Evaluation of F₁ hybrids of pumpkin (*Cucurbita moschata* Duch. ex Poir) for yield and quality

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ABSTRACT

An investigation was carried out to study the performance of 36 hybrids of pumpkin (*Cucurbita moschata* Duch. ex Poir) through Line x Tester mating design. Observations were recorded on the traits, viz., vine length, days to first female flower appearance, node number for first female flower appearance, sex ratio, days to first harvest, fruit number per vine, fruit weight, flesh thickness and fruit yield per vine, besides quality traits such as total carbohydrate content, total carotenoid content and crude fibre content in the fruit. Among the 36 hybrids of pumpkin studied, the cross 'Kasi Harit x Avinashi Local' excelled in yield per vine, followed by the crosses 'Vadhalagundu Local x CO-2' and 'Narendra Uphar x CO-2', respectively. Thus, first generation hybrids can be well-utilized for exploiting hybrid vigour to achieve improved quality.

Key words: Hybrids, Pumpkin, Evaluation, Line x tester

INTRODUCTION

Pumpkin *(Cucurbita moschata* Duch. ex Poir*)* originated in Central Mexico and is cultivated in the tropical and subtropical regions of the world. It is an important cucurbitaceous vegetable crop of India, constituting a principal ingredient in several Indian dishes. Pumpkin has received little attention in crop improvement compared to other cucurbitaceous vegetables. In pumpkin, the major problem is its large-sized fruits (4-5kg each). This is not overly preferred by the present nuclear families of three to four members. Further, with increase in number of such families recently in India, customers prefer to buy only whole fruits of medium-size pumpkins, instead of cut pieces. Further, small fruits are easily packed and transported, without any damage. Therefore, developing pumpkin hybrids with small-to medium-sized fruits (2-3kg) is essential. The present study was undertaken to evaluate F₁ hybrids for yield and quality for this purpose.

MATERIAL AND METHODS

The investigation was carried out at Department of Vegetable Crops, Horticulture College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, during 2009-10, with 36 F₁ hybrids (obtained by crossing 12 lines and 3 testers through line x tester mating design) along with the standard check, MPH-1, from Mahyco Seeds (P)

Ltd. Field experiments with the hybrids were laid out in Randomised Block Design, with three replications and seven plants per replication at a spacing of 2.5x2.5m². Recommended package of practices of TNAU was followed to grow a successful crop of pumpkin (Anon, 1985). Observations were recorded in five randomly selected plants in each replication on important quantitative traits, viz., vine length (m), days to first female flower appearance, node number for first female flower appearance, sex ratio, days to first harvest, fruit number per vine, fruit weight (kg), flesh thickness (cm) and fruit yield per vine (kg) besides quality traits such as total carbohydrate content (g/100g) (Hedge and Hofreiter, 1962), total carotenoid content (mg/100g) (Roy, 1973) and crude fibre content of the fruit (%) (Chopra and Kanwar, (1976). Statistical analysis of data was done to estimate *per se* values and degree of significance of various traits (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

In Pumpkin hybrids exhibited significant differences for all the characters under study for growth, yield and quality, thus offering scope for selecting high-yielding hybrids with good quality traits. Results of *per se* performance of hybrids are presented in Tables 1 and 2. The *sca* effect of a hybrid denotes deviation from performance prediction based on *gca* of the parents (Allard, 1960). The *sca* effect seen is

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due to dominance, epistasis and environmental influence. Under certain favourable conditions, all the non-additive gene functions may be triggered and may result in high *sca* effect and mean value of a responding hybrid. Thus, evaluation of a hybrid for high *per se* and *sca* effect is also an important criterion. Hybrids with high *per se* and *sca* effect were evaluated for selecting the best hybrids. The *gca* and *sca* values of parents and hybrids are presented in Tables 3 and 4, respectively.

Vine length is an important parameter for obtaining high fruit yield in crops like the pumpkin. Among the 36

hybrids of pumpkin studied, the cross 'Ashoka Farm Aids x CO-2', followed by 'Karamadai Local x Avinashi Local' and 'Virudhachalam Local x Avinashi Local' exhibited high *sca* and mean performance for vine length. Sharma *et al* (1993) recorded similar results in bitter gourd in the cross 'Pocha Seed x PSPL'. In these crosses, the parents, Ashoka Farm Aids, Karamadai Local, Virudhachalam Local and the testers CO-2 and Avinashi Local exhibited good general combing ability for vine length. A predominant role of non-additive gene action for vine length in pumpkin was reported by Sirohi and Ghorui (1993) and Nisha (1999).

Table 1. Mean performance of F_1 hybrids of pumpkin for growth parameters

Hybrid	Vine length (m)	Days to 1st female flower appearance	Node number of female flower appearance	Sex ratio	Days to first harvest	No. of fruits per vine
Pusa Vishwas x Arka Suryamukhi	2.78	52.87	16.12	18.50	120.75	2.62
Pusa Vishwas x Avinashi Local	3.39	52.62	17.75	19.65	127.62	1.37
Pusa Vishwas x CO-2	4.52	50.87	19.62	19.21	125.87	1.25
Punjab Samrat x Arka Suryamukhi	2.88	48.12	19.87	17.85	126.50	3.62
Punjab Samrat x Avinashi Local	3.57	49.50	22.75	19.35	132.37	4.25
Punjab Samrat x CO-2	4.65	47.12	21.75	19.60	134.25	3.37
Narendra Abhushan x Arka Suryamukhi	5.06	45.87	20.62	26.38	107.50	2.50
Narendra Abhushan x Avinashi Local	3.31	47.00	22.87	29.90	104.37	1.62
Narendra Abhushan x CO-2	5.64	46.62	17.00	25.88	105.75	2.87
Narendra Uphar x Arka Suryamukhi	3.71	49.75	21.25	19.83	107.87	1.37
Narendra Uphar x Avinashi Local	2.38	47.37	23.50	19.97	107.12	2.50
Narendra Uphar x CO-2	2.57	48.00	21.12	19.31	106.37	3.37
Ambili x Arka Suryamukhi	3.64	49.87	20.00	24.97	110.62	2.25
Ambili x Avinashi Local	3.27	51.00	21.87	23.95	112.00	2.00
Ambili x CO-2	5.21	46.12	21.37	23.10	115.75	2.37
Virudhachalam Local x Arka Suryamukhi	5.06	50.00	24.62	28.45	128.75	1.37
Virudhachalam Local x Avinashi Local	6.39	56.37	23.87	28.85	134.25	1.12
Virudhachalam Local x CO-2	3.57	52.62	23.62	26.38	130.87	1.62
Chakor x Arka Suryamukhi	5.51	55.75	22.75	19.80	119.87	3.37
Chakor x Avinashi Local	4.24	52.75	24.87	20.21	105.87	3.12
Chakor x CO-2	4.25	48.50	20.87	19.85	112.62	4.37
Ashoka Farm Aids x Arka Suryamukhi	3.71	46.75	25.62	20.15	122.75	2.87
Ashoka Farm Aids x Avinashi Local	7.25	48.87	23.62	19.35	104.75	3.50
Ashoka Farm Aids x CO-2	8.55	52.00	23.50	20.01	104.12	2.87
Vadhalagundu Local x Arka Suryamukhi	3.31	45.50	20.75	18.12	103.87	4.25
Vadhalagundu Local x Avinashi Local	2.89	46.75	20.87	19.23	105.62	3.87
Vadhalagundu Local x CO-2	4.36	43.75	15.37	16.30	100.62	8.50
Karamadai Local x Arka Suryamukhi	4.17	46.62	22.87	19.23	107.12	4.25
Karamadai Local x Avinashi Local	6.27	45.25	22.37	19.45	117.12	5.50
Karamadai Local x CO-2	3.77	46.75	21.12	19.80	111.00	3.87
Karwar Local x Arka Suryamukhi	3.50	50.37	23.25	20.95	120.87	2.62
Karwar Local x Avinashi Local	5.31	54.50	24.75	21.75	114.75	2.87
Karwar Local x CO-2	5.53	47.87	23.00	19.95	107.87	2.87
Kasi Harit x Arka Suryamukhi	3.79	44.62	22.12	18.91	109.12	3.12
Kasi Harit x Avinashi Local	5.81	42.00	13.87	13.31	101.75	7.37
Kasi Harit x CO-2	4.97	45.87	22.00	18.75	105.00	4.12
MPH-1	6.13	51.25	22.62	20.04	136.50	5.37
Mean	4.41	48.78	21.47	21.00	114.26	3.19
SEd	0.11	0.88	0.75	0.68	2.47	0.38
CD (*P=0.05*)	0.22	1.78	1.52	1.38	4.96	0.76

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Table 2. Performance of pumpkin hybrids for yield and quality

Hybrid	Fruit weight (kg)	Flesh thickness (cm)	Total carbohydrate content (g per 100 g)	Total carotenoid content (mg per 100 g)	Crude fibre content (%)	Fruit yield per vine (kg)
Pusa Vishwas x Arka Suryamukhi	3.60	2.43	0.53	0.98	1.26	9.33
Pusa Vishwas x Avinashi Local	4.45	2.08	1.03	0.88	0.64	5.83
Pusa Vishwas x CO-2	4.16	2.62	0.76	0.77	1.02	5.29
Punjab Samrat x Arka Suryamukhi	3.57	2.72	1.03	0.92	0.85	10.10
Punjab Samrat x Avinashi Local	3.76	2.98	1.73	1.31	0.89	13.44
Punjab Samrat x CO-2	3.06	1.91	1.08	0.71	0.79	6.43
Narendra Abhushan x Arka Suryamukhi	2.57	2.22	1.17	0.98	0.98	6.42
Narendra Abhushan x Avinashi Local	2.78	2.65	1.25	1.02	0.88	4.49
Narendra Abhushan x CO-2	4.11	3.05	1.20	0.90	1.17	11.02
Narendra Uphar x Arka Suryamukhi	3.27	2.18	1.11	0.82	0.99	4.70
Narendra Uphar x Avinashi Local	3.71	2.66	2.11	1.37	0.68	9.26
Narendra Uphar x CO-2	4.08	2.10	1.14	0.96	1.19	13.74
Ambili x Arka Suryamukhi	4.74	3.07	1.13	0.84	1.00	10.61
Ambili x Avinashi Local	3.76	2.57	1.52	1.17	1.03	7.54
Ambili x CO-2	4.07	2.67	0.51	0.44	0.79	10.01
Virudhachalam Local x Arka Suryamukhi	4.51	3.08	1.44	0.95	1.01	6.92
Virudhachalam Local x Avinashi Local	4.59	3.01	1.66	1.30	0.95	6.16
Virudhachalam Local x CO-2	4.09	2.98	1.19	0.85	0.89	6.74
Chakor x Arka Suryamukhi	3.60	3.40	1.15	1.01	1.04	10.24
Chakor x Avinashi Local	4.41	2.92	1.98	1.27	0.87	12.18
Chakor x CO-2	4.18	2.83	1.55	1.15	0.93	14.00
Ashoka Farm Aids x Arka Suryamukhi	4.35	3.42	1.36	0.91	0.72	8.70
Ashoka Farm Aids x Avinashi Local	3.35	3.52	1.79	1.40	1.30	10.30
Ashoka Farm Aids x CO-2	3.73	2.53	1.03	0.89	0.96	6.92
Vadhalagundu Local x Arka Suryamukhi	2.50	1.71	1.47	1.22	0.87	8.35
Vadhalagundu Local x Avinashi Local	2.58	1.73	2.08	1.78	0.82	6.23
Vadhalagundu Local x CO-2	1.94	3.22	2.56	5.10	0.64	17.51
Karamadai Local x Arka Suryamukhi	3.32	2.80	1.95	1.53	0.75	9.46
Karamadai Local x Avinashi Local	2.39	2.48	2.93	2.11	0.92	10.03
Karamadai Local x C- 2	3.02	3.00	1.65	1.30	1.31	9.21
Karwar Local x Arka Suryamukhi	3.66	1.93	1.83	1.60	1.25	6.67
Karwar Local x Avinashi Local	2.66	2.50	3.05	3.24	0.93	8.77
Karwar Local x CO-2	3.21	2.47	3.13	2.80	0.86	5.65
Kasi Harit x Arka Suryamukhi	2.09	2.46	2.54	2.16	1.17	6.00
Kasi Harit x Avinashi Local	2.22	3.55	3.07	3.57	0.77	18.01
Kasi Harit x CO-2	2.40	2.28	2.88	2.68	1.05	8.25
MPH-1	3.01	2.38	1.80	3.25	1.32	9.17
Mean	3.46	2.66	1.65	1.46	0.94	9.04
SEd	0.16	0.24	0.04	0.06	0.04	0.21
CD (*P=0.05*)	0.33	0.49	0.08	0.13	0.08	0.42

Days taken to first female flower appearance is considered as one of the essential criteria for selecting for earliness in hybrids. Among the 36 pumpkin crosses studied, the hybrid 'Kasi Harit x Avinashi Local' was identified as the best. However, the female parent, 'Kasi Harit', only had favorable negative *gca* value. Neeraj Sharma *et al* (2002) recorded similar results in bottle gourd. *Per se* and *sca* performance for node number for first female flower appearance in the 36 crosses was favorable in 'Kasi Harit x Avinashi Local', followed by 'Vadhalagundu Local x CO-2' and 'Pusa Vishwas x Arka Suryamukhi'. Further it was

also observed that the female parent, Vadhalagundu Local, also contributed to development of crosses with favourable, and negative and significant *sca,* for this trait. Similar results of earliness in muskmelon were recorded in the hybrids 'Pusa Madhuras X IIHR-615-5-2' and 'RM-43 x Durgapur Madhu' by Aravindakumar *et al* (2005).

Selection of hybrid combinations in cucurbits with low sex ratio is preferable to get high fruit set and high yield. Among the 36 pumpkin hybrids under study, hybrid 'Kasi Harit x Avinashi Local' followed by 'Vadhalagundu Local x CO-2' recorded the lowest mean, coupled with negative

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Table 3. Estimation of general combining ability (gca) effects of parents for various traits in pumpkin

Source	Vine length	Days to 1st female flower appearance	Node no. for 1st female flower appearance	Sex ratio	Days to 1st harvest	No. of fruits per vine	Fruit weight	Flesh thickness	Total carbohydrate content	Total carotenoid content	Crude fiber content	Fruit yield per vine
Line												
Pusa Vishwas	-0.85 **	3.35**	-3.60**	-1.89 **	10.21**	-1.38 **	0.61 **	-0.28 **	-0.88 **	-0.59 **	0.03	-2.20 **
Punjab Samrat	-0.71 **	-0.53	0.02	-2.07 **	16.63**	0.62 **	0.01	-0.12	-0.38 **	-0.49 **	-0.11 **	0.97 **
Narendra Abhushan	0.26 **	-2.28**	-1.52**	6.38 **	-8.54**	-0.80 **	-0.30 **	-0.02	-0.45 **	-0.50 **	0.06 **	-1.70 **
Narendra Uphar	-1.52 **	-0.40	0.32	-1.30 **	-6.88**	-0.72 **	0.23 **	-0.35 **	-0.20 **	-0.42 **	0.00	0.22 **
Ambili	-0.37 **	0.18	-0.43	3.00 **	-1.33	-0.92 **	0.73 **	0.11	-0.60 **	-0.65 **	-0.01	0.37 **
Virudhachalam Local	0.60 **	4.22**	2.61**	6.89 **	18.17**	-1.76 **	0.94 **	0.37 **	-0.23 **	-0.44 **	0.00	-2.41 **
Chakor	0.26 **	3.56**	1.40**	-1.05 **	-1.63	0.49 **	0.61 **	0.39 **	-0.09 **	-0.33 **	-0.00	3.13 **
Ashoka Farm Aids	2.09 **	0.43	2.82**	-1.17 **	-3.88**	-0.05	0.35 **	0.50 **	-0.26 **	-0.40 **	0.04 *	-0.37 **
Vadhalagundu Local	-0.89 **	-3.44**	-2.43**	-3.12 **	-11.04**	2.03 **	-1.12 **	-0.44 **	0.38 **	1.23 **	-0.17 **	1.68 **
Karamadai Local	0.33 **	-2.61**	0.69**	-1.51 **	-2.67*	1.41 **	-0.55 **	0.10	0.52 **	0.18 **	0.04 *	0.55 **
Karwar Local	0.37 **	2.14**	2.23**	-0.12	0.08	-0.34 *	-0.28 **	-0.36 **	1.01 **	1.08 **	0.06 **	-1.99 **
Kasi Harit	0.45 **	-4.61**	-2.10**	-4.02 **	-9.13**	1.41 **	-1.22 **	0.10	1.17 **	1.34 **	0.05 *	1.74 **
SEd	0.02	0.39	0.33	0.29	1.18	0.16	0.06	0.09	0.01	0.02	0.01	0.03
Testers												
Arka Suryamukhi	-0.48 **	0.06	0.11	0.09	-1.30*	-0.28 **	0.02	-0.04	-0.26 **	-0.31 **	0.04 **	-0.89 **
Avinashi Local	0.10 **	0.72**	0.48**	0.24	-0.22	0.05	-0.07 *	0.06	0.36 **	0.23 **	-0.06 **	0.34 **
CO-2	0.39 **	-0.78**	-0.59**	-0.33 *	-1.08	0.23 **	0.05	-0.02	-0.10 **	0.08 **	0.02	0.55 **
SEd	0.01	0.19	0.16	0.14	0.59	0.08	0.03	0.04	0.009	0.01	0.009	0.01

*, **Significant at 5% and 1% level, respectively

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Table 4. Estimation of specific combining ability (sca) effects of crosses for various traits in pumpkin

Hybrid	Vine length	Days to 1st male flower appearance	Node no. for 1st female flower appearance	Sex ratio	Days to 1st harvest	fruit no. per vine	Fruit weight	Flesh thickness	Total carbohydrate content	Total carotenoid content	Crude fiber content	Fruit yield per vine
Pusa Vishwas x Arka Suryamukhi	-0.30 **	0.69	-1.82**	-0.71	-5.55*	1.15 **	-0.49 **	1.00 *	0.02	0.41 **	0.24 **	3.40 **
Pusa Vishwas x Avinashi Local	-0.27 **	-0.22	-0.57	0.29	3.22	-0.42	0.45 **	-0.33	-0.10 **	-0.23 **	-0.28 **	-1.33 **
Pusa Vishwas x CO-2	0.56 **	-0.47	2.38**	0.42	2.33	-0.73 *	0.05	-0.67	0.08 *	-0.18 **	0.03	-2.07 **
Punjab Samrat x Arka Suryamukhi	-0.34 **	-0.18	-1.69**	-1.17 *	-5.84**	0.15	0.08	-1.83 **	0.01	0.25 **	-0.03	1.00 **
Punjab Samrat x Avinashi Local	-0.23 **	0.53	0.81	0.18	1.55	0.45	0.37 **	0.96 *	0.09 **	0.10	0.11 **	3.11 **
Punjab Samrat x CO-2	0.56 **	-0.35	0.88	1.00	4.29*	-0.61 *	-0.45 **	0.87	-0.10 **	-0.35 **	-0.07	-4.11 **
Narendra Abhushan x Arka Suryamukhi	0.87 **	-0.68	-0.15	-1.09 *	0.32	0.44	-0.61 **	-2.83 **	0.23 **	0.32 **	-0.07 *	0.00
Narendra Abhushan x Avinashi Local	-1.46 **	-0.22	2.48**	2.27 **	-1.28	-0.75 *	-0.30 *	2.09 **	-0.32 **	-0.18 **	-0.07 *	-3.16 **
Narendra Abhushan x CO-2	0.58 **	0.90	-2.33**	-1.18 *	0.96	0.31	0.91 **	0.74	0.09 **	-0.14 **	0.14 **	3.16 **
Narendra Uphar x Arka Suryamukhi	1.31 **	1.32	-1.23*	0.04	-0.97	-0.76 *	-0.44 **	6.17 **	-0.08 *	0.08	-0.00	-3.64 **
Narendra Uphar x Avinashi Local	-0.60 **	-1.72*	1.27*	0.03	1.05	0.04	0.09	-2.91 **	0.30 **	0.09	-0.21 **	-0.31 **
Narendra Uphar x CO-2	-0.71 **	0.40	-0.03	-0.06	-0.08	0.73 *	0.35 **	-3.26 **	-0.22 **	-0.17 **	0.22 **	3.96 **
Ambili x Arka Suryamukhi	0.09	0.74	-1.11	0.88	-2.89	0.32	0.53 **	1.92 **	0.34 **	0.33 **	0.02	2.11 **
Ambili x Avinashi Local	-0.87 **	1.32	0.39	-0.30	-0.86	-0.25	-0.36 **	-3.29 **	0.10 **	0.12 *	0.15 **	-2.19 **
Ambili x CO-2	0.78 **	-2.60**	0.72	-0.58	3.75	-0.07	-0.17	1.37 **	-0.45 **	-0.45 **	-0.17 **	0.07
Virudhachalam Local x Arka Suryamukhi	0.54 **	-3.06**	0.48	0.47	-2.64	0.28	0.09	0.42	0.27 **	0.23 **	0.02	1.21 **
Virudhachalam Local x Avinashi Local	1.29 **	2.65**	0.65	0.72	3.39	-0.30	0.26 *	3.21 **	-0.13 **	0.03	0.06	-0.79 **
Virudhachalam Local x CO-2	-1.83 **	0.40	0.17	-1.18 *	-0.75	0.02	-0.36 **	-3.63 **	-0.14 **	-0.26 **	-0.08 *	-0.42 **
Chakor x Arka Suryamukhi	1.33 **	3.36	-0.19	-0.24	5.78**	0.03	-0.49 **	-0.67	-0.15 **	0.18 **	0.05	-1.01 **
Chakor x Avinashi Local	-0.52 **	-0.31	1.56**	0.02	-6.70**	-0.55	0.42 *	-1.68 **	0.06	-0.11 *	-0.02	-0.30 **

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Table 4. Contd.

Hybrid	Vine length	Days to 1st male flower appearance	Node no. for 1st female flower appearance	Sex ratio	Days to 1st harvest	fruit no. per vine	Fruit weight	Flesh thickness	Total carbohydrate content	Total carotenoid content	Crude fiber content	Fruit yield per vine
Chakor x CO-2	-0.80 **	-0.36**	-1.37*	0.23	0.92	0.52	0.07	2.35 **	0.09 *	-0.07	-0.03	1.31 **
Ashoka Farm Aids x Arka Suryamukhi	-2.31 **	-2.51**	1.27*	0.23	10.91**	0.07	0.52 **	0.04	0.23 **	0.15 **	-0.31 **	0.95 **
Ashoka Farm Aids x Avinashi Local	0.65 **	-1.06	-1.11	-0.73	-5.57**	0.37	-0.39 **	1.21 *	0.03	0.10 *	0.37 **	1.32 **
Ashoka Farm Aids x CO-2	1.66 **	3.57**	-0.16	0.50	-5.33**	-0.44	-0.13	-1.26 *	-0.26 **	-0.25 **	-0.05	-2.27 **
Vadhalagundu Local x Arka Suryamukhi	0.27 **	0.11	1.64**	0.15	-0.80	-0.64 *	0.14	1.25 *	-0.30 **	-1.17 **	0.05	-1.46 **
Vadhalagundu Local x Avinashi Local	-0.72 **	0.69	1.39*	1.11 *	2.47	-1.34 **	0.31 *	-2.33 **	-0.32 **	-1.15 **	0.11 **	-4.81 **
Vadhalagundu Local x CO-2	0.45 **	-0.81	-3.03**	-1.25 *	-1.67	1.98 **	-0.44 **	1.08 *	0.62 **	2.32 **	-0.16 **	6.26 **
Karamadai Local x Arka Suryamukhi	-0.08	0.40	0.64	-0.35	-5.93**	-0.01	0.39 **	-0.79	0.04	0.19 **	-0.28 **	0.78 **
Karamadai Local x Avinashi Local	1.44 **	-1.64*	-0.23	-0.28	5.59**	0.91 **	-0.45 **	-0.99 *	0.39 **	0.23 **	-0.01	0.13
Karamadai Local x CO-2	-1.36 **	1.24	-0.41	0.64	0.33	-0.90 **	0.06	1.79 **	-0.43 **	-0.42 **	0.30 **	-0.90 **
Karwar Local x Arka Suryamukhi	-0.79 **	-0.60	-0.52	-0.02	5.07*	0.11	0.46 **	0.29	-0.58 **	-0.64 **	0.20 **	0.53 **
Karwar Local x Avinashi Local	0.43 **	2.86**	0.60	0.63	0.47	0.04	-0.45 **	-2.04 **	0.02	0.46 **	-0.02	1.40 **
Karwar Local x CO-2	0.36 **	-2.26**	-0.08	-0.60	-5.54**	-0.15	-0.01	1.74 **	0.56 **	0.18 **	-0.17 **	-1.93 **
Kasi Harit x Arka Suryamukhi	-0.58 **	0.40	2.68**	1.83 **	2.53	-1.14 **	-0.17	-4.96 **	-0.02	-0.34 **	0.13 **	-3.86 **
Kasi Harit x Avinashi Local	0.85 **	-2.89**	-5.94**	-3.92 **	-3.32	1.79 **	0.05	6.09 **	-0.12 **	0.54 **	-0.17 **	6.92 **
Kasi Harit x CO-2	-0.27 **	2.49**	3.26**	2.09 **	0.79	-0.65 *	0.12	-1.13 *	0.15 **	-0.20 **	0.04	-3.05 **
SEd	0.05	0.68	1.88	0.50	2.05	0.29	0.11	0.16	0.03	0.04	0.03	0.06

*, **Significant at 5% and 1% level, respectively

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significant *sca* values. Also, the lines 'Kasi Harit' and 'Vadhalagundu Local' and the tester CO-2 rated as the better performing parents for developing hybrids with lower sex ratio values. Shivanand Hegde (2009) obtained similar results of low sex ratio in ridge gourd.

Earliness in terms of days to first harvest is an important criteria to select hybrids for commanding a premium price for fruits in the early markets. 'Vadhalagundu Local x CO-2', followed by the other hybrids, 'Kasi Harit x Avinashi Local', 'Kasi Harit x CO-2' and 'Vadhalagundu Local x Avinashi Local' could be selected as these best performing hybrids as they proved their superiority through *per se* and *sca* values for days to first harvest. Similar trend of earliness was observed in ash gourd hybrids by Joydip Mandal *et al* (2002). The crosses 'Monsoon Miracle x Holly Green' and 'The largest x Indian Prime' gave significant and negative *sca* for days to first harvest in bitter gourd (Pal *et al*, 1983). Fruit number per vine is a preferable trait for screening the hybrids for high yield. The hybrids 'Vadhalagundu Local x CO-2', 'Kasi Harit x Avinashi Local' and 'Karamadai Local x Avinashi Local' recorded highest *per se* values coupled with significant *gca* and *sca* effects for fruit number per vine. In this cross, as the female parent, 'Kasi Harit', 'Vadhalagundu Local' and 'Karamadai Local' already proved to be good general combiners for this trait. In pumpkin, Uma Maheshwari and Hari Babu (2005) reported higher fruit number per vine in ten crosses and five parents in a partial diallele analysis wherein the cross 'CM-45 x CM-14' showed highest *per se* performance and *sca* for this trait.

Fruit weight is a primary trait to be considered in any hybrid development programme, as, it directly contribute towards yield. In this study, of the 36 pumpkin hybrids studied, highest fruit weight and *sca* effect was registered by 'Ambili x Arka Suryamukhi' followed by 'Virudhachalam Local x Avinashi Local'. Higher fruit weight in hybrids was reported by Shivanand Hegde (2009) in ridge gourd. However, lately, small-to medium-sized pumpkin fruits of 2-3kg weight each are preferred. In the present study, small to medium sized fruits of 2-3kg were seen in the hybrids 'Vadhalagundu Local x CO-2', 'Kasi Harit x Avinashi Local' and 'Karwar Local x Avinashi Local'. Supporting evidence on less fruit weight of hybrids than their parents has been reported by Nisha (1999) in pumpkin hybrid 'P$_5$ x P$_4$'. However, *gca* value of 'Arka Suryamukhi' was positive, but non-significant. Therefore, transgressive segregants can be identified which helps for cyclic selection. 'Arka Suryamukhi' was a poor combiner as a parent, while, both the female parents were good combiners for fruit weight.

Similar results were recorded by Rao *et al* (2000) in ridge gourd.

In pumpkin, flesh thickness is yet another important character determining market preference. The present investigation revealed that the hybrid 'Kasi Harit x Avinashi Local' possessed highest flesh thickness and *sca* among the thirty six hybrid combinations. The hybrids 'Ashoka Farm Aids x Avinashi Local' and 'Ashoka Farm Aids x Arka Suryamukhi' also recorded highest *per se* values coupled with significant *sca* effect for fruit flesh thickness. This is in accordance with the report of Nisha (1999) in pumpkin involving twenty five crosses and five parents in a partial diallele analysis wherein the cross 'P$_4$ xP$_3$' showed highest *per se* performance and *sca* for flesh thickness.

Pumpkin is a good source of total carbohydrate content. In the present study, among the 36 hybrids of pumpkin studied, the cross 'Karamadai Local' x Avinashi Local' followed by 'Karwar Local X CO-2' can be selected as a good combination for developing hybrids with high carbohydrate content, as evidenced by their significant mean, *gca* and *sca* effects. Suganthi (2008) also recorded similar results with reference to total carbohydrate content in bottle gourd hybrid 'IC 362430 x Punjab Long'.

Exploitation of pumpkin as a source of carotene on an industrial scale is gaining momentum. Among the thirty six hybrids under this study, highest *per se*, *gca* and *sca* values for total carotenoid content were observed in 'Vadhalagundu Local x CO-2' followed by 'Kasi Harit x Avinashi Local' and 'Karwar Local x Avinashi Local'. was found to be best crosses to develop hybrids with high total carotenoids content as adjudged by their mean, g*ca* and *sca* effects. Hazra *et al* (2007) showed similar results in pumpkin. It was also noticed that both the parents were responsible for developing hybrids with high total carotenoid content. Development of superior hybrids with improved carotene content by using the best performing parents was also recorded by Moon *et al* (2006) in muskmelon.

Presence of crude fibre in pumpkin fruit is a preferred quality trait. Quantity of the crude fibre should be optimum at harvestable maturity. Among the 36 crosses studied, 'Vadhalagundu Local x CO-2' and 'Ashoka Farm Aids x Avinashi Local' were found to be the best crosses for developing hybrids with high total crude fibre content, as adjudged by their mean values alone. Similar results were observed in ridge gourd by Shivanand Hegde (2009) where the hybrid, 'IC 393014 x IC 413592', gave highest significant mean value for crude fibre content.

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Expression of yield to the fullest potential of the crop is the prime trait to be considered in any hybridization programme. Based on *per se* performance and *sca* of hybrids, the crosses 'Kasi Harit x Avinashi Local' followed by 'Vadhalagundu Local x CO-2' and 'Narendra Uphar x CO-2' proved to be the best specific combiners for yield. These proved their superiority with their *per se, gca* and *sca* values. Choudhary *et al* (2006) also obtained similar results crosses 'MS1 x Punjab Sunheri' and 'MS1 x Hara Madhu' which exhibited highest *sca* effect and recorded highest fruit yield per vine.

Evaluation of hybrids for *per se* and *sca* revealed that the cross 'Kasi Harit x Avinashi Local' was the best hybrid, since, it recorded highest mean and *sca* effect for a greater number of traits under study, viz., earliness in terms of early female flowering, early node of female flower appearance, sex ratio, fruit number per vine, flesh thickness, total carotenoid content and total yield per vine.

The next best hybrid, 'Vadhalagundu Local x CO-2' can also be classified as among the better combinations owing to less node number for first female flower appearance, fruit number per vine, sex ratio, flesh thickness, total carotenoid content and fruit yield per vine.

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