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GENETIC VARIABILITY STUDIES IN F2 GENERATION OF PUMPKIN (*CUCURBITA MOSCHATA* DUCH EX. POIR)

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ABSTRACT
The present investigation was carried out to determine the variability, heritability and genetic advance in F2 generation of pumpkin during *kharif*, 2017. A wide variability was observed for most of the traits like vine length 2.7 to 7.38 m, sex ratio 14.22 to 20.16, average fruit weight 1.24 to 3.58 kg, fruit length 12.3 to 16.89 cm, fruit diameter 46.41 to 57.42 cm, number of seeds per fruit 274.5 to 397.10 and fruit yield per plant 2.15 to 6.52 kg. High PCV and GCV was observed in crosses P6XP5 for vine length (23.74, 21.73), days to first female flowering (4.74, 2.26), yield per plant (81.58, 75.74), P5XP3 for sex ratio (16.21, 9.10), number of fruits (34.68, 21.51), P2XP6 for days to first harvest (1.23, 1.60) and fruit weight (40.40, 39.57). High heritability was recorded in the cross P3XP5 for days to male flowering (65.80), days to first female flowering (65.80), sex ratio (76.25), average fruit weight (96.07) and fruit yield (58.66) with high genetic advance. The high heritability coupled with high genetic advance for fruit yield and fruit weight was recorded in the cross P3XP5 (58.66, 71.64).

INTRODUCTION

Pumpkin is a member of Cucurbitaceae family and is considered as a major kharif vegetable. This crop is being cultivated in the tropical and subtropical regions of the world. It is consumed as vegetable at both immature and mature stages. The pumpkin pulp is yellow to orange in colour due to presence of carotenoid pigments which is a source of pro vitamin A (11mg/100g). The fruit contains 92 percent moisture, fat 0.15 percent, protein 0.98 percent, ash 0.76 percent, crude fiber 0.56 percent and carbohydrate 5.31 per cent. The carotene and cryptoxanthin present in pumpkin fruit help to prevent cell damage which in turn protects from chronic illness (Khansari*et al* .,2009). The pumpkin fruit is also rich in vitamin E (1.06mg/g), iron (80mg/g) and folate (16 mciro gram/g) which can strengthn our immune system. The dietary intake of pumpkin seeds has been found to reduce the risk of gastric, breast, lung and colorectal cancers due the presence of the compound moschatin (Xia *et al*., 2003). Consumption of pumpkin fruits also reduce the blood sugar levels due to the presence of insulin sensitizer D-chiro inositol (Yadav *et al*., 2010). The seed oil is effective in treatment arthritis, hypotensive activity, formation of stone in the bladder, ease depression and anti-helminthic activity. The fruits are one of the cheapest sources of carotene; essential to maintain the human eye health.

Around one million people around the world suffers from various kinds of eye disorders that may be associated with lack of vitamins (Anon, 2019). Hence, the consumption of pumpkin adds a lot of health benefits. In India, it is cultivated in an area of 72,000 hectares with the production of 15.72 tones and has a productivity of 21 tonnes per hectare (Saxena, 2017). It is commercially cultivated in Odisha, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Karnataka, Haryana, Kerala, Tamil Nadu, Meghalaya, Rajasthan and many other states. These fruits are consumed commonly in rural households and usually they grow the crop in kitchen gardens from July to January. The consumption of this vegetable commences at the immature stage. The harvesting can be done up to March as the fruit has long shelf life. Its nutritional importance was recognized by Indian people very long back as it was associated with traditional dishes. The consumer preference in the recent years has changed as nuclear families increased in urban and semi urban areas. The large sized fruits were commonly used in the social and family gatherings. The large sized fruits are less preferred by the small families as it causes spoilage of cut fruits during extended storage, therefore small-sized whole fruits are picked.

Genetic variability is a prerequisite for a successful breeding programme of any crop species and a critical study of genetic variability is essential before initiating an improvement programme aiming to develop high yielding varieties (Falconer, 1989). The variability analysis and partitioning of the total variation into heritable and nonheritable components with suitable genetic parameters like genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), percent heritability, percent genetic advance *etc*. is therefore, a necessity (Barma *et al*., 1990). The magnitude of these

components is a measure of the type of gene action involved in the expression of various traits. The information about gene action helps in deciding a breeding procedure for the genetic improvement of traits (Singh and Narayanan, 2007). However, it is possible to develop high-yielding open pollinated varieties by utilizing existing and creation of variability (Islam *et al*., 2009) and this technique could be used in improvement of sponge gourd. Therefore, an attempt was made in the present investigation to estimate the magnitude of genetic variability, heritability, genetic advance in F2 generation of pumpkin derived from ten different crosses of varying characters for selection of high yielding small size fruit, medium size fruit and large size.

MATERIALS AND METHODS

A field trial on pumpkin was conducted at Department of Horticulture, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during *Kharif* 2017. The location of the trial plot was located at 158 m above MSL and lies between 09º58´30.5´´N latitude and 078 º 12´27.4E longitude. Warm tropical climate prevailed during experiment period. The experiment was laid out in randomized block design without replication due to the segregating population. The soil type of the trial plot was sandy loam. The pit of one cubic feet was dug out at a spacing of 2 meter between rows and 2 meter between pits and the seeds were sown. The required dose of manures and fertilizers were applied as per the Tamil Nadu Agricultural University recommendation (Anon., 2013). The seeds obtained from ten cross combinations P2 x P5 (Ottanchathiram local x Attur local-Small fruited and early maturity), P3 x P5 (Harur local x Attur local-small fruited, early maturing and high â-carotene content), P5 x P6 (Attur local x Acc. No. MDU CM31- medium size fruit, early flowering and high total soluble solids), P6 x P5 (Acc. No. MDU CM31 x Attur local -medium fruited and narrow sex ratio) were sown to obtain a population of 250 plants in each cross. The observation on various parameters like vine length, days to first male flowering, days to first female flowering, sex ratio, number of fruits per vine, days to first harvest, average fruit weight, fruit length, fruit diameter, flesh thickness, number of seeds per fruit, hundred seed weight and fruit yield per plant were registered. The Phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were calculated by using the formula as suggested by Lush (1940).

$$PCV = \sqrt{\frac{\text{Phenotypic variance}}{\text{Mean}}} X100$$

$$GCV = X\sqrt{\frac{\text{Genotypic variance}}{\text{Mean}}} X100$$

PCV and GCV were classified as suggested by Sivasubramanian and Madhavamenon (1973). The values were categorized as; less than 10% as low, between 10-20% as moderate and more than 20% as high. The heritability (h2) in broad sense was calculated by Genotypic variance divided by Phenotypic variance X 100 and expressed in percentage as suggested by Lush (1940). The heritability percentage was categorized as low (0- 30 %), moderate (31-60 %) and high (above 60 %) as suggested by Johnson *et al*. (1955). The genetic advance was estimated by Genotypic variance / phenotypic standard deviation X K, where, K is the selection differential of 2.06 at 5 % selection intensity. The Genetic advance was also expressed as per cent of mean which was calculated as genetic advance/grand mean X 100. It was categorized low (less than 10%), moderate (10-20%) and high (more than 20%).

RESULTS AND DISCUSSION

The mean performance, estimates of phenotypic coefficient variance (pcv), genotypic coefficient variance (gcv), heritability and genetic advance as per cent mean of thirteen traits in ten crosses of pumpkin are presented in table 1,2,3 and 4. A wide range of variation was observed for most of the traits like vine length 2.7 to 7.38 meter, sex ratio 14.22 to 20.16, number of fruits 1.41 to 2.15 per plant, average fruit weight 1.24 to 3.58kg, fruit length 12.3 to 16.89cm, fruit diameter 46.41-57.42cm, number of seeds per fruit 274.5-397.10, fruit yield per plant 2.15 to 6.52kg and total soluble solids (TSS) 7.10-9.690 brix (Table1). High variability present for these parameters can form a basis for effective selection of superior lines in pumpkin. Such variability has also been reported by Pradhan *et al*. (2018) in bottle gourd. Mahadevprasad *et al*. (2018) registered high mean performance for number of fruits, days to harvest, yield per vine and fruit weight in bitter gourd. Chaudhary *et al*. (2019) found high beta carotene in bitter gourd genotypes. Presence of high variability in these traits can provide basis for effective selection of superior genotypes with desirable characters. Suresh and Balamohan (2018) reported such wide variability in ridge gourd crop.

The degree of variability seen in various parameters can be judged by the magnitude of GCV and PCV. GCV indicates the extend of genetic variability present in a population. Considerable variation existed between PCV and GCV values for most of the traits (Table 2). This indicated the influence of environment on the expression of these characters. The genotypic coefficient of variation (GCV) values were comparatively lesser than phenotypic coefficient of variation (PCV) values for all the characters and it indicates that further selection can be made in the generations for obtaining desirable genotypes.

The high PCV and GCV for vine length was observed in P6XP5 (23.74, 21.73), P5XP6 (13.74, 11.05) and P2XP6 (13.48, 12.58), for days to first male flowering in P6XP5 (4.74, 2.26), P6XP2 (4.47, 3.85), P2XP6 (3.59, 0.79) and P3XP6 (3.57, 1.78) was recorded. Similar kind of results for vine length was observed by Usha and Reddy (2017) in bottle gourd. Similarly, variability for days to female flowering was also high in P6XP2 (4.07, 2.82), P5XP3 (3.99, 3.72), P2XP5 (3.79, 3.32), P2XP6 (3.61, 2.56). The sex ratio in pumpkin decides the number of female flowers and fruits in a plant and high PCV and GCV values were recorded in P5XP3 (16.21, 9.10), P2XP6 (15.29, 10.14), P2XP5 (14.5, 9.85) and P5XP2 (12.38, 8.34) crosses. Similar results were observed by Suresh and Balamohan (2018) in ridge gourd. High GCV and PCV values for days to first harvest was registered in P2XP6 (1.23, 1.60) and P2XP6 (1.06, 1.44) crosses. Number of fruits per vine recorded high

Table 1: Mean performance of pumpkin (*Cucurbita moschata* Duch Ex. Poir) crosses

Cross	Vine length (m)	Days to first male flowering	Days to first female flowering	Sex ratio	Days to first harvest	Number of fruits per vine	Average fruit weight (kg)	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Number of seeds per fruit	Hundred seed weight (g)	Fruit yield per plant (kg)	TSS	^{2}– carotene (micro gram/ gram)
P2xP5	7.38	45.35	53.96	17.94	85.29	1.41	3.07	14.66	55.17	2.66	331.1	13.2	3.95	7.36	7.8
P2xP6	5.84	45.22	53.94	18.21	84.45	2.15	2.45	14.47	47.33	2.51	356.8	13.13	5.23	7.96	8.7
P3xP5	7.13	45.14	52.69	20.16	86.74	1.65	2.79	15.21	57.42	2.64	325.6	13.37	4.49	8.3	9
P3xP6	6.59	45.56	52.74	17.21	85.78	1.57	3.29	16.52	57.27	2.39	341	13.96	5.08	8.32	8.2
P5xP2	6.48	44.23	52.46	16.54	88.53	1.72	2.52	15.35	55.89	2.25	396.5	12.21	3.46	9.43	7
P5xP3	6.21	45.4	53.56	19.48	88.43	1.47	3.58	16.89	56.97	2.49	346.5	13.79	6.52	9.22	7.2
P5xP6	3	46.26	51.66	16.28	87.03	1.8	1.47	14.11	53.44	2.4	347.9	12.9	2.15	9.69	6.8
P6xP2	5.75	47.21	54.09	15.52	91	1.74	1.59	12.3	46.41	2.22	296.4	11.43	2.8	7.62	8.2
P6xP3	2.78	46.03	54.44	14.22	90.33	1.52	1.65	14.14	47.94	2.16	274.5	11.97	2.43	7.15	8.9
P6xP5	3.12	44.09	53.37	14.46	88.98	1.91	1.24	13.3	50.44	2.35	397.1	12.49	2.26	7.1	8.8
Min	2.78	44.09	51.66	14.22	84.45	1.41	1.24	12.3	46.41	2.16	274.5	11.43	2.15	7.1	6.8
Max	7.38	47.21	54.44	20.16	91	2.15	3.58	16.89	57.42	2.66	397.1	13.96	6.52	9.69	9

Table 2: Phenotypic (pcv) and genotypic coefficient variance (gcv) of pumpkin (*Cucurbita moschata* Duch Ex. Poir) crosses

Cross		Vine length (m)	Days to first male flowering	Days to first female flowering	Sex ratio	Days to first harvest	Number of fruits per vine	Average fruit weight (kg)	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Number of seeds per fruit	Hundred seed weight (g)	Fruit yield per plant (kg)
P2xP5	PCV	5.75	3.3	3.79	14.5	1.09	39.16	36.17	18.94	18.94	19.9	31.49	16.38	34.43
	GCV	4.06	2.19	3.32	9.85	1.06	15.03	35.73	15.95	21.82	17.64	28.06	8.6	12.14
P2xP6	PCV	13.48	3.59	3.61	15.29	1.44	23.71	40.4	40.4	40.4	18.68	30.82	17.68	45.01
	GCV	12.58	0.79	2.56	10.14	1.23	13.15	39.57	39.57	12.33	9.75	27.33	6.32	25.02
P3xP5	PCV	12.7	2.75	2.75	16.89	1.6	34.28	36.19	20.98	20.98	21.42	33.74	17.12	45.69
	GCV	11.39	2.23	2.23	10.15	0.88	19.16	35.48	18.67	17.14	19.31	32.26	15.74	35
P3xP6	PCV	6.06	3.57	3.24	13.69	1.15	36.03	28.02	22.15	22.15	19.17	34.63	14.73	41.94
	GCV	4.55	1.78	2.12	8.45	0.2	18.01	27.35	18.52	11.84	9.35	32.88	13.24	33.75
P5xP2	PCV	5.92	3.32	2.02	12.38	1.04	27.82	43.84	21.88	21.88	24.74	32.46	18.64	42.67
	GCV	4.3	1.54	1.87	8.34	0.76	10.74	22.09	16.04	13.71	23.09	31.41	15.75	32.31
P5xP3	PCV	5.34	2.65	3.99	16.21	0.95	34.68	27.08	23.21	23.21	19.33	35.67	20.27	36.19
	GCV	4.55	1.79	3.72	9.1	0.83	21.51	26.49	20.34	19.23	14.53	34.63	18.72	26.25
P5xP6	PCV	13.74	3.45	3.16	10.25	0.96	29.91	25.45	18.71	18.71	19.98	33.58	19.25	84.1
	GCV	11.05	2.28	2.25	6.41	0.22	11.11	21.51	9.61	13.93	7.21	32.25	16.78	71.14
P6xP2	PCV	4.25	4.47	4.07	12.4	0.91	29.3	48.3	22.27	22.27	24.25	40.7	20.51	57.25
	GCV	2.45	3.85	2.82	8.37	0.43	15.2	46.64	7.62	21.34	6.37	37.57	12.58	15.97
P6xP3	PCV	11.37	1.88	2.18	10.92	90.16	33.54	34.73	34.73	34.73	23.6	39.77	39.68	63.11
	GCV	10.17	1.52	0.68	4.96	0.55	6.57	6.74	6.74	11.03	20.7	37.09	19.05	15.39
P6xP5	PCV	23.76	4.74	2.66	5.4	0.85	31.41	24.19	58.76	58.76	24.41	33.38	18.87	81.58
	GCV	21.73	2.26	1.77	1.1	0.63	16.55	18.03	54.35	10.93	18.05	33.38	16.34	75.74

Table 3: Heritability of pumpkin (*Cucurbita moschata* Duch Ex. Poir) crosses.

Cross	Vine length (m)	Days to first male flowering	Days to first female flowering	Sex ratio	Days to first harvest	Number of fruits per vine	Average fruit weight (kg)	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Number of seeds per fruit	Hundred seed weight (g)	Fruit yield per plant (kg)
P2xP5	50.01	44.32	75.66	68.73	95.4	14.73	97.56	69.13	99.28	78.57	79.4	27.56	12.43
P2xP6	87.09	4.9	50.39	71.25	72.97	30.76	95.91	95.91	97.73	27.27	78.66	12.8	30.9
P3xP5	80.48	65.8	65.8	76.25	30.41	31.25	96.07	79.19	98.71	81.25	91.4	84.54	58.66
P3xP6	56.25	24.81	43	65.59	3.06	25	95.29	69.92	97.27	23.8	90.12	80.85	64.75
P5xP2	63.56	58.63	86.27	65.92	53.46	11.39	25.39	53.74	94.63	87.09	93.63	71.42	57.33
P5xP3	72.72	44.13	87.3	73.55	77.46	38.46	95.74	76.78	99.23	56.52	94.25	85.72	52.6
P5xP6	64.7	43.92	50.61	50.41	5.63	13.79	71.42	26.39	98.89	13.04	92.28	76.01	71.55
P6xP2	33.33	74.21	48.04	67.88	22.85	26.92	93.22	11.71	99.12	6.89	85.18	37.63	7.78
P6xP3	80	65.33	9.92	50.64	20.32	3.84	10.97	10.97	98.8	76.92	86.95	81.88	5.57
P6xP5	83.63	22.88	44.55	93.34	55.17	27.77	55.55	85.56	97.9	54.54	99.99	75.01	86.17

Table 4: Genetic advance as per cent mean of pumpkin (*Cucurbita moschata* Duch Ex. Poir) crosses

Crosses	Vine l ength (m)	Days to first male flowering	Days to first female flowering	Sex ratio	Days to first harvest	Number of fruits per vine	Average fruit weight (kg)	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Number of seeds per fruit	Hundred seed weight (g)	Fruit yield per plant (kg)
P2xP5	5.92	2.99	5.99	30.51	2.14	11.89	72.7	26.97	44.8	32.22	51.51	9.3	8.81
P2xP6	24.19	0.36	3.75	32.56	2.16	15.03	79.83	79.83	25.13	10.49	49.94	4.66	28.65
P3xP5	21.05	3.73	3.73	34.51	1	22.07	71.64	34.08	35.08	35.86	63.54	29.81	55.23
P3xP6	7.03	1.82	2.87	28.96	0.07	18.55	55.01	31.91	24.06	9.4	64.3	24.53	55.95
P5xP2	6.89	5	3.59	28.91	1.15	8.21	22.93	24.22	27.48	44.39	62.62	27.42	50.4
P5xP3	8	2.41	7.17	32.78	1.52	27.48	53.41	36.72	39.46	22.51	69.26	35.63	39.2
P5xP6	18.31	3.12	3.29	26.24	0.11	8.5	37.45	10.17	28.55	5.36	63.12	30.15	123.98
P6xP2	2.92	6.83	4.02	30.86	0.43	16.25	92.76	5.37	43.76	3.44	71.43	15.9	9.18
P6xP3	18.74	2.53	0.44	22.18	0.51	2.65	4.6	4.6	38.48	37.4	71.25	35.5	7.49
P6xP5	40.95	2.23	2.44	75.23	0.97	17.97	27.68	103.38	22.29	27.46	68.77	29.16	144.83

PCV and GCV in the crosses P2XP5 (39.16, 15.03), P3XP6 (36.03, 18.01), P5XP3 (34.68, 21.51) and P3XP5 (34.28, 19.16). High values for PCV and GCV were recorded for the crosses P6XP2 (48.30, 46.64), P5XP2 (43.84, 22.09), P2XP6 (40.40, 39.57), P3XP5 (36.17, 35.48) and P2XP5 (36.17, 35.73) crosses for fruit weight. The higher magnitude of GCV further revealed the greater extend of variability present in the characters which in turn provide considerable scope for improvement through selection in the F2 generation. These results are corroborated with the findings of Singh *et al*. (2014) in bitter gourd and Sampath and Krishnamoorthy (2017) in pumpkin.

PCV and GCV were found high for the crosses P6XP5 (58.76, 54.35), P2XP6 (40.40, 39.57) in case of fruit length and for fruit diameter in P6XP5 (58.76, 21.82) and P2XP6 (40.40, 21.34). High PCV and GCV was estimated in P5XP2 (24.74, 23.09), P6XP5 (24.41, 18.05), P6XP2 (24.25, 6.37) and P6XP3 (23.6, 20.7) crosses respectively, for flesh thickness. The PCV and GCV for number of seeds per fruit was found high in the crosses P6XP2 (40.70, 37.57) and P6XP3 (39.77, 37.09) and these crosses also showed high PCV and GCV for hundred seed weight *ie*., P6XP3 (39.68, 37.09) and P6XP2 (20.57, 12.58). The PCV and GCV for fruit yield per plant was high in the crosses P5XP6 (84.10, 71.14) and P6XP5 (81.58, 75.74). Singh *et al*. (2019) reported similar kind of results in sponge gourd.

The GCV estimates alone was not useful to determine the heritable variations. Hence, heritability was also estimated for effective selection which can be exploited from the existing genetic variability (Table 3). High heritability was found for vine length in P2XP6 (87.09), P6XP5 (83.63), P3XP5 (80.48), P6XP3 (80.00), P5XP3 (72.72), P5XP6 (64.70) and P5XP2 (63.56) crosses. Chaudhary *et al*. (2019) found high heritability for vine length and days to first harvest in bitter gourd genotypes. High heritability coupled with low genetic advance, low heritability with high genetic advance or low heritability and low genetic advance offers less scope for selection because of non additive genetic effects. High heritability coupled with high genetic advance showed greater proportion of additive genetic variance and consequently a higher genetic gain is expected through selection (Devi and Mariappan, 2013). The characters having high heritability with low genetic advance as percent of mean appeared to be controlled by non-additive gene action and selection for such characters may not be effective (Singh and Singh, 2007).

High heritability for days to first male flower appearance was found in P6XP2 (74.21), P3XP5 (65.80) and P6XP3 (65.33) and for days to first female flower opening was observed in P5XP3 (87.30), P5XP2 (86.27), P2XP5 (75.66), P3XP5 (65.80). The high heritability for sex ratio was found in the crosses P6XP5 (93.34), P3XP5 (76.25), P5XP3(73.55), P2XP6 (71.25), P2XP5 (68.73), P6XP2 (67.88), P5XP2 (65.92), P3XP6 (65.59). The heritability for days to first harvest was high in P2XP5 (95.40), P5XP3 (77.46) and P2XP6 (72.97) crosses. The heritability for number of fruits per vine was found low. The heritability for average fruit weight was high in seven crosses viz., P2XP5 (97.56), P3XP5 (96.07), P2XP6 (95.91), P5XP3 (95.74), P3XP6 (95.29), P6XP2 (93.22) and P5XP6 (71.42) respectively. Similar estimates were observed by Amangouda *et al*. (2018) in bottle gourd. High heritability for fruit length was estimated in the crosses like P2XP6 (95.91), P6XP5 (85.56), P3XP5 (79.19), P5XP3 (76.78), P3XP6 (69.92) and P2XP5 (69.13) and in case of fruit diameter all the crosses exhibited high heritability.The flesh thickness was highly heritable in the crosses viz.P5XP2 (87.09), P3XP5 (81.25), P2XP5 (78.57), P6XP3 (76.92) and the number of seeds per fruit was highly heritable in all the crosses. The 100 seed weight was highly heritable in seven crosses except P6XP2, P2XP5 and P2XP6.The fruit yield per plant was highly heritable in the crosses P6XP5 (86.17), P5XP6 (71.55), P3XP6 (64.75) and P3XP5 (58.66), P5XP2 (57.33), P5XP3 (52.60) showed moderate heritability.

Johnson (1955) recommended that genetic advance was more useful than heritability alone while predicting the effect of selecting the best individual genotypes as it determines the presence of additive gene effects. The vine length, days to first male flowering, days to first female flowering, number of fruits per vine, days to first harvest, fruit diameter, flesh thickness and hundred seed weight in all the ten crosses showed less genetic advance (Table 4). The high genetic advance for sex ratio was recorded in P6XP5 (75.23). The high genetic advance for average fruit weight in P6XP2 (92.76), P2XP6 (79.83), P2XP5 (72.70), P3XP5 (71.64) and moderate genetic advance was found in P3XP6 (55.01), P5XP3 (53.41). The genetic advance for fruit length was high in P6XP5 (103.38) and P2XP6 (79.83). The genetic advance for number of seeds per fruit was high in all the crosses. High genetic advance for fruit yield per plant was high in P6XP5 (144.83) and P5XP6 (123.98) and moderate genetic advance was found in P3XP6 (55.95), P3XP5 (55.23), P5XP2 (50.40).Out of 13 characters studied, average fruit weight and yield per plant showed high heritability coupled with high genetic advance in two crosses P3XP6 and P5XP6, which showed that these characters are governed by additive gene effect and therefore further effective selections are possible. Muralidhara *et al*. (2014) in pumpkin, Maurya *et al*. (2018) and Alekar *et al*. (2019) in bitter gourd reported high genetic advance for the characters fruit weight and yield per vine.

Among the ten crosses of pumpkin, high genetic advance, high heritability, high PCV and GCV for fruit yield was recorded in the crosses P5XP6 and P6XP5 followed by P3XP6. The cross P5XP2 was found to have high genetic advance and heritability for days to first female flowering, sex ratio, average fruit weight and flesh thickness.

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