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A CASE STUDY

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Heterosis in bitter gourd (*Momordica charantia* L.)

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ABSTRACT : Twenty F_1 hybrids of bitter gourd in a diallel set involving five parents including reciprocals were evaluated to assess the extent of hybrid vigour in the yield contributing traits. Appreciable amount of heterosis was observed for all the characters under this study except node number of first female flower. The F_1 hybrids $P_5 \times P_3$ (Panruti local × VK-1 Priya), $P_4 \times P_2$ (MC -13 × Arka Harit) and $P_2 \times P_1$ (Arka Harit × CO-1) were observed best performing for yield and they showed 46.21, 29.31 and 14.30 per cent heterosis, respectively better parent Arka Harit (P_2).

KEY WORDS : Hetrosis, Bitter gourd, Monoecious

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Bitter gourd (*Momordica charantia* L.) is an important commercial cucurbit belonging to the family Cucurbitaceae, genus Momordica. The crop is extensively grown in China, Japan, South East Asia, tropical Africa and South America. In India, Karnataka, Maharashtra, Tamil Nadu and Kerala are the major bitter gourd growing states. Inspite of the potential economic and medicinal importance of the crop, due attention was not given towards a need based crop improvement programme. However, recently the cultivation of bitter gourd has become increasingly popular, because of the growing awareness of the antidiabetic property and nutritive value of the crop among the consumers. Due to the efforts of the many vegetable breeders, marked improvement in yield has been achieved and a good number of new varieties and hybrids have been developed. Heterosis is the superiority of F1over the mean of the parents or over the better parent (BP) or over the standard check (Hayes *et al.*, 1956) with respect to agriculturally useful traits. The primary objective of heterosis breeding is to achieve a quantum jump in yield and quality aspects of crop plants.

It is a monoecious and highly cross-pollinated crop in which a large amount of variation is observed in quantitative and qualitative characters. The exploitation of hybrid vigour in any crop depends on substantial heterosis for yield coupled with an economical method of producing hybrid seed. The heterosis reveals type of gene action involved and therefore, it helps in the selection of suitable breeding methodology and parameters, which are to be employed in crop improvement. However, several workers have demonstrated the existence of varying degrees of heterosis for yield and other traits. Pal and Singh (1946); Lal *et al*. (1976); Lawande and Patil (1989, 1990a and b); Singh and Joshi (1980); Thangamani and Pugalendhi (2012); and Ranpise *et al.* (1992); Sirohi and Choudhary (1978) and Chaudhari and Kale(1991a and b) have reported that the F_1 hybrids had high total yield over their parents in bitter gourd. Very little attention has so far been given for genetic improvement of this crop. The present experiment was undertaken to identify potential parental combinations that are likely to produce superior hybrids having qualities with high yield.

RESEARCH METHODS

The present study was undertaken on a diallel set of twenty F_1 hybrids including reciprocals involving five diverse parental lines of bitter gourd. They were CO-1 (P_1), ArkaHarit (P_2), VK-1 Priya (P_3), MC-13 (P_4) and Panruti local (P_5). All the 20 F_1 hybrids with five parents were grown in summer season in a Randomized Block Design with three replications. The crop was sown in rows 2m apart with spacing of 45 cm between plants. Observations were recorded from selected five plants for ten important characters. The heterosis was calculated as the percentage of F_1 performance in the favourable direction of its better parents as well as top parents for each character. The best parental lines were established individually for different characters based on their performance in the diallel.

RESEARCH FINDINGS AND DISCUSSION

Percentage of heterosis in F_1 hybrids varied form 0.32 (fruit length) to 61.23 (total yield/vine) over better parental values. Out of 20 F_1 hybrids, the heterotic effects over better parents were observed in ten crosses in days to first female flowering, six in node number of first female flower, fourteen crosses in days to fruit maturity, five in fruit length, fifteen in fruit girth, 8 in fruit diameter, 8 in fruit size index, 7 in number of fruits, 12 in single fruit weight and 6 in yield per vine. Highly significant differences were observed among the treatments.

Among the parents, Arka Harit was the earliest in days to first female flower opening and single fruit weight. The parent CO-1 performed better in traits like fruit length, fruit size index, number of fruits per vine and yield per vine. Panruti local gave earliest fruit maturity and node number of first female flower and highest fruit diameter appeared. The biggest fruit girth was recorded in MC-13. F_1 hybrids exhibiting higher percentage of heterosis when compared to their better parental lines for different traits included $P_2 \times P_1$ (-8.93) for days to first female flowering, $P_1 \times P_2$ (-9.49) for days to fruit maturity, $P_4 \times P_2$ (22.10) for fruit length, $P_3 \times P_2$ (15.32) for fruit girth, $P_1 \times P_2$ (20.38) for fruit diameter, $P_5 \times P_2$ (5.30) for single fruit weight and $P_5 \times P_3$ (46.21) for

Table 1 : Heterosis and superior F_1 combinations for 5 × 5 diallel analysis in bitter gourd

Sr. No.	Characters	Range of heterosis over better parent	Three top performing combinations with heterosis (% in parenthesis) over best check for different characters
1.	Days to first female flowering	-0.22 to -29.51	$P_2 \times P_1$ (-8.93)
			$P_2 \times P_3$ (-5.10)
			$P_1 \times P_4$ (-1.91)
2.	Node number of first female flower	-3.33 to -24.81	None
3.	Days to fruit maturity	-2.25 to -30.40	$P_1 \times P_2$ (-9.49)
4.	Fruit length (cm)	1.43 to 39.79	$P_4 \times P_2$ (22.10)
			$P_5 \times P_2$ (8.38)
5.	Fruit diameter (cm)	1.07 to 25.34	$P_1 \times P_2$ (20.38)
			$P_3 \times P_2$ (12.13)
			$P_4 \times P_2$ (11.03)
6.	Fruit girth (cm)	1.66 to 24.56	$P_5 \times P_2$ (15.32)
7.	Fruit size index (cm)	1.71 to 74.92	$P_5 \times P_2$ (26.32)
			$P_4 \times P_2$ (22.82)
8.	Number of fruits per vine	2.79 to 38.10	$P_5 \times P_3$ (34.54)
			$P_4 \times P_5$ (22.58)
			$P_4 \times P_2$ (13.69)
9.	Single fruit weight	1.13 to 49.44	$P_5 \times P_2$ (5.30)
			$P_4 \times P_2$ (2.48)
			$P_5 \times P_3$ (1.32)
10.	Yield per vine (g)	0.38 to 60.38	$P_5 \times P_3$ (46.21)
			$P_4 \times P_2$ (29.31)
			$P_2 \times P_1$ (14.30)

yield per vine in heterosis (Table 1).

Celine and Sirohi (1996) showed heterosis for vine length, days to first female flowering, fruit number and fruit length in the three hybrids in bitter gourd. Devadas (1993) reported that better parent heterosis for vine length, yield per vine, weight of first fruit, fruit length, node of first female flower. Vahab (1989) observed appreciable amount of heterosis percentage in F_1 hybrids over better parent in days to first female flowering, yield per vine and fruit per vine. Tiwari and Ram (1999) found the best performing hybrid showed 25.75 per cent heterosis over better parent. Richard *et al.* (1995) reported appreciable heterosis with regard to fruit weight and yield per vine in bitter gourd.

In view of the above results, which give enough support to our own results. This could be attributed to higher number of fruits, fruit length and single fruit weight. It can be concluded that heterosis breeding should be adopted as one of the most important breeding methods in bitter gourd and in this direction Panruti Local × VK-1 Priya and MC-13 × Arka Harit which gave 46.21 and 29.37 per cent higher yield over top parent Arka Harit need to be exploited on commercial scale through production of hybrid seeds of these two crosses.

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