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COMPONENT ANALYSIS FOR QUANTITATIVE TRAITS IN RIDGE GOURD [*LUFFA ACUTANGULA* (ROXB.) L.]

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Summary

Genetic variability, heritability (h^2), genetic advance, character association and path analysis were carried out in 22 accession of ridgegourd [*Luffa acutangula* (Roxb.) L.] during rainy season of 2006. Highly significant differences between genotypes were recorded for all the characters. Maximum range of mean values was observed for fruit weight followed by yield per plant and fruit length. High degree of variability was observed for fruit weight, yield per plant, fruit length, node at which Ist female flower appears and fruits per plant. High estimates of heritability in broad sense were obtained for fruit weight and fruit length suggesting hereby both these traits are governed by additive gene action. Positive and significant association of yield per plant was observed with fruit length and fruit weight at both genotypic and phenotypic level indicating that selection based on these characters either in combination or alone will result in identifying the genotypes having high yield potential. The average fruit weight, fruits per plant and days taken to initiation of Ist female flower had maximum direct effect on yield followed by number of primary branches per plant. Therefore, fruit weight, fruits per plant, days taken to initiation of Ist female flower and number of primary branches per plant should be considered as selection criteria for yield improvement in ridgegourd breeding.

सारांश

नसदार तोरि के 22 विभिन्न जीन प्ररूपों का अनुवांशिक विभिन्नता, वंशागतित्व अनुवांशिक उन्नयन, गुण–सम्बन्ध तथा पाथ विश्लेषण किया गया। सभी गुणों के लिये जीन प्ररूपों के बीच उच्च सार्थक विभिन्नता प्राप्त हुई। सबसे अधिक औसत मूल्य फल भार में पाया गया इसके बाद फल की लम्बाई। विभिन्नता की उच्चता फल भार, उपज प्रति पौध, फल की लम्बाई, गाँठ जिसपर मादा पुष्पन प्रारम्भ हुआ और फल प्रति पौध के लिये ज्यादा थी। वृहद रूप से वंशागतित्व की उच्चता फल भार ताि फल की लम्बाई के लिये ज्यादा थी जिससे स्पष्ट होता है कि ये सभी गुण योज्य जीन से प्रतिपादित होते हैं।

Introduction

Ridgegourd [*Luffa acutangula* (Roxb.) L.] is one of the most important cucurbitaceous vegetable crops grown extensively throughout the tropical and subtropical region of the world. Its tender fruits are popular and well known for culinary vegetable in India with good nutritive value and high yield potential. Due to high degree of cross pollination, wide range of variability in vegetative and fruit characters exists in this crop. The knowledge about the magnitude and nature of genetic variation in a specific population is of prime importance for the effective breeding programme (Debnath, 1988). Evaluation of the available variability is prerequisite for planning the value added improvement programme. The germplasm, which maintain in heterogeneous environment may be genetically diverse and can provide a plenty of scope for screening the better genotype with specific traits. The observed variability is a combined estimate of genetic and environmental factors, of which only former one is heritable. However the estimate of heritability alone does not provide an idea about the expected gain in next generation, therefore it has been considered in conjunction with genetic advance. Correlation and path analysis establish the extent of association between yield and its components and also bring out relative importance of their direct and indirect effects. This gives a clear understanding of their association with yield. Hence, the present study was carried out to assess the performance of various economic traits and to measure the extent of variability, heritability, expected genetic advance and interrelationship of yield components in ridgegourd.

Materials and methods

Twenty two accessions of ridgegourd were grown in a Randomized Block Design with three replications with row-to-row distance of 3m and plant-to-plant distance of 60cm during rainy season, 2006. Eight plants were maintained in each plot. All the cultural practices and fertilizers were given as per recommendations for proper growth and stand of the crop as and when required. The observations were recorded on five competitive plants for each treatment in each replication selected at random for days to initiation of first female flower, node at which first female flower appears, days to first fruit harvest, primary branches per plant, vine length, inter-nodal length, fruit length, fruits per plant, fruit weight and yield per plant. Data were averaged and analyzed for standard statistical procedure followed for estimating the genotypic and phenotypic coefficient of variation (Burton, 1952), heritability (Hanson *et al.*, 1956) and genetic advance (Johnson *et al.*, 1955). Phenotypic and genotypic correlation coefficients were calculated following A1-Jibouri *et al.* (1958) and path analysis following the method of Dewey and Lu (1959).

Results and discussion

The analysis of variance indicated highly significant differences among genotypes for all the characters (Table 1). The estimate of mean, range, genotypic (GCV) and phenotypic (PCV) coefficient of variation is given in table-2. The accession VRRG-18 was earliest, whereas VRRG-5 was late for days taken to initiation of Ist female flower and days taken to Ist fruit harvesting. The minimum and maximum length of fruit was recorded in VRRG-21 (9.90cm) and VRRG-15 (27.33cm), respectively. The number of fruits per plant was highest in VRRG-19 (27.13) and lowest in VRRG-2 (12.33). Maximum fruit weight was recorded in VRRG-12 (132.23g) and minimum in VRRG-21 (33.17g). The yield per plant was ranged between 0.71kg (VRRG-23) to 2.46kg (VRRG-18). Maximum range of mean values was observed for fruit weight (33.17-132.23g) followed by yield per plant (0.71-2.46kg) and fruit length (9.90-27.33cm). The higher

Table 1: Analysis of variance

Source of variation	d.f.	Days to initiation of 1st female flower	Node at which 1st female flower appears	Days to first fruit harvest	No. of primary branches/ plant	Vine length (m)	Inter-nodal length (cm)	Fruit length (cm)	Number of fruit/ plant	Fruit weight (g)	Yield/ plant (kg)
Replication	2	0.76	1.28	0.39	0.02	0.02	0.51	1.03	0.18	5.06	0.009
Treatment	21	34.80**	27.34**	50.80**	1.47**	1.03**	7.92*	61.81**	51.78**	2942.24**	0.84**
Error	42	1.75	1.52	1.62	0.36	0.37	4.13	2.42	2.91	24.13	0.03

* Significant at 5% probability level, ** Significant at 1% probability level

Table 2. Range, mean, variability, heritability and genetic advance

Characters	Range	Mean	Variability		Heritability (h^2)	Genetic advance
			PCV	GCV		
Days to initiation of 1st female flower	33.47-48.40	40.04	8.92	8.29	86.3	6.35
Node at which 1st female flower appears	7.73-17.33	12.53	25.329	23.41	85.0	5.57
Days to first fruit harvest	41.27-57.33	49.30	8.61	8.21	91.0	7.96
No. of primary branches/ plant	3.07-6.07	4.72	18.15	12.87	50.2	0.89
Vine length (m)	4.14-6.65	4.86	15.79	9.66	37.4	0.59
Inter-nodal length (cm)	11.67-18.44	14.14	16.43	7.96	23.5	1.12
Fruit length (cm)	9.90-27.33	18.21	25.89	24.44	89.1	8.65
Number of fruit/plant	12.33-27.13	19.92	22.00	20.26	84.8	7.66
Fruit weight (g)	33.17-132.23	81.47	38.75	38.28	97.6	63.47
Yield/plant (kg)	0.73-2.46	1.55	35.68	33.56	88.5	1.01

phenotypic coefficient of variation than those of genotypic coefficient of variation indicated the predominant role of environment on the expression of the traits. The genotypic and phenotypic coefficient of variation were highest for fruit weight (38.75 and 38.28), yield per plant (35.68 and 35.56), fruit length (25.89 and 24.44), node at which I[st] female flower appears (25.39 and 23.41) and fruits per plant (22.00 and 20.26) indicating maximum variability in these characters and have ample scope for effective improvement through selection. These findings are in accordance with the findings of Sahni *et al.* (1987) in ridgegourd, Dahiya *et al.* (1989) in roundmelon, Prasad and Singh (1992) in cucumber and Pandey *et al.* (2003) in snapmelon.

High estimates of heritability in broad sense were obtained for all the characters except inter-nodal length, vine length and number of primary branches per plant. The high value for heritability were obtained for fruit weight (97.6), days to I[st] fruit harvest (91.0) fruit length (89.1) and yield per plant (88.5). These findings suggest that there is scope for improvement in these characters through direct selection. In the present study fruit weight showed maximum genetic advance (63.47) followed by fruit length (8.65), days to I[st] fruit harvest (7.96) and fruits per plant (7.66). A similar result has also been reported by Sahni *et al.* (1987) and Varalakshmi *et al.* (1994) in ridgegourd and Pandey *et al.* (2003) in snapmelon.

Heritability along with genetic advance is more useful criteria in predicting the resultant effect for selecting the best individual (Johnson *et al.* 1955). Burton (1952) suggested that characters with high heritability coupled with high genetic advance would respond to selection better than those with high heritability and low genetic advance. High heritability along with high genetic advance was observed for fruit weight and fruit length. These results are in accordance with the findings of Varalakshmi *et al.* (1994) in ridgegourd and Pandey *et al.* (2003) in snapmelon. Here practicing phenotypic selection could bring about improvement in these characters.

Genotypic correlation coefficient was higher than their corresponding phenotypic correlation coefficient for most of the characters except vine length, inter-nodal

Table 3. Estimates of genotypic and phenotypic correlation coefficients of yield and its contributing traits

Traits		Node at which 1[st] female flower appears	Days to first fruit harvest	No. of primary branches/ plant	Vine length (m)	Inter-nodal length (cm)	Fruit length (cm)	Number of fruit/ plant	Fruit weight (g)	Yield/ plant (kg)
		2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	G	0.456*	0.966**	0.504*	0.222	0.581**	-0.447*	0.252	-0.366	-0.351
	P	0.365	0.784**	0.298	0.134	0.383	-0.379	0.236	-0.330	-0.287
2	G		0.358	0.309	0.227	0.217	0.032	0.098	-0.056	0.005
	P		0.352	0.178	0.094	0.071	0.020	0.089	-0.056	0.008
3	G			0.454*	0.276	0.726**	-0.581**	0.300	-0.345	-0.344
	P			0.315	0.097	0.257	-0.544**	0.254	-0.328	-0.312
4	G				-0.067	0.910**	-0.196	0.658**	-0.578**	-0.328
	P				-0.105	0.254	-0.135	0.455*	-0.370	-0.154
5	G					-0.641**	-0.117	-0.286	0.113	-0.012
	P					0.007	-0.022	-0.182	0.055	-0.053
6	G						-0.815**	0.867**	-0.850**	-0.679**
	P						-0.357	0.342	-0.417	-0.334
7	G							-0.258	0.448*	0.513*
	P							-0.264	0.423*	0.436*
8	G								-0.552**	-0.152
	P								-0.487**	-0.019
9	G									0.875**
	P									0.845**

* Significant at 5% probability level, ** Significant at 1% probability level

Table 4. Direct (diagonal) and indirect effect of different traits on yield at genotypic level

Traits	Days to initiation of 1st female flower	Node at which 1st female flower appears	Days to first fruit harvest	No. of primary branches/ plant	Vine length (m)	Inter-nodal length (cm)	Fruit length (cm)	Number of fruit/ plant	Fruit weight (g)	Correlation with yield/ plant (kg)
	1	2	3	4	5	6	7	8	9	10
1	**0.557**	-0.008	-0.621	0.008	0.011	-0.029	0.002	0.145	-0.416	-0.351
2	0.254	**-0.017**	-0.230	0.005	0.011	-0.011	0.00	0.056	-0.063	0.005
3	0.538	-0.006	**-0.643**	0.007	0.014	-0.036	0.002	0.172	-0.393	-0.344
4	0.281	-0.005	-0.292	**0.015**	-0.003	-0.045	0.001	0.379	-0.657	-0.328
5	0.123	-0.004	-0.177	-0.001	**-0.051**	0.032	0.000	-0.165	0.128	-0.012
6	0.324	-0.004	-0.467	0.014	-0.032	**-0.050**	0.003	0.499	-0.966	-0.679*
7	-0.249	-0.001	0.374	-0.003	-0.006	0.041	**-0.004**	-0.148	0.509	0.513*
8	0.141	-0.002	-0.193	0.010	-0.014	-0.043	0.001	**0.575**	-0.627	-0.152
9	-0.204	0.001	0.222	-0.009	0.006	0.042	-0.002	-0.317	**1.136**	0.875**

* Significant at 5% probability level, ** Significant at 1% probability level, Residual effect = 0.131

...ngth and fruits per plant (Table-3). A perusal of data revealed that yield has positive and significant correlation with fruit length (0.513, 0.436) and fruit weight (0.875, 0.845) at both genotypic and phenotypic level, respectively thus it can be inferred that selection based on these characters either in combination or alone will result in identifying the genotypes having high yield potential. Fruit weight and fruit length showed positive and significant association berween themselves therefore, these characters should be kept in mind while making selection for yield improvement in ridgegourd. The combination of these characters was further analyzed by computing their direct and indirect effect on yield (Table-4). The results during the study revealed that characters like fruit weight (1.136), fruits per plant (0.575) and days taken) initiation of Ist female flower (0.557) had maximum direct effect on yield followed by number of primary branches per plant (0.015), which is in agreement with the results of Pandey *et al.* (2003) in snapmelon. The node at which Ist female flower appears (-0.017) and fruit length (-0.004) had negative direct effect but correlation with yield is positive owing to indirect effect through all characters. A similar result has also been reported by Pandey *et al.* (2003).

From the above findings it may be concluded that besides direct selection for fruit weight, fruits per plant and days taken to initiation of Ist female flower indirect selection through node at which Ist female flower appears and fruit length should be considered for yield improvement in ridgegourd breeding programme.

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