, HETEROBELTIOSIS AND GENETIC EFFECT FOR YIELD AND SOME YIELD RELATED AGRONOMIC CHARACTERS IN CHILLI (*CAPSICUM ANNUUM* L.) *

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INTRODUCTION

Chilli (*Capsicum annuum* L) is one of the major condiments in Sri Lanka. Development of open pollinated and hybrid chilli varieties having high productivity and desirable qualities are identified as a key factor to increase the production of chilli within the country. Exploitation of heterosis has been recognized as a practical tool in providing a means of increasing yield and other economic traits of chilli. Additive genetic effect and dominant effect are important to decide the selection method that should be followed to fix the yield and yield related agronomic characters in the breeding program. Therefore, this study was conducted to study heterosis, heterobeltiosis and genetic effect for yield and some yield related agronomic characters in chilli.

MATERIALS AND METHODS

This experiment was conducted at the Field Crop Research and Development Institute (FCRDI), Mahailluppallama. Ten inbred lines (GK- 1, MICH 3-1, CAH 218-1, HB-1, MI Waraniya 1-1, CAH 36-1, KA 2-1, 985.3-1, MI Hot-1, MI 1-1) were used as parents to incorporate characters related to yield. F1 seeds were produced of the 12 crosses (MICH 3-1 x GK-1 , MICH 3-1 x CAH 218-1 , GK-1 x CAH 218-1 , HB-1 x MI Hot-1 , MI 1-1 x MI Waraniya 1-1 , MI 1-1 x GK-1 , MI 1-1 x MICH 3-1 , CAH 218-1 x CAH 36-1 , MI 1-1 x CAH 218-1 , MI 1-1 x KA 2-1 , MI 1-1 x 985.3-1 , MI 1-1 x MI Hot-1) through hand emasculation and pollination during *Yala* 2013. F1 hybrids and their parents were

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evaluated in the field under the Randomized complete block design during *Maha* 2013/14.

Agronomic characters were assessed based on the descriptors published by Department of Agriculture. Analysis of variance of the agronomic characters was done to find whether there is significant difference among hybrids and parents for tested characters. Mean separation was done using Duncan Multiple Range Test (DMRT). Heterosis and heterobeltiosis values for yield and other agronomic characters were calculated using the mean values of the yield and yield related agronomic characters according to Chaudhary *et al.* (2013).Significance (p=0.05) of the heterosis and heterobeltiosis values was tested using the t test explained by Wynne *et al.* (1970). Parents and chilli hybrids were analyzed to estimate the genetic components of means according to Chahal and Gosal (2002) by assuming that there is no non- allelic interaction for the characteristics that were tested in the experiment.

RESULTS AND DISCUSSION

Analysis of variance and mean separation showed significant difference among parents and crosses for the characters studied indicating the sufficient genetic variability, directional dominance and heterosis. The number of crosses, which indicated significant heterosis among the twelve crosses, were 6 for yield, 4 each for pod length and plant height, 9 for number of pods/ plant, 8 for canopy width, 2 for pod diameter and 1 for pericarp thickness (Table 1). The number of crosses, which indicated significant heterobeltiosis were 4 each for plant height and canopy width, 3 for yield, 7 for number of pods/ plant. None of the crosses exhibited significant heterobeltiosis for pod length, diameter and pericarp thickness. Significant heterosis observed for yield, number of pods per plant and pod length was high and was in varying proportion probably due to dominance gene effect rather than additive gene effect. The cross, MI 1-1 x MI Waraniya 1-1 showed highest mean performance and significant heterosis for the characters, yield, number of pods/plant and plant height indicating close agreement between mean performance and heterosis.

The top heterotic cross for the pod length, MICH 3-1 x CAH 218-1 had significant heterosis for yield, number of pods/per plant, plant height and canopy width. The cross combination, GK-1 x CAH 218-1 showed significant heterosis for

yield and number of pods/plant. The cross, MI 1-1 x MI Waraniya 1-1 exhibited significant heterosis and heterobeltiosis for number of pods/plant and the crosses, MICH 3-1 x CAH 218-1, MI 1-1 x MI Hot-1, MI 1-1 x GK-1 exhibited significant heterobetiosis for the same character. The cross MICH 3-1 x CAH 218-1 showed significant heterobeltiosis for yield, number of pods/plant, plant height and canopy width. The crosses, especially GK-1 x CAH 218-1, MICH 3-1 x CAH 218-1, MI 1-1 x MI Waraniya 1-1 heterotic for yield and most of the yield related characters like number of pods/plant, pod length, plant height and canopy width. Both additive and dominant gene action were found to play a role in the expression of the yield and tested agronomic characters.

Table 1. Number of hybrids and names of the hybrids showing significant heterosis and heterobeltiosis.

Characters	No of hybrids showing significant heterosis and heterosis percentage	No of hybrids showing significant heterobeltiosis and heterobeltiosis percentage
Yield (t/ha)	6	3
	MICH 3-1 x CAH 218-1, MI 1-1 x 985.3-1, MI 1-1 x MI Hot-1	
Number of pods per plant	9	7
	MI 1-1 x MI Waraniya 1-1, GK-1 x CAH 218-1, MICH 3-1 x CAH 218-1, MI 1-1 x GK-1, MI 1-1 x KA 2-1, MI 1-1 x 985.3-1, MI 1-1 x MI Hot-1	
Pod length (cm)	4	0
Pod diameter (mm)	2	0
Pericarp thickness (mm)	1	0
Plant height (cm)	4	4
	MICH 3-1 x CAH 218-1, MI 1-1 x MI Waraniya 1-1, CAH 218-1 x CAH 36-1	
Canopy width (cm)	8	2
	MICH 3-1 x GK-1, MICH 3-1 x CAH 218-1, MI 1-1 x GK-1, CAH 218-1 x CAH 36-1	

Note: Crosses listed under each character are hybrids showing both heterosis and heterobeltiosis

Numerical values of [d] greater than [a] for yield, plant height, number of pods/plants and pod length in most of the crosses indicate that the genes of those character are dispersed between parents resulting more segregates in the next

generation of selfing. Higher numerical value of [a] than [d] for pod diameter and pericarp thickness in the 10 crosses and 9 crosses respectively indicated the less possibility of segregates in the next generation of selfing. Negative [d] value for the pericarp thickness in the crosses, GK-1 x CAH 218-1, MI 1-1 x GK, MI 1-1 x CAH 218-1, MI 1-1 x KA 2-1 will provide an opportunity to extract chilli breeding lines with less pericarp thickness suitable for developing chilli varieties suitable for dry chilli production.

In the study, none of the crosses was consistent for all the tested characters in case of heterosis and heterobeltiosis. The hybrids namely, GK-1 x CAH 218-1, MICH 3-1 x CAH 218-1, MI 1-1 x MI Waraniya 1-1 which revealed higher positive heterosis for yield and yield contributing characters can be utilized to extract higher yielding breeding lines to develop pure lines with great vigour through generation advancement.

CONCLUSIONS

The cross MI 1-1 x MI Waraniya 1-1 can be utilized for further testing of adaptability to release as a chilli F1 hybrid. Since, both additive and dominant gene actions are presence, pedigree breeding with recurrent selection can be used to extract both dominant and additive genetic effect simultaneously in the improvement of chilli.

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