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Studies on genetic variability, correlation and path co-efficient analysis in kachri

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Abstract

The genetic variability, heritability in broad sense, genetic gain, correlation and path coefficient analysis were studied in 29 diverse populations of kachri. Wide range of variation was observed in most of the characters. The magnitude of PCV was greater than the corresponding GCV for all the characters indicating importance of environment in expression of characters. High values of PCV as well as GCV were recorded for yield per vine, weight of fruit and number of fruits per vine. Out of 14 characters studied, yield per vine and weight of fruit showed high GCV and heritability coupled with high genetic advance which showed that these two characters had additive gene effect and, therefore, they are more reliable for effective selection. Correlation coefficient revealed that fruit yield per vine can be successfully improved by making selection for higher fruit weight, more fruit length, greater fruit diameter and minimum node number at which first female flower appeared. Path coefficient analysis revealed that maximum weightage should be given primarily to number of fruits per vine, weight of fruit, diameter of fruit and node number at which first female flower appeared, while formulating selection indices for improvement of yield per vine in kachri.

Key words: *Genetic variability, correlation, path coefficient, kachri, Cucumis callosus*

Introduction

Kachri or cucumber pubescent (*Cucumis callosus* L.) commonly known as *kachariya, Petha, senga, gordi* is an underutilized cucurbitaceous vegetable. It is hardy and grows wildly in arid and semi arid conditions of Rajasthan during rainy season. Fruits are smooth, roundish and 4-5 cm long. Tender fruits are bitter, while the ripe fruits are sour and usually cooked for various vegetable preparations like *chutney,* pickles and for garnishing vegetables. Ripe fruits are peeled and dried whole or sliced and stored as such or in powder form and used in combination with chilli, turmeric, cumin, fenugreek, coriander and other spices to manufacture various kinds of curry powder (Pareek and Samadia, 2002).

Kachri is a cross-pollinated vegetable, thus, its natural population has tremendous variability for fruit colour, shape, taste, etc. Being an important crop for arid climate, the research work on kachri is very scanty. Evaluation of genotypes to assess the existing variability is considered as preliminary step in any crop improvement programme. In order to pursue an effective breeding programme, the present investigation was carried out to gather information on genetic variability, heritability, genetic gain, correlation and path analysis for different characteristics in kachri.

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Materials and methods

The present investigation comprised of 29 genotypes of kachri collected from different places of Rajasthan. The genotypes were sown in randomized block design with three replications at Department of Horticulture, Rajasthan College of Agriculture, Udaipur during rainy season 2001. Each genotype was planted in a single row of 3 m length, maintaining row to row and plant to plant spacing of 250 cm and 30 cm, respectively. Observations on five randomly selected plants from each replication were recorded for days to anthesis of first male flower, days to anthesis of first female flower, node number at which first female flower appeared, weight of fruit, length of fruit, diameter of fruit, days to first harvest, number of fruits per vine, number of branches per vine, vine length, total soluble solids, dry matter content, ascorbic acid content and yield per vine. Data recorded were subjected to statistical analysis.

Genotypic coefficient variation (GCV) and phenotypic coefficient variation (PCV), broad sense heritability, genetic advance, correlations (genotypic and phenotypic) and path coefficient were computed by the methods suggested by Al-Jibouri *et al.* (1958) and Dewey and Lu (1959).

Result and discussion

The analysis of variance revealed highly significant differences amongst 29 genotypes of kachri for all the characters studied. The magnitude of PCV, as expected, was greater than the corresponding GCV for all the characters indicating importance of environment in expression of characters. Maximum range was recorded for yield per vine (256.37-3236.47 g) followed by fruit (31.10 - 280.92 g), number of fruits per vine (3.53 – 21.20) and length of fruit (4.33 – 14.33 cm) indicating maximum variability present in these traits which showed a greater scope for selection among the existing genotypes while the smallest range was observed for days to maturity (Table 1). The findings are in accordance with Mohanty and Mishra (1999) in pumpkin and Sindhu and Brar (1978) in watermelon. High values of PCV as well as GCV were recorded for yield per vine, weight of fruit and number of fruits per vine. The high magnitude of GCV further revealed the great extent of variability present in the characters, thereby suggesting good scope for improvement through selection.

The GCV does not offer full scope to estimate the variation that is heritable and, therefore, estimation of heritability becomes necessary. In the present study, all the traits expressed high heritability which ranged from 62.09 per cent (node number at which first female flower appeared) to 99.99 per cent (ascorbic acid content) suggesting thereby the major role of genetic constitution in the expression of the character and such traits are considered to be dependable for breeding point of view. Out of 14 characters studied, yield per vine and weight of fruit showed high GCV and heritability coupled with high genetic advance which showed that these two characters had additive gene effect and, therefore, they are more reliable for effective selection. Similar results were also reported by Hawlader *et al.* (1999) in bottle gourd and Methew and Khader (1999) in snake gourd.

The estimates of genotypic correlation were slightly higher than their corresponding phenotypic correlation for all the characters except for number of fruits per vine, days to first harvest and ascorbic acid content where the value of r_g and r_p were same. Similar finding was also reported by Rao *et al.* (2000) in ridge gourd. Yield was found to be positively and significantly correlated with weight of fruit, length of fruit, diameter of fruit and node number at which first female flower appeared both at genotypic and phenotypic levels (Table 2) indicated that any increase in the later four characters should bring about an enhancement in the yield. Correlation coefficient between yield and fruit weight and fruit diameter have also been observed by Sarkar *et al.* (1999) in pointed gourd. Further, weight of fruit has positive correlation with length of fruit and diameter of fruit suggesting thereby the increase in either of one will take care for the increase in fruit weight. Fruit yield is influenced by its components directly as well as indirectly. Deeper understanding would emerge from the path coefficient analysis (Table 3).

Path analysis revealed appreciable amount of direct positive effect of weight of fruit followed by number of fruits per vine, days to anthesis of first female flower on yield indicating, therefore, the dependability of the earlier three traits on the latter i.e. yield. Significant genotypic correlation coefficients between fruit weight and days to anthesis of first female flower with yield further strengthened their reliability in the process of selection for higher yield. The results are in agreement with those of Gwanama *et al.* (1998) in pumpkin and Sarkar *et al.* (1999) in pointed gourd.

Table1. Estimates of genotypic coefficient of variation, phenotypic coefficient of variation, heritability, genetic gain for different characters studied in kachri

Characters	PCV (%)	GCV (%)	Heritability (%)	Genetic Gain (%)
Days to anthesis of first male flower	7.97	7.40	86.24	14.16
Days to anthesis of first female flower	7.23	6.59	83.24	12.39
Node at which first female flower appeared	15.87	12.50	62.09	20.30
Weight of fruit (g)	55.74	54.67	96.26	110.45
Length of fruit (cm)	33.47	31.74	89.93	62.61
Diameter of fruit(cm)	23.68	22.28	88.49	43.17
Days to first harvest	5.04	4.46	78.32	8.13
Number of fruits per vine	46.67	46.00	97.15	93.41
Number of branches per vine	22.78	22.18	94.79	44.48
Vine length (cm)	19.16	18.92	97.59	38.51
Total soluble solid ("Brix)	21.84	19.81	82.29	37.02
Dry matter content (%)	13.59	13.24	94.95	26.58
Ascorbic acid content (mg/100g)	19.23	19.23	99.99	39.62
Yield per vine (g)	60.62	60.03	98.06	122.46

Table 2. Genotypic (r_g) and phenotypic (r_p) correlation coefficient between characters studied in kachri

Character		Days to anthesis of first male flower	Days to anthesis of first female flower appeared	Node number at which first female flower	Weight of fruit (g)	Length of fruit (cm)	Diameter of fruit (cm)	Days to harvest	Number of fruits per vine	Number of branches per vine	Vine length (cm)	TSS (°Brix)	Dry matter content (%)	Ascorbic Acid (mg/ 100 g edible portion)	Yield per vine (g)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	r_g	1.00	0.33	0.16	0.03	-0.03	-0.12	0.39*	-0.55**	0.07	0.13	0.10	-0.07	0.16	-0.30
	r_p	1.00	0.27	0.17	0.02	-0.02	-0.09	0.30	-0.51**	0.08	0.11	0.08	-0.07	0.15	-0.28
2	r_g		1.00	0.34	0.16	-0.01	0.24	0.76**	-0.23	-0.23	-0.09	-0.05	-0.25	0.27	0.13
	r_p		1.00	0.23	0.14	0.01	0.22	0.66**	-0.20	-0.22	-0.08	-0.01	-0.22	0.25	0.11
3	r_g			1.00	0.48**	0.28	0.39	0.03	-0.09	-0.11	0.24	0.16	-0.18	0.51*	0.58**
	r_p			1.00	0.36	0.20	0.29	0.07	-0.09	-0.11	0.18	0.11	-0.14	0.40	0.44*
4	r_g				1.00	0.76**	0.89**	-0.04	-0.33	-0.06	0.41*	-0.07	-0.04	0.33	0.67**
	r_p				1.00	0.71**	0.83**	-0.04	-0.34	-0.06	0.39*	-0.06	-0.05	0.22	0.66**
5	r_g					1.00	0.66**	-0.05	-0.28	-0.14	0.33	0.02	0.20	0.05	0.47**
	r_p					1.00	0.55**	-0.02	-0.26	-0.16	0.31	0.05	0.19	0.04	0.44**
6	r_g						1.00	0.02	-0.33	-0.02	0.41*	-0.17	-0.23	0.27	0.56**
	r_p						1.00	0.05	-0.31	-0.01	-0.37*	-0.11	-0.22	0.25	0.52**
7	r_g							1.00	-0.29	-0.23	0.04	0.19	-0.11	0.11	-0.15
	r_p							1.00	-0.26	-0.21	0.04	0.18	-0.11	0.09	-0.15
8	r_g								1.00	-0.25	-0.26	0.09	0.25	-0.14	0.37
	r_p								1.00	-0.24	-0.25	0.08	0.24	-0.14	0.37
9	r_g									1.00	0.13	-0.13	-0.30	-0.10	-0.37*
	r_p									1.00	0.13	-0.11	-0.28	-0.10	-0.36
10	r_g										1.00	0.01	-0.12	0.26	0.17
	r_p										1.00	0.02	-0.11	0.25	0.16
11	r_g											1.00	0.48**	-0.09	0.02
	r_p											1.00	0.41*	-0.09	0.01
12	r_g												1.00	-0.25	0.05
	r_p												1.00	-0.24	0.04
13	r_g													1.00	0.29
	r_p													1.00	0.29
14	r_g														1.00
	r_p														1.00

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

Table 3. Direct (diagonal) and indirect effects of yield components on yield in kachri

Character	Days to anthesis of first male flower	Days to anthesis of first female flower	Node number at which first female flower appeared	Weight of fruit (g)	Length of fruit (cm)	Diameter of fruit (cm)	Days to harvest	Number of fruits per vine	Number of branches per vine	Vine length (cm)	TSS (°Brix)	Dry matter content (%)	Ascorbic Acid (mg/ 100 g edible portion)	Genotypic correlation coefficient with yield
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	**-0.0628**	0.0030	0.0417	0.0272	0.0009	0.0246	0.0051	-0.3232	-0.0131	0.0000	-0.0017	0.0084	-0.0080	-0.3017
2	-0.0205	**0.0091**	0.0888	0.1540	0.0003	-0.0473	0.0101	-0.1324	0.0405	-0.0000	0.0008	0.0289	-0.0137	0.1259
3	-0.0100	0.0031	**0.2616**	0.4583	-0.0073	-0.0767	0.0004	-0.0543	0.0202	0.0001	-0.0027	0.0206	-0.0260	0.5825**
4	-0.0018	0.0015	0.1268	**0.9456**	-0.0195	-0.1764	-0.0005	-0.1952	0.0104	0.0001	0.0012	0.0050	-0.0167	0.6707**
5	0.0021	-0.0001	0.0739	0.7142	**-0.0258**	-0.1188	-0.0007	-0.1606	0.0244	0.0001	-0.004	-0.0234	-0.0024	0.4704**
6	0.0078	0.0022	0.1013	0.8422	-0.0155	**-0.1981**	0.0003	-0.1934	0.0028	0.0001	0.0029	0.0269	-0.0135	0.5575**
7	-0.0243	0.0069	0.0074	-0.0369	0.0013	-0.0044	**0.0133**	-0.1683	0.0404	0.0000	-0.0032	0.0129	-0.0053	-0.1547
8	0.0348	-0.0021	-0.0243	-0.3163	0.0071	0.0656	-0.0038	**0.5837**	0.0443	-0.0001	-0.0016	-0.0291	0.0071	0.3669
9	-0.0047	-0.0021	-0.0299	-0.0555	0.0036	0.0031	-0.0030	-0.1465	**-0.1766**	0.0000	0.0022	0.0351	0.0052	-0.3726*
10	-0.0081	-0.0008	0.0637	0.3846	-0.0085	-0.0818	0.0006	-0.1521	-0.0231	**0.0002**	-0.0003	0.0143	-0.0129	0.1663
11	-0.0062	-0.0004	0.0420	-0.0693	-0.0006	0.0334	0.0025	0.0540	0.0229	0.0000	**-0.0169**	-0.0560	0.0048	0.0168
12	0.0045	-0.0022	-0.0458	-0.0403	-0.0051	0.0455	-0.0015	0.1445	0.0527	-0.0000	-0.0081	**-0.1174**	0.0216	0.0463
13	-0.0099	0.0024	0.1346	0.3116	-0.0012	-0.0529	0.0014	-0.0825	0.0182	0.0001	0.0016	0.0293	**-0.0506**	0.2946

*, ** Significant at 5 per cent and 1 per cent level, respectively
Underlined figures denote direct effects
Residual Effect (genotypic) = 0.26

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