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RESEARCH ARTICLE

Assessment of genetic variability and magnitude of correlation co-efficient among different traits in isabgol (*Plantago ovata* L. Forsk)

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SUMMARY

The present investigation was carried out using 26 diverse genotypes including 3 checks. The genotypes were planted in Randomized Block Design with three replications during *Rabi*, 2010-2011 at Research Farm, Department of Plant Breeding and Genetics, Rajasthan College of Agriculture, MPUAT, Udaipur. The observations were recorded on ten randomly selected plants and estimation of different variability parameters and magnitude of correlation co-efficient among different traits in Isabgol (*Plantago ovata* L. Forsk). Analysis of variance revealed significant differences among the genotypes for all the characters suggesting sufficient amount of variability in the experimental material under study. High GCV coupled with high heritability and expected genetic gain of a character provides good selection advantage. There is a substantial scope for improvement of number of florets per plant, total soluble sugar, number of effective tillers per plant and seed yield per plant. Selection for these characters would be effective in selection of suitable genotype for Isabgol improvement. Association study indicated that seed yield per plant was positively and significantly correlated at both genotypic and phenotypic level with number of tillers per plant and 1000 seed weight, whereas swelling factor showed positive significant correlation with seed yield per plant only at genotypic level. These associations indicated that improvement in seed yield can be achieved by improving the characters for further breeding programme.

Key Words : Isabgol, Variability, Character association, Seed yield

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Isabgol [*Plantago ovata* L. Forsk.] is one of the most important medicinal plants valued for its thin white husk prescribed for certain ailment in the Unani and Ayurvedic medicine. The husk or mucilaginous seed coat has the property of absorbing and retaining water and as such, it has numerous pharmaceutical uses principally as swelling dietary and potentially for lowering blood cholesterol level. It is an anti-diarrhoea drug and beneficial in chronic dysenteries of amoebic and bacillary origin. It is also known as "blond psyllium" belonging to the family *plantaginaceae* and genus *Plantago* which comprises about 200 species. Out of these 10 are found in India including 3 important species *viz.*, *ovata*, *psyllun* and *indica*. It has 2n=8 chromosome number. Isabgol is an annual herb which is nearly stemless, softly hairy plant having tillers which spread nearly the ground surface. Its height is 25 to 40 cm and number of tillers varies from 3 to 10 depending on fertility of the soil. The flowers are bisexual, tetramerous, animophilous and protogynous in nature and such favouring out crossing (Husain *et al.*, 1984). India holds a monopoly in production and export of Isabgol to the world market. Isabgol is the major foreign exchange earner worth INR 2.5 billion (Dhar *et al.*, 2005). In Rajasthan, it is largely grown in Jodhpur, Pali, Jalore, Jaisalmer, Barmer, Nagaur, Sirohi

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and Chittoragarh districts over an area of about 214 thousand ha with a total production of 113 thousand tonnes and a productivity of 529 kg/ha (Anonymous, 2011). The progress of any breeding programme depends upon the extent of genetic variability present in the population.

The genetic variability along with the heritability gives a reliable picture of the genetic advance to be expected from selection while the heritability coupled with genetic advance aids in predicting the valuable conclusion for effective selection based on phenotypic performance. Correlation co-efficient studies provide an opportunity to study the magnitude of association among different traits in isabgol.

MATERIALS AND METHODS

The present investigation was carried out using 26 diverse genotypes including 3 checks. The genotypes were planted in Randomized Block Design with three replications during *Rabi*- 2010-11 at Research Farm, Department of Plant Breeding and Genetics, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. Each entry was planted in 4 rows of 3.0 m. length keeping row to row distance of 30 cm, respectively. The recommended package of practices was followed to raise a healthy crop. The observations were recorded on ten randomly selected competitive plants for each entry in each replication for all the morphological characters *viz*., plant height, number of effective tillers per plant, number of spikes per plant, spike length, number of florets per plant (central two spikes), leaf length, leaf width and seed yield per plant. However, the observations' Days to 75 per cent flowering and Days to 75 per cent maturity were recorded on plot basis. Also the representative bulk sample from each entry in each replication was used for 1000-seed weight and for analysis of swelling factor and total soluble sugar. The data collected on various characters were averaged and subjected to statistical analysis.

RESULTS AND DISCUSSION

The experimental results of the present investigation entitled "Assessment of genetic variability and magnitude of correlation co-efficients among different traits in Isabgol (*Plantago ovata* L. Forsk)" are presented as the analysis of variance was done for all the thirteen characters studied. The mean squares due to genotypes were highly significant for all the characters while mean squares due to replication were found to be non significant for all the characters. Magnitude of genotypic variability is measured in terms of genotypic co-efficient of variance (GCV). It provides a direct comparison of variability between different traits. In general, estimate of phenotypic co-efficients of variance (PCV) were slightly higher than their corresponding genotypic co-efficient of variance (GCV) indicating the important role of environment in the expression of the characters. In present investigation higher estimates of GCV and PCV were obtained for seed yield per plant (15.33, 19.05), number of florets per plant (13.57, 14.26), number of effective tillers per plant (12.62, 14.51) and spike length (10.93, 15.57) (Table 1). Lower values of GCV and PCV were recorded in days to 75 per cent flowering indicating the important role of environment in the expression of the character. These results indicating the presence of ampoule variability for seed yield and related traits in Isabgol. These findings of the experiment are also supported by the similar trends of results by Verma (1998) and Yadav *et al*. (2001).

Heritability (in broad sense) is the ratio of genotypic variance to phenotypic variance. It determines the efficiency with which we can utilize the genotypic variability in breeding programme. An estimate of heritable fraction of variability is of paramount importance in any crop improvement programme. In the present study high estimates of heritability was observed for the trait number of florets per plant (90.46 %), total soluble sugar (90.01 %), swelling factor (87.19 %), 1000-seed weight (86.26 %), number of effective tillers per plant

Table1 : Phenotypic and genotypic coefficient of variation, heritability and genetic advance and genetic gain for characters in isabgol

Sr. No.	Characters	GCV	PCV	h^2	GA	GG
1.	Days to 75 per cent flowering	2.03	2.37	73.50	2.60	3.59
2.	Days to 75 per cent maturity	2.05	2.66	59.49	3.71	3.26
3.	Plant height (cm)	6.82	8.16	69.75	4.01	11.73
4.	Number of effective tillers	12.62	14.51	75.69	1.32	22.62
5.	Number of spikes	8.55	13.91	37.75	5.49	10.82
6.	Spike length (cm)	10.93	15.57	49.22	0.79	15.79
7.	Number of florets	13.57	14.26	90.46	29.78	26.58
8.	Leaf length (cm)	9.14	13.33	47.07	2.55	12.92
9.	Leaf width (cm)	12.74	18.92	45.34	0.19	17.67
10.	1000 seed weight (g)	11.72	12.61	86.26	0.33	22.42
11.	Seed yield per plant (g)	15.33	19.05	64.79	1.22	25.42
12.	Swelling factor (cc/mg)	6.20	6.64	87.19	1.25	11.92
13.	Total soluble sugar (mg/g)	9.37	9.64	90.01	12.7	17.80

(75.69 %), days to 75 per cent flowering (73.50 %) and plant height (69.75 %) indicating a close agreement between genotype and phenotype for the expression of these characters over environmental condition (Table 1). These trends of results also indicated less influence of the environment in the expression of those traits. Such traits are more amenable to selection for crop improvement. Godawat and Sharma (1994) also reported the similar results in Isabgol.Genetic advance indicates the shift in gene frequency towards superior sides on exercising selection pressure. Genetic advance expressed as percentage of mean was maximum for number of florets per plant (29.78%) followed by total soluble sugar (12.7%). The characters namely number of spikes per plant (5.49%), plant height (4.01%) and days to 75 per cent maturity (3.71%) exhibited moderate genetic advance while remaining traits exhibited low estimates of genetic advance (Table-1).The character number of florets per plant and total soluble sugar exhibited high heritability accompanied with high genetic advance. Similarly high heritability associated with moderate genetic advance was recorded in traits like 1000 seed weight, swelling factor and number of tillers per plant.

Genetic advance as per cent of mean is expressed as genetic gain. The highest genetic gain was observed for number of florets per plant (26.58 %) followed by seed yield per plant (25.42 %), number of tillers per plant (22.62 %) and 1000- seed weight (22.42 %). The magnitude of genetic gain was medium for total soluble sugar (17.80 %), leaf width (17.67 %), spike length (15.79 %), leaf length (12.92 %), swelling factor (11.92 %) and plant height (11.73 %). Very low estimates of genetic gain were recorded for days to 75 per cent flowering (3.59 %) and days to 75 per cent maturity (3.26 %) (Table-1). In consonance to present finding, Verma (1998) also observed higher estimates of genetic gain for seed yield per plant (22.25) in isabgol. It was also observed that the traits like seed yield per plant, number of florets per plant, 1000 seed weight and number of effective tillers per plant exhibited high GCV along with high genetic gain indicating preponderance of additive gene effect for those traits. The characters like days to75 per cent flowering and days to 75 per cent maturity though exhibited moderate heritability but had low estimates of genetic gain might be attributed to low variability for those traits in the material taken for study.

In present study the correlation co-efficients were worked out among thirteen characters to find out correlation of seed yield per plant with its components at genotypic (r_g) and phenotypic (r_p) levels. The perusal of data given in Table 2 revealed that in general, the genotypic correlation co-efficients were relatively higher than their corresponding phenotypic correlations. Higher values of genotypic correlation than their corresponding phenotypic correlation may be due to masking effect of environment in modifying the total expression of genotype. Correlation between seed yield per plant and different characters indicated that seed yield

Table2 : Genotypic (r_g) and phenotypic (r_p) correlation coefficients between different characters in isabgol

Characters / r_g / r_p	Days to 75 % flowering	Days to 75 % maturity	Plant height	No. of effective tillers per plant	No. of spikes per plant	Spike length	No. of florets per plant	Leaf length	Leaf width	1000 seed weight	Seed yield per plant	Swelling factor	Total soluble sugar
Days to 75 % flowering		0.23	-0.11	-0.09	0.06	-0.55**	-0.10	0.63**	-0.35	-0.51**	-0.37	-0.10	-0.02
Days to 75 % maturity	0.09		-0.17	-0.36	0.32	0.14	0.03	-0.02	-0.32	-0.36	-0.52**	-0.34	-0.42*
Plant height	-0.17	-0.13		0.27	0.07	0.04	0.24	-0.39*	0.35	0.23	0.16	0.07	0.46*
No. of effective tillers per plant	-0.09	-0.26	0.23		0.32	-0.21	-0.15	-0.13	-0.01	0.67**	0.81**	0.42*	0.32
No. of spikes per plant	-0.01	0.19	-0.06	0.16		-0.43*	-0.22	0.06	-0.12	0.08	0.25	0.40*	0.24
Spike length	-0.26	0.11	0.02	-0.20	-0.12		0.36	-0.19	0.16	-0.13	-0.08	-0.07	-0.12
No. of florets per plant	-0.07	0.02	0.21	-0.11	-0.17	0.27		0.02	0.24	-0.47*	-0.26	-0.19	0.10
Leaf length	0.44*	0.04	-0.21	-0.07	0.43*	-0.48*	0.03		-0.49*	-0.45*	-0.16	0.01	0.07
Leaf width	-0.19	-0.17	0.19	-0.01	-0.71**	0.34	0.33	-0.26		0.12	-0.07	-0.03	0.18
1000- seed weight	-0.44*	-0.24	0.17	0.51**	0.07	-0.07	-0.39*	-0.32	0.04		0.81**	0.28	0.17
Seed yield per plant	-0.31	-0.29	0.12	0.55**	0.20	-0.02	-0.22	-0.11	-0.04	0.59**		0.44*	0.16
Swelling factor	-0.08	-0.23	0.06	0.35	0.23	-0.07	-0.17	0.04	-0.02	0.20	0.37		0.70**
Total soluble sugar	-0.04	-0.29	0.40*	0.30	0.10	-0.09	0.08	0.05	0.07	0.17	0.11	0.61**	

* and ** indicate significance of value at P=0.05 ard 0.01, respectively

per plant was positively and significantly correlated with number of effective tillers per plant (r_g= 0.81**, r_p= 0.59**) and 1000-seed weight (r_g= 0.81**, r_p= 0.59**) at both genotypic and phenotypic level, However swelling factor was positively significant correlated only at genotypic level (r_g= 0.44*,). Days to 75 per cent maturity showed significant negative association with seed yield per plant (-0.52**) at only genotypic level. These associations seemed favourable for increasing seed yield through selection.

Mutual correlation co-efficient between other characters revealed that Days to 75 per cent flowering showed positive and significant association with leaf length (0.63**, 0.44*) at both genotypic and phenotypic level and negatively significant association with spike length (-0.55**) only at genotypic level. However days to 75 per cent maturity showed negative and significant association with seed yield per plant (-0.52**) and total soluble sugar (-0.42*) at genotypic level only. Similarly Plant height depicted positive and significant association with total soluble sugar (0.46*, 0.40*) both at genotypic and phenotypic level and significant negative association with leaf length (0.39*) at genotypic level only. Number of effective tillers per plant showed highly significant positive association with 1000-seed weight (0.67**, 0.51**) and seed yield per plant (0.81**, 0.59**) at genotypic and phenotypic levels and swelling factor (0.42*) only at genotypic level. Number of spikes per plant showed significant positive correlation with swelling factor (0.40*) only at genotypic level. Spike length and leaf width exhibited non significant association with all other characters studied, indicating the absence of significant correlation among yield and quality characters. 1000-seed weight had strong significant and positive correlation with seed yield per plant (0.81**, 0.59**) at both genotypic and phenotypic levels. Seed yield per plant showed significant positive correlation with swelling factor (0.44*) at only genotypic level while swelling factor had significant positive relationship with total soluble sugar (0.70**, 0.44**) at both genotypic and phenotypic level. These findings are in agreement with Singh *et al.* (1995), Sharma and Kothari (1997), Lal *et al.* (1999), Yadav *et al.* (2001), Sharma and Garg (2002), who reported positive correlation of most of the traits with seed yield per plant. Ranwah and Shivaneson (2009) and Verma (1998) also found strong positive correlation of number of traits like number of tillers per plant and test weight with seed yield per plant.

It can be concluded from the above experimental findings that main yield contributing traits are plant height, number of effective tillers per plant, number of spikes per plant, 1000 seed weight, swelling factor and total soluble sugar due to their direct high positive association with seed yield. It indicated the possibilities of simultaneous improvement of these traits by selection. This in turn will improve the seed yield, since they are positively correlated with the seed yield**.** The trait days to 75 per cent maturity had negative and significant correlation with seed yield per plant thereby indicating selection for early maturity would be affecting to enhance the seed yield in isabgol.

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