Short communication

Evaluation of spine gourd genotypes for variability

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Abstract

Thirty one accessions of spine gourd collected from different parts of Kerala were grown with objectives of genetically cataloguing the germplasm and to assessing genetic variability, heritability, genetic gain and correlating different traits with yield. High genotypic and phenotypic coefficient of variation was observed for days from flowering to vegetable maturity, total number of harvests and fruit length. Yield exhibited genotypic correlation with number of branches per plant, total number of harvests, fruit length and number of fruits per plant. In path coefficient analysis the highest positive direct effect on yield was exhibited by total number of harvests followed by fruit girth.

Keywords: Genetic gain, Genetic variability, Heritability, Spine gourd

Spine gourd (*Momordica dioica* Roxb.) is a dioecious and perennial (up to five-six years) cucurbitaceous vegetable which occurs in semi domesticated and wild forms in local pockets. It is native to South East Asia, especially India and Bangladesh (Thiruvengadam and Chung, 2011). The tubers underneath sprout at the onset of monsoon every year. Immature green fruits, young leaves, flowers and tubers are cooked as vegetable (Ram et al., 2001). Spine gourd shows enormous diversity in shape and size of the leaf, fruit shape and colour as this crop is strictly cross pollinated (Bharathi et al., 2006). The objective of the study was to genetically catalogue the germplasm and to assess genetic variability, heritability, genetic gain and correlate different traits with yield.

The study was conducted in the vegetable research farm of the Department of Olericulture, College of Horticulture, Vellanikkara during October 2011 to February 2012 in randomized block design with two replications. Thirty one accessions of spine gourd (15 male and 16 female) collected from different parts of Kerala were used for the experiment. Three noded stem cuttings were planted in polythene bags containing sand, red earth and cow dung at 2:1:1 ratio and kept inside the polyhouse for three weeks to one month for rooting. Twenty to thirty days old rooted cuttings were transplanted. The crop was raised as per the Package of Practices Recommendations (KAU, 2007) for bitter gourd. Descriptions were made as per the minimal descriptor list of NBPGR for bitter gourd (Srivastava et al., 2001) in the absence of a specific descriptor for spine gourd. The analysis technique suggested by Fisher (1954) was employed for estimation of various genetic parameters. Selection index was also worked out.

Male accessions were evaluated for the morphological characters like early plant vigour, plant growth habit, leaf margin, flower colour and susceptibility to major biotic stress. Early plant vigour (visual observation) was very good for five accessions. Plant growth habit varied between medium viny and short viny. Half of the accessions showed multifid leaf margin while the remaining half were trifid, with flower colour yellow for all

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the accessions. Most of the accessions recorded low susceptibility to *Fusarium* wilt and red pumpkin beetle. For female accessions, apart from the above mentioned morphological characters, fruit characters like fruit shape, nature of spines, blossom end fruit shape, fruit skin colour, fruit bitterness and seediness were also recorded. Early plant vigour was very good for half of the accessions. Plant growth habit varied among long viny, short viny and medium viny. Leaf margin was trifid for most of the accessions with flower colour yellow for all accessions. Fruit shape varied among globular, oblong, tapering and elliptical. Nature of spines varied among dense, dense soft, dense sharp, sparse sharp and sparse. For ten accessions blossom end fruit shape was acute. Fruit skin colour varied from light green, green to dark green. For all accessions, the fruit bitterness was mild. Medium seediness (35 – 44 seeds) was observed in ten accessions while the other six accessions showed high seediness (more than 45 seeds per fruit). Most of the accessions exhibited low susceptibility to *Fusarium* wilt and low and medium susceptibility to red pumpkin beetle. All the accessions showed medium susceptibility to fruit fly infestation.

Genetic parameters like genotypic coefficient of variation, phenotypic coefficient of variation, heritability, genetic advance and genetic gain were estimated for 14 quantitative characters (Table 1). Days from flowering to vegetable maturity (21.10), total number of harvests (28.48) and fruit length (29.09) showed high genotypic coefficient of variation (21 per cent and above). High phenotypic coefficient of variation (21 per cent and above) was observed for characters like days from flowering to vegetable maturity (21.28), total number of harvests (31.42), fruit length (29.25) and number of fruits per plant (27.17). This variability offers scope for selection for high fruit yield as suggested by Panchbhai et al. (2006).

The characters with higher PCV than GCV indicated the high influence of environment on these characters. The medium GCV and PCV values recorded for number of branches per plant, fruit girth and average fruit weight, can be used to make an effective selection according to Bharathi et al. (2006).

In the present study most of the quantitative characters like days to first flowering (64.3%), days

Table 1. Range, Mean, Genotypic Coefficient of Variation (GCV), Phenotypic Coefficient of Variation (PCV), Heritability, Genetic advance and Genetic gain of different characters

Characters	Range	Mean	GCV	PCV	Heritability (%)	Genetic advance	Genetic gain (%)
Vine length (cm)	0.570 – 1.197	1.081	8.86	18.16	23.8	0.10	9.25
Number of branches per plant	6.250 – 12.250	10.875	11.39	16.62	46.9	1.75	16.09
Days to first flowering	51.250 – 61.750	55.612	4.12	5.14	64.3	3.78	6.79
Days to first harvest	69.500 – 90.750	80.001	7.53	9.42	63.8	9.91	12.38
Days to last harvest	91.750 – 118.00	104.344	6.20	7.31	72.0	11.31	10.83
Days from flowering to vegetable maturity	5.00 – 9.500	6.531	21.10	21.28	98.4	2.82	43.17
Total number of harvests	2.750 – 6.00	3.875	28.48	31.42	82.2	2.06	53.16
Fruit length (cm)	5.220 – 11.300	6.545	29.09	29.25	98.9	3.90	59.58
Fruit girth (cm)	4.410 – 7.230	5.674	12.53	12.60	98.9	1.46	25.73
Average fruit weight (g)	5.140 – 7.830	6.156	10.90	11.36	92.1	1.33	21.60
Number of fruits per plant	12.500 – 18.250	15.390	18.27	27.17	45.2	3.89	25.30
Yield per plant (g)	90.835 –110.063	99.819	4.58	5.33	73.9	8.09	8.10
Duration of the crop	99.500 – 122.00	111.406	5.49	6.72	66.7	10.28	9.22
Shelf life in open condition	2.0 – 3.0	2.563	19.99	19.99	1.000	1.06	41.35

Table 2. Genotypic path coefficient analysis of the various characters on the yield of spine gourd.

Character	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X13	X14	rg
X1	-0.141	0.016	-0.037	0.183	-0.648	0.133	-0.366	0.358	0.026	0.050	-0.035	0.018	-0.003	-0.446
X2	-0.042	0.053	0.170	0.080	0.222	-0.094	0.366	-0.182	-0.119	0.062	0.282	-0.075	-0.047	0.516*
X3	-0.015	-0.026	-0.351	0.060	-0.238	0.031	-0.214	0.165	-0.018	0.064	-0.070	0.080	0.082	-0.448
X4	-0.070	-0.012	-0.058	0.362	-0.882	0.063	0.500	0.081	-0.144	0.035	0.017	0.255	0.101	0.247
X5	-0.097	-0.012	-0.088	0.338	-0.946	0.095	0.181	0.200	-0.041	0.027	-0.058	0.299	0.089	-0.013
X6	-0.053	-0.014	-0.031	0.063	-0.255	0.352	-0.170	0.078	0.120	0.020	-0.241	0.060	-0.097	-0.168
X7	0.055	0.021	0.081	0.194	-0.184	-0.064	0.931	-0.154	-0.172	0.036	0.130	0.043	0.110	1.000**
X8	0.123	0.024	0.142	-0.072	0.463	-0.067	0.352	-0.409	0.038	-0.022	0.024	-0.086	-0.029	0.481*
X9	-0.010	-0.017	0.017	-0.141	0.105	0.114	-0.433	-0.042	0.370	0.077	-0.194	-0.010	-0.058	-0.376
X10	0.034	-0.016	0.108	-0.060	0.122	-0.034	-0.159	-0.044	0.136	-0.209	-0.053	-0.015	-0.004	-0.195
X11	-0.017	-0.050	-0.082	-0.021	-0.186	0.285	-0.409	0.033	0.242	-0.037	-0.297	0.063	-0.042	-0.318
X13	-0.008	-0.013	-0.092	0.304	-0.931	0.069	0.133	0.115	-0.012	0.011	-0.062	0.304	0.048	-0.019
X14	-0.002	0.009	0.105	-0.133	0.306	0.124	-0.371	-0.042	0.078	-0.003	-0.045	-0.053	-0.276	-0.261

X1-vine length, X2- number of branches per plant, X3- days to first flowering, X4- days to first harvest, X5- days to last harvest, X6- days from flowering to vegetable maturity, X7- total number of harvests, X8- fruit length, X9- fruit girth, X10- average fruit weight, X11- number of fruits per plant, X13- duration of the crop, X14- shelf life in open condition.

to first harvest (63.8%), days to last harvest (72.0%), days from flowering to vegetable maturity (98.4%), total number of harvests (82.2%), fruit length (98.9%), fruit girth (98.9%), average fruit weight (92.1%), yield per plant (73.9%) and duration of the crop (66.7%) recorded high heritability (61 per cent and above). Two characters *viz*. number of branches per plant and number of fruits per plant showed moderate (31 – 60 per cent) and vine length and shelf life in open condition recorded low heritability (0 – 30 per cent) indicating that these characters were least influenced by the environment and this is supported by Johnson et al. (1955) and Bharathi et al. (2005).

Genetic advance was maximum for the character days to last harvest (11.31) and minimum for the character vine length (0.10). The highest magnitude of genetic gain was recorded for the character fruit length (59.58%) and the lowest for the character days to first flowering (6.79%).

The estimates of heritability were high and coupled with high genetic gain for days from flowering to vegetable maturity (98.4%, 43.17%), total number of harvests (82.2%, 53.16%), fruit length (98.9%, 59.58%), fruit girth (98.9%, 25.73%) and average fruit weight (92.2%, 21.60%). High heritability coupled with high genetic gain indicated prevalent role of additive gene effect and was more precise in predicting the effect of selection than the former alone (Bharathi et al., 2006). High GCV and PCV values coupled with high heritability and genetic gain were recorded for the characters like total

Figure 1. Rooted cuttings

Figure 2. Leaf shape and leaf margin variability

Figure 3. Variability in fruit shape and blossom end shape

Table 3. Phenotypic (lower diagonal) and genotypic (upper diagonal) correlation coefficients between yield and its components.

Character	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14
X1	1.00**	0.301	0.107	0.506	0.685**	0.379	-0.393	-0.875**	0.070	-0.240	0.119	-0.446	0.060	0.011
X2	0.140	1.00**	-0.485*	-0.220	-0.235	-0.269	0.393	0.445	-0.321	0.297	-0.949**	0.516*	-0.247	0.171
X3	-0.040	-0.515	1.00**	0.166	0.251	0.089	-0.230	-0.404	-0.049	-0.307	0.234	-0.448	0.262	-0.299
X4	0.297	-0.028	0.170	1.00**	0.933**	0.180	0.537*	-0.198	-0.390	-0.166	-0.059	0.247	0.838**	-0.367
X5	0.286	-0.054	0.279	0.724*	1.00**	0.270	0.195	-0.489*	-0.111	0.129	0.197	-0.013	0.984**	-0.324
X6	0.171	-0.146	0.080	0.166	0.249	1.00**	-0.183	-0.190	0.324	-0.097	0.811**	-0.168	0.197	0.351
X7	-0.139	0.229	-0.163	0.363	0.175	-0.146	1.00**	0.378	-0.465*	-0.171	-0.439	1.000**	0.143	-0.398
X8	-0.484	0.291	-0.304	-0.171	-0.407	-0.180	0.358	1.00**	0.102	0.107	-0.082	0.481*	-0.282	0.104
X9	0.052	-0.236	-0.026	-0.318	-0.116	0.319	-0.417	0.100	1.00**	0.366	0.653**	-0.376	-0.033	0.210
X10	-0.069	-0.210	-0.226	-0.134	-0.085	-0.090	-0.137	0.097	0.361	1.00**	0.177	-0.195	-0.051	0.016
X11	-0.120	-0.310	0.178	-0.016	0.172	0.563	-0.216	-0.035	0.460	0.078	1.00**	-0.318	0.207	0.152
X12	0.007	0.381	-0.372	0.266	-0.010	-0.126	0.831*	0.404	-0.317	-0.139	-0.287	1.00**	-0.135	-0.304
X13	0.205	-0.089	0.205	0.668*	0.876*	0.165	0.172	-0.237	-0.028	-0.030	0.233	-0.019	1.00**	-0.174
X14	0.005	0.117	-0.240	-0.293	-0.275	0.348	-0.361	0.103	0.209	0.016	0.102	-0.261	-0.142	1.00**

X1-vine length, X2- number of branches per plant, X3- days to first flowering, X4- days to first harvest, X5- days to last harvest, X6- days from flowering to vegetable maturity, X7- total number of harvests, X8- fruit length, X9- fruit girth, X10- average fruit weight, X11- number of fruits per plant, X12- yield per plant, X13- duration of the crop, X14- shelf life in open condition.

*- significant **- highly significant

number of harvests, fruit length and fruit girth. High heritability along with low GCV and PCV values were recorded for characters like days to first flowering, days to first harvest, days to last harvest, yield per plant and duration of the crop implying that these characters were less effective in selection since they were controlled by non additive genes.

The genotypic and phenotypic correlations between different pairs of characters were estimated and are presented in Table 2. In the present study it was observed that yield had significant and positive genotypic correlation with number of branches per plant (0.516), total number of harvests (1.000) and fruit length (0.481). On the other hand, yield showed significant and negative genotypic correlation with number of fruits per plant (-0.518). The yield was significant and had positive correlation with total number of harvests (rg=1.00, rp= 0.831) since it had a direct inherent effect on yield. The genotypic correlation coefficient for vine length, number of branches per plant, days to first harvest, total number of harvests, fruit length and duration of the crop were higher than the phenotypic correlation coefficient indicating the direct influence of these characters on yield. The low phenotypic correlation coefficient indicated the lower effect of environment on yield.

In path coefficient analysis the highest positive direct genotypic effect on yield was exhibited by total number of harvests (0.931), followed by fruit girth (0.370), days to first harvest (0.362), days from flowering to vegetable maturity (0.352) and duration of the crop (0.304) (Table 2). The characters like vine length, number of branches per plant, days to first harvest, days from flowering to vegetable maturity, total number of harvests, fruit length and fruit girth exhibited direct and positive phenotypic effect on yield (Table 3). In path coefficient analysis the highest positive direct phenotypic effect on yield was exhibited by total number of harvests (0.737) with positive phenotypic correlation (0.831).

On partitioning of the coefficients into direct and indirect effects, it was observed that maximum positive direct effect on yield was exhibited by total number of harvests (0.931) followed by fruit girth, days to first harvest, days from flowering to vegetable maturity, duration of the crop and number of branches per plant revealing the direct relationship of these characters with yield which therefore could be considered for selection in yield improvement programmes. Even though number of days from flowering to vegetable maturity, fruit girth and duration of the crop showed high and direct

positive effect on yield, their correlation with yield was found to be negative. Hence, direct selection for the trait should be practised to reduce the undesirable indirect effects.

Estimation of selection indices involving the characters vine length, number of branches per plant, days to first harvest, total number of harvest, fruit length, fruit girth and number fruits per plant was conducted to identify the superior genotypes. Ranking based on the selection index showed MD 226 (average yield of 110.06 g) as the most superior one followed by MD 227 (average yield of 105.91 g) and MD 221 (average yield of 105.50 g). Thus the study revealed these three accessions as the most promising ones with respect to yield and other economic characters.

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