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Variability and Association Analysis for Seed Yield and its Contributing Traits in Isabgol Genotypes

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Abstract

The present investigation was carried out at Agricultural Research Station, Mandor to study the variability and correlation analysis for seed yield and its contributing traits in 20 genotypes of Isabgol. The analysis of variance revealed sufficient variation for all the quantitative characters viz.,days to 50% flowering (66-85 days), plant height (33.0-42.6 cm), number of spikes (34.2-62.8), spike length (4.3-7.0 cm), seed yield/plot (380-1450 g) indicating available genetic variability to be exploited in breeding programme. High GCV coupled with high heritability and expected genetic gain was found in number of spikes, spike length & seed yield per plant and selection for these characters would be effective in selection of suitable genotype for Isabgol improvement. Correlation study revealed that seed yield per plant was highly significant &positively correlated with number of spikes (0.734**, 0.653**)at genotypic & phenotypic level, while with spike length (0.290*) at phenotypic level only. Hence, it would be rewarding to lay stress on these characters in selection programme for increasing yield.

Key words : *Variability, heritability, genetic advance, correlation.*

Introduction

Blond psyllium (*Plantago ovate* Forsk, 2n=8) popularly known as isabgol has great commercial and medicinal importance due to its thin rosy huskon the seed. Seed husk (rosy-white membranous covering of the seed) mainly given as a safe laxative, particularly beneficial in habitual constipation, chronic diarrhea and dysentery (1). The husk, which is about 25 to 30% of the seed, has theproperty of absorbing and retaining water and hence, it works as an antidiarrheal drug. It is also used in calico printing, dyeing, agar-agar media preparation, gum and jelly making, as binder in tablets, as thickner and a fixative in ice-cream, confectionary and in cosmetics industries (2). Isabgol is largely cultivated in parts of Gujarat, Rajasthan and Madhya Pradesh. Sporadic area under cultivation is also found in the parts of Uttar Pradesh and Haryana (3).

Progress in any crop improvement programme depends on the magnitude of genetic variability and heritability present in the available genetic material. The amount of available variability is measured by genotypic coefficient of variation (GCV) and phenotypic coefficient of variation, which provides the information of variation present in the base material. The genetic variability along with the heritability provides a reliable picture of the genetic advance to be expected from further selection in the genetic material while the heritability coupled with genetic advance helps in predicting the valuable conclusion for effective selection based on phenotypic performance (4,5,6). The correlation coefficient would help in determining the strength of the relationship between different variables under study and also provide information about selection for one variable affects positively or negatively for another variable. The present investigation was conducted with the objectives to calculate variability present among 20 genotypes of isabgol and inter-relationship of yield with other important yield contributing traits.

Materials and Methods

The present investigation was carried out using twenty (Table-1) isabgol genotypes. These genotypes were grown in a randomized block design (RBD) with three replications during Rabi-2018-19 at Agricultural Research Station, Agriculture University, Jodhpur. Each genotype was planted in a single plot of 4 m X 3 m length with spacing of 30 cm between row to row. All the recommended package of practices was followed to raise to healthy crop. The observations were recorded on five randomly selected plants from each replication and genotypes, for all the characters namely, number of spikes, spike length, plant height, grain yield/plant. However, the observations of days to 50 per cent flowering was recorded on plot basis. The data collected on various characters were averaged and subjected to statistical analysis.

Statistical analysis was carried out for estimating analysis of variance as suggested (7). Phenotypic coefficient of variation and genotypic coefficient of variation were calculated as described (8). Heritability in broad sense (9) and expected genetic advance (10) were

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also calculated. The genotypic and phenotypic correlation between yield and its component traits and among themselves was calculated as per the methods suggested (11).

Results and Discussion

Genotypic and phenotypic variability, heritability and genetic advance : The analysis of variance revealed that 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 studied. It indicates presence of variability among the lines being evaluated and ample scope of improvement by selection in breeding programmes. Large variation among genotypes were found for all the traits studied like, days to 50% flowering (66-85 days), plant height (33.0-42.6 cm), number of spikes (34.2-62.8), spike length (4.3-7.0 cm), seed yield/plot (380-1450 g) in the present study which were in conformity with previous works of (12,13).

Magnitude of genotypic variability is measured in terms of genotypic coefficient of variance (GCV) and it provides a direct comparison of variability between different traits while phenotypic variability is measured in terms of phenotypic coefficient of variance (PCV). In the present study, GCV and PCV were higher for characters like seed yield (24.81, 27.08), number of spikes per plant (14.95, 15.41) and spike length (12.46, 12.69) indicating the scope of exploiting variability for further improvement of these traits. High GCV and PCV for one or more above mentioned traits have also been previously reported by (14,15,16) in isabgol. The results revealed (Table-2) that days to flowering (5.206 and 5.606) and plant height (4.653 and 5.851) exhibited lowest GCV and PCV values implying the difficulty of improving these traits through simple selection procedure. These results indicating the presence of ampoule variability for seed yield and contributing traits in Isabgol. The magnitude of PCV was generally higher than GCV for all the characters indicating the important role of environment in the expression of these characters.

Heritability is the ratio of genotypic variance to phenotypic variance. It determines the efficiency with which we can utilize the genotypic variability in crop improvement programmes. The difference between estimates of PCV and GCV was also indicative of heritability. In this study, high heritability estimate was observed for the characters like number of spikes (94.19%) and spike length (96.34%), which has low difference between PCV and GCV. These results indicated less influence of environment on the expression of these characters. (13,14) also reported the similar results for number of spikes in isabgol. The character plant height exhibited low heritability (63.23%) and low estimates of genetic gain (7.62) might be attributed to low variability for the trait in the material taken for study.The GCV along with heritability estimates provides a better picture of the amount of expected genetic advance by phenotypic selection by breeders. High heritability coupled with high genetic advance for number of spikes (94.19% and 29.90), spike length (96.34 and 25.19) and seed yield (83.94% and 46.82) indicated the scope of improvement through direct phenotypic selection.

Table-1 : List of isabgol genotypes used in experiment.

S. No.	Name of Genotype	S. No.	Name of Genotype
1.	RI 148	11.	RI 154
2.	RI 156	12.	HI 2
3.	RI 151	13.	RI 167
4.	RI 136	14.	RI 168
5.	RI 1	15.	RI 150
6.	RI 158	16.	RI 3025
7.	GI 2	17.	RI 147
8.	RI 166	18.	RI 89-800-4
9.	DM 9	19.	GI 2-800-15
10.	RI 153	20.	MI 12

Genetic advance as per cent of mean is expressed as genetic gain. The highest genetic gain was observed for seed yield (46.82%) followed by number of spikes (29.90 %) and spike length (25.19 %). The magnitude of genetic gain was low in the characters days to flowering (9.96%) and plant height (7.62). It was also observed that the seed yield per plant exhibited high GCV (24.81) along with high genetic gain (46.82%) indicating preponderance of additive gene effect. (15) also observed higher estimates of genetic gain for seed yield (22.25) in isabgol.

Correlation Analysis : Correlation studies were carried out to reveal the nature and extent of association between yield and related traits. In present study the correlation coefficients were worked out among five characters to find out correlation of seed yield with its components at genotypic (r_g) and phenotypic (r_p) levels. From correlation matrix (Table-3), it was observed that seed yield exhibited highly significant positive correlation with number of spikes (0.734**, 0.653**) at genotypic and phenotypic level, while significant positive correlation with spike length (0.290*) at phenotypic level only. This significant positive association between number of spikes and grain yield potential is in close confirmation with the earlier findings of (15,16,17) in isabgol. The positive correlation of grain yield with these characters implies that improving one or more of these traits could results in higher grain yield for isabgol. Spike length was also important yield determinant character because of their positive and highly significant levels of correlations with grain yield potential.

Table-2 : Estimation of grand mean, range, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability, genetic advance and genetic advance as percent of mean for quantitative characters in isabgol genotypes.

Characters	Range	Grand Mean ± SEm	PCV (%)	GCV (%)	Heritability (Broad Sense) (%)	Genetic Advance	Genetic Advance as % of mean
Days to flowering	66 - 85	75.28 ± 0.90	5.606	5.206	86.25	7.498	9.960
Plant height	33.0 - 42.6	36.42 ± 0.74	5.851	4.653	63.23	2.776	7.622
Number of spikes	34.20 - 62.80	49.89 ± 1.07	15.411	14.956	94.19	14.919	29.902
Spike length	4.3 - 7.0	5.14 ± 0.072	12.694	12.460	96.34	1.296	25.195
Seed yield	380 - 1450	962.43 ± 60.30	27.082	24.812	83.94	450.70	46.829

Table-3 : Genotypic (below diagonal) and Phenotypic (above diagonal) correlation coefficients among isabgol genotypes.

	Days to flowering	Plant height	Number of spikes	Spike length	Seed yield
Days to flowering	1	-0.0277 NS	0.0034 NS	-0.1824 NS	0.0759 NS
Plant height	-0.0618 NS	1	0.2303 NS	0.4686 **	0.2335 NS
Number of spikes	-0.006 NS	0.2889 NS	1	0.1301 NS	0.6531 **
Spike length	-0.2208 NS	0.6169 **	0.1312 NS	1	0.2905 *
Seed yield	0.0307 NS	0.2353 NS	0.7342 **	0.2758 NS	1

Further, It was also observed that seed yield/plant had non-significant and positive genotypic and phenotypic association with plant height (0.235, 0.233), similar results were obtained by (19) in finger millet, (20,21,22) in pearl millet,in which they found that plant height is positively correlated with seed yield per plant which revealed that tall plants could contribute to more grain yield types, while dissimilar observations were found by Kumar and Jha, 2000 in isabgol, where they observed that plant height was negatively correlated with yield.

Mutual correlation coefficient between other characters revealed that days to flowering showed non-significant negative association with plant height (-0.0618, -0.0277) and spike length (-0.2208, -0.1824) at both genotypic and phenotypic level, while non-significant negative association with number of spikes (-0.006) at genotypic level and positive association (0.0034) at phenotypic level. Similar results were obtained by (18) in which they found days to flowering was positively correlated with spike length (-0.445). Plant height showed highly significant positive association with spike length (0.616**, 0.468**) while non-significant positive association with number of spikes (0.288, 0.230) at both genotypic and phenotypic level. Number of spikes showed non-significant positive correlation with spike length (0.131, 0.130) at both genotypic and phenotypic level.

The positive correlation of grain yield with these characters implies that improving one or more of these traits could results in higher grain yield in isabgol. The genotypic correlation coefficient value for most of the characters were higher in magnitude than the corresponding phenotypic values showing the existence of inherent association among the traits.

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