

Original Research Article

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Heterosis Studies in Ridge Gourd [*Luffa acutangula* (Roxb.) L.]

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ABSTRACT

A study was carried out on heterosis for fruit yield and yield related traits in ridge gourd. Twenty eight F₁ hybrids were generated by half diallel (excluding reciprocals) mating design. These F₁ hybrids along with eight parents were evaluated in randomized block design with three replication at Horticulture farm, College of Agriculture, Bikaner and KVK farm, Bhartiya Krishi Vigyan Kendra, Fatehpur-Shekhawati, Sikar. The maximum positive heterosis was observed in the crosses maximum standard heterosis (85.29 %) followed by cross Jaipuri Long x Arka Sujath (81.85 %) in E₄ whereas maximum heterobeltilosis Jaipuri Long x Swarna Manjari depicted (63.82 %) in E₄ followed by cross Swarna Uphar x Jaipuri Long (40.58 %) for total fruit yield per vine.

Keywords

Ridge gourd, Yield, Diallel, Heterosis, Hybrids.

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Introduction

Ridge gourd [*Luffa acutangula* (Roxb.)L.] is considered as one of the most important cucurbitaceous vegetable crops both nutritionally and economically. Its tender fruits are well known for culinary vegetable in India with good nutritive value and high yield potential, which are rich in vitamin A, vitamin C and iron (Yawalkar, 2004) and have certain medicinal uses too. Hayes and Jones (1916) were the earliest investigators to export heterosis in cucurbits. The different size of fruits indicates about its wide genetic variability (Irulappan, 1992). For its being a monoecious and essentially cross pollinated crop, it has ample scope for successful

exploitation of hybrid vigour. Aiming, this present investigation was undertaken with an objective to select elite parental line which can be best utilized for hybridization programmes yielding best performing hybrids for commercial cultivation in India as there is still a least availability of varieties and hybrids of this crop.

Materials and Methods

The present investigation was carried out during summer season and rainy season (2011) at Horticulture farm, College of Agriculture, Bikaner and KVK farm, Bhartiya

Krishi Vigyan Kendra, Fatehpur-Shekhawati, Sikar. The experimental material for the present study consisted of eight diverse genotypes *viz.*, Pusa Nasdar, Swarna Uphar, Swarna Manjari, AHRG-1, Salumber Long, Jaipuri Long, Arka Sujath and Arka Sumeet. These eight genotypes were crossed in all possible combinations excluding reciprocals during summer season (2011) to produce F₁'s seed by hand pollination. Eight parents and their 28 crosses were tested in randomized block design (RBD) with three replication and four environments, created by two different date(s) of sowing (5th and 25th July, 2011) at two different location (Bikaner and Fatehpur - Shekhawati, Sikar). Observations were recorded on five randomly selected plants from each treatment for fruit yield, yield related traits and quality traits *viz.*, number of node at which first female flower appears, days to opening of first female flower, days to first fruit harvest, number of fruits per vine, fruit length (cm), fruit weight (g), total fruit yield per vine (kg) and crude fiber content (%) at harvest. The heterosis over better and top parent was estimated for these traits in each environment as well as over the environments.

Results and Discussion

Earliness, which is considered as one of the most important parameters in hybrids was decided upon as it's indicated by number of node at which first female flower appears, days to opening of first female flower and days to first fruit harvest (Table 1 and 2). The best cross, which gave highest performance over mid parent in relation to earliness was found in cross Swarna Uphar x Salumber Long (-26.18%) in E₁, Pusa Nasdar x Swarna Uphar (-27.19%) in E₂ and Pusa Nasdar x Swarna Uphar (-24.62%) in E₄ for number of node at which first female flower appears; Swarna Manjari x Arka Sujath (-25.71 %) in E₁, Salumber Long x Arka Sumeet (-24.20 %) in E₂, Swarna Uphar x Arka Sumeet (-

24.26%) in E₃ and Swarna Uphar x Arka Sumeet (-13.35) in E₄ for days to opening of first female flower and Swarna Manjari x Arka Sujath (-22.95%) in E₁, Salumber Long x Arka Sumeet (-20.79%) in E₂ and Pusa Nasdar x Arka Sumeet (-11.61%) in E₄ for days to first fruit harvest. Significant maximum negative heterobeltiosis over their better parent was recorded in the cross Swarna Uphar x Salumber Long (-27.12%) in E₁, Swarna Uphar x Salumber Long (-33.37%) in E₂, Swarna Uphar x AHRG-1 (-20.52%) in E₃ and Pusa Nasdar x Swarna Uphar (-29.55) in E₄ for number of node at which first female flower appears; Swarna Manjari x Arka Sujath (-31.24%) in E₁, Swarna Uphar x Arka Sumeet (-28.24%) in E₂, Swarna Uphar x Arka Sumeet (-36.05%) in E₃ and Pusa Nasdar x Arka Sumeet (-22.02%) in E₄ for days to opening of first female flower and cross Swarna Manjari x Arka Sujath (-28.27%) in E₁, Swarna Uphar x Arka Sumeet (-24.12%) in E₂ and Pusa Nasdar x Arka Sumeet (-19.22%) in E₄ for days to first fruit harvest. Naliyadhara *et al.*, (2007) reported heterosis for earliness in sponge gourd. Similar type of appreciable heterosis for number of node at which first female flower appears, days to opening of first female flower and days to first fruit harvest in ridge gourd have also been found by Karmakar *et al.*, (2014) and Poshia *et al.*, (2015).

(Table 1 and 2) indicate that number of fruit per vine, fruit length and fruit weight are the direct component of fruit yield in ridge gourd. For fruit length Jaipuri Long x Swarna Manjari (76.10%) in E₁, Pusa Nasdar x Arka Sujath (37.66%) in E₃ and AHRG-1 x Arka Sumeet (33.91%) in E₄ had highest heterosis. F₁ hybrid Swarna Manjari x Arka Sumeet (33.97%) in E₁, AHRG-1 x Swarna Manjari (32.26%) in E₂, Pusa Nasdar x Jaipuri Long (14.82%) in E₃ and Swarna Uphar x Arka Sujath (20.53%) in E₄ exhibited maximum heterosis for fruit weight.

Table.1 Range of heterosis of different character under different environmental condition of 28 F₁'s of ridge gourd

Characters	E1		E2		E3		E4	
	Mid parent	Better parent	Mid parent	Better parent	Mid parent	Better parent	Mid parent	Better parent
No. of node at which first female flower appears	-26.18 to 62.44	-27.12 to 39.27	-27.19 to 31.96	-33.37 to 23.67	NS	-20.52 to 40.41	-24.62 to 23.26	-29.55 to 20.53
Days to Opening of first female flower	-25.71 to 18.88	-31.34 to 15.41	-24.20 to 26.90	-28.24 to 18.10	-24.26 to 17.68	-36.05 to 15.81	-13.35 to 25.25	-22.02 to 24.31
Days to first fruit harvest	-22.95 to 18.42	-28.27 to 16.78	-20.79 to 24.51	-24.12 to 15.74	NS	NS	-11.61 to 22.43	-19.22 to 19.66
No. of fruits per vine	NS	NS	-63.69 to 37.39	NS	-53.35 to 73.88	-68.13 to 26.74	-29.66 to 92.78	-47.80 to 73.38
Fruit length (cm)	-24.82 to 76.10	-33.56 to 72.87	NS	NS	-24.32 to 37.66	-33.85 to 35.32	-31.95 to 33.91	-36.90 to 28.15
Fruit weight (g)	-13.46 to 33.97	-19.34 to 29.33	-12.29 to 32.26	-21.50 to 30.28	-13.09 to 14.82	NS	-15.82 to 20.53	NS
Total fruit yield per vine (kg)	-60.10 to 31.72	NS	-54.60 to 54.82	-63.67 to 33.33	-53.26 to 81.58	-70.06 to 40.58	-21.92 to 85.29	-40.69 to 63.82
Crude fiber content (%)	-17.03 to 42.32	NS	-30.85 to 50.54	-34.28 to 44.00	-19.13 to 46.85	-22.35 to 36.57	-29.08 to 41.19	-34.41 to 40.77

E₁: Bikaner, 5 July 2011; E₂: Fatehpur Shekhawati, 5 July 2011; E₃: Bikaner, 25 July 2011 and E₄: Fatehpur Shekhawati 25, July, 2011

Table.2 The best cross selected on the basis of best performing parents for different character under different environments

Characters	E1		E2		E3		E4	
	Cross	Heterosis (%)	Cross	Heterosis (%)	Cross	Heterosis (%)	Cross	Heterosis (%)
No. of node at which first female flower appears	Swarna Uphar x Salumber Long	-26.18 *	Pusa Nasdar x Swarna Uphar	-27.19**	-	-	Pusa Nasdar x Swarna Uphar	-24.62 **
Days to Opening of first female flower	Swarna Manjari x Arka Sujata	-25.71 **	Salumber Long x Arka Sumeet	-24.20 **	Swarna Uphar x Arka Sumeet	-24.26 **	Swarna Uphar x Arka Sumeet	-13.35 **
Days to first fruit harvest	Swarna Manjari x Arka Sujath	-22.95**	Salumber Long x Arka Sumeet	-20.79 **	-	-	Pusa Nasdar x Arka Sumeet	-11.61 **
No. of fruits per vine	-	-	AHRG-1 x Jaipuri Long	37.39 **	Jaipuri Long x Arka Sujath	73.88 **	Jaipuri Long x Swarna Manjari	92.78 **
Fruit length (cm)	Jaipuri Long x Swarna Manjari	76.10 **	-	-	Pusa Nasdar x Arka Sujath	37.66 **	AHRG-1 x Arka Sumeet	33.91 **
Fruit weight (g)	Swarna Manjari x Arka Sumeet	33.97 **	AHRG-1 x Swarna Manjari	32.26 **	Pusa Nasdar x Jaipuri Long	14.82 *	Swarna Uphar x Arka Sujath	20.53 *
Total fruit yield per vine (kg)	Jaipuri Long x Arka Sujath	31.72*	Jaipuri Long x Arka Sujath	54.82 **	Jaipuri Long x Arka Sujath	81.58 **	Jaipuri Long x Swarna Manjari	85.29 **
Crude fiber content (%)	Swarna Manjari x Arka Sumeet	42.32*	Pusa Nasdar x Arka Sumeet	50.54**	Salumber Long x Jaipuri Long	46.85**	Salumber Long x Arka Sujath	41.19**

* and ** significant at 5 and 1 per cent level, respectively

E₁: Bikaner, 5 July 2011; E₂: Fatehpur, Shekhawati 5 July 2011; E₃: Bikaner, 25 July 2011 and E₄: Fatehpur Shekhawati 25, July, 2011

Cross like AHRG-1 x Jaipuri Long (37.39%) in E₂, Jaipuri Long x Arka Sujath (73.88%) in E₃ and Jaipuri Long x Swarna Manjari (92.78%) in E₄ was found to be heterotic combination for number of fruit per vine. For total fruit yield per vine, F₁ hybrid Jaipuri Long x Arka Sujath (31.72%) in E₁, Jaipuri Long x Arka Sujath (54.82%) in E₂, Jaipuri Long x Arka Sujath (81.58%) in E₃ and Jaipuri Long x Swarna Manjari (85.29%) in E₄. For fruit length significant positive heterobeltiosis was observed for Jaipuri Long x Swarna Manjari (72.87%) in E₁, Pusa Nasdar x Arka Sujath (35.32%) in E₃ and AHRG-1 x Arka Sumeet (28.15%) in E₄; whereas Swarna Manjari x Arka Sumeet in E₁ and AHRG-1 x Swarna Manjari in E₂ exhibited higher heterobeltiosis for fruit weight. For number of fruits per vine AHRG-1 x Swarna Manjari (26.74%) in E₃ and Jaipuri Long x Swarna Manjari (73.38%) in E₄ have highest heterobeltiosis. F₁ hybrids Swarna Uphar x Jaipuri Long (33.33%) in E₂, Swarna Uphar x Jaipuri Long (40.58%) in E₃ and Jaipuri Long x Swarna Manjari (63.82%) in E₄ exhibited highest heterobeltiosis and some other crosses like AHRG-1 x Swarna Uphar in E₂, Swarna Uphar x Jaipuri Long in E₂ and E₃, Jaipuri Long x Swarna Manjari, Swarna Uphar x Arka Sujath, Pusa Nasdar x Jaipuri Long, Pusa Nasdar x Swarna Manjari in E₄ exhibited significant positive heterobeltiosis for total fruit yield per vine. These results are conformity with the studies of Tyagi *et al.*, (2010), Anand (2012), Reddy *et al.*, (2013), Karmakar *et al.*, (2014), Koppad *et al.*, (2015) and Poshia *et al.*, (2015) who have reported a positive and significant standard heterosis for fruit length and total fruit yield found in ridge gourd.

Occurrence of good crude as indicator its good quality of fruits was also evident by positive heterosis as indicated in Table 1 and 2. The maximum positive heterosis was observed for crude fiber in tender fruits in

crosses like Swarna Manjari x Arka Sumeet (42.32%) in E₁, Pusa Nasdar x Arka Sumeet (50.54%) in E₂, Salumber Long x Jaipuri Long (46.85%) in E₃ and Salumber Long x Arka Sujath (41.19%) in E₄ was reflected for crude fiber in tender fruits. Whereas cross Pusa Nasdar x Arka Sumeet (44.00%) in E₂, Salumber Long x Swarna Manjari (36.57%) in E₃ and Salumber Long x Arka Sujath (40.77%) in E₄ exhibited significant positive heterobeltiosis for crude fiber (%) in tender fruits.

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