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Short Communication

Stability analysis for economic traits in blond psyllium (*Plantago ovata* Forsk.)

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Abstract

Stability analysis was carried out with thirty six genotypes of isabgol (*Plantago ovata* Forsk) under three environments to identify stable genotypes that could be cultivated uniformly under varied environmental conditions for yield and yield attributing traits. Pooled analysis of variance for stability indicated that all the genotypes of isabgol were highly significant for all the characters indicated that materials selected possessed sufficient genetic variation for all the traits studied. Mean squares arising due to genotype, G x E interaction and E + (G x E) were found significant for all the traits. Sufficient genotype x environment (linear) were exhibited by all the genotypes for all characters. The genotype RI-158 was superior in *per se* performance and stability for seed yield suggesting its suitability for inclusion in future breeding programme for development of stable variety. The genotypes, namely, RI-138, RI-3004, RI-166, RI-155, RAUI-Ja-2, RAUI-Ja-3, RAUI-B, RI-89, HI-2, GI-4 and Niharika were found suitable for high yielding environments, while genotypes, GI-2, RI-1(9808) and RI-142 were best in poor environments for seed yield.

Key words: Isabgol, stability, G x E interaction

Isabgol also known as blond psyllium is a wonder medicinal plant valued for its thin white husk on seed which is prescribed as a drug for certain ailments in Unani and Ayurvedic systems of medicine. The demand for herbal remedies has led to over exploitation of medicinal plant species including *Plantago ovata* and thus endangered the diversity. It is, therefore, necessary to characterize them, assess their medicinal value, conserve the diversity and maintain it [1]. Singh *et al*. [2] have made some efforts in characterizing 80 accessions of *Plantago ovata* and found some of them very promising. The seed coat known as husk has a medicinal properties. Romero-Baranzimi *et al*. [3] analysed seed and *in vitro* digistibility. The seeds of *Plantago ovata* contains 17.4% protein, 6.7% fat, 24.6% fibre, 19.6% insoluble fibre, 5% soluble fibre and combustion dietary heat of 4.75% kcl/g. The stability analysis provides information on genotypes for their stability over wide range of environments. Numerous statistical parameters as well as non-parametric have been proposed for the measurement of yield stability [4-6]. The study of genotype x environment interaction is important not only from the genetically and evolutionary point of view but is also related to agricultural production problem in general and to plant breeding, in particular [7]. Therefore in the present study, an attempt was made to collect the information as to whether genotypes of isabgol respond differentially when grown at different times and if they do so, how important the GxE interactions are for yield and its components.

Thirty six genotypes of isabgol which were obtained from Haryana, Gujarat, Lucknow, Jodhpur, Nagore and Jalore. These genotypes were raised during *rabi* for three years (2008-2010) in randomized block design with three replications at College of Agriculture, Bikaner. Each genotype was sown in double row with spaced apart at 30 x 10 cm in a plot of 3 x 4m size. The observations were recorded for days to 50 per cent flowering, plant height, number of effective tillers per plant, spike length, 1000-seed weight, biological yield

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Table 1. Analysis of variance for stability in blond psyllium

Source of variation	df	Days to 50% flowering	Plant height (cm)	No. of effective tillers/plant	Spike length (cm)	1000-seed weight (g)	Biological yield per plant (g)	Harvest index	Seed yield/ plant (g)
Genotype	35	22.52##**	8.06##**	581.46##**	1.22##**	0.052##**	114.63##**	64.40##**	15.13##**
Environment	2	367.43##**	94.18##**	2139.94##**	9.06##**	0.316##**	673.00##**	6.14	74.99##**
G x E	70	4.49**	0.33**	7.84**	0.05**	0.0013**	1.79**	11.13**	0.58**
E + (G x E)	72	14.57**++	2.94**++	67.07**++	0.30**++	0.010**++	20.43**++	10.99**	2.65**++
E (Linear)	1	734.86**++	188.36**++	4279.88**++	18.11**++	0.632**++	1346.01**++	12.28*	149.99**++
G x E (Linear)	35	5.36**	0.49**++	14.31**++	0.08**++	0.002**++	3.29**++	3.90	1.12**++
Pooled deviation	36	3.51**	0.16	1.33	0.02	0.001	0.28	17.86**	0.04**
Pooled error	216	0.81	0.21	4.89	0.03	0.0008	0.65	7.20	0.11

#,##Significant at 5% and 1% level against G x E, respectively; *,**Significant at 5% and 1% level against pooled error, respectively; +,++Significant at 5% and 1% level against pooled deviation, respectively

Table 2. Isabgol genotypes classified with respect to their adaptability in different type of environments

Characters	Genotypes suited to different type of environments		
	High mean performance, above average response (bi > 1) suited in favourable environment	High mean performance, average response (bi =1) general adaptation	High mean performance, below verage response (bi <1) suited in poor environment
Days to 50% flowering	-	-	RI-151, RI-148, RI-154, RI-165, RI-1(9808), RI-154, RI-138, RI-164, RI-166, RI-155, RI-3025, RI-150, RI-147
Plant height (cm)	RI-148, RI-136, RAUI-N-II,	RI-142, RI-139 RAUI-Ja-3, RAUI-B	RI-145, RI-3026, RI-151, RI-156, RI-137, RI-3004, RI-150, RI-147, RAUI-N-I, RAUI-30, RAUI-Ja-1, RAUI-Ja-2, HI-2, GI-2
Number of effective tillers/plant	RI-1(9808), RI-138, RI-166, RI-155, RI-3025, RAUI-Ja-2, RAUI-Ja-3, HI-2, GI-2, GI-4	RAUI-B, RI-89	Niharika
Spike length (cm)	RI-1(9808), RI-158, RI-3004, RI-164, RI-166, RI-155, RI-3025, RAUI-Ja-2, RAUI-Ja-3, RI-89, HI-2, GI-2, GI-4, Niharika	RI-142, RI-150	-
1000-grain weight	RI-158, RI-153, RI-138, RI-164, RI-139, RAUI-Ja-3, HI-2, Niharika	RI-1(9808), RI-155, RI-89, GI-2, GI-4	RI-3004, RI-165, RI-166, RAUI-B
Biological yield (g)	RI-138, RI-155, RI-166, RI-3025, RAUI-Ja-2, RAUI-Ja-3, RI-89, HI-2, GI-2, GI-4	RAUI-B, Niharika	RI-1(9808)
Harvest index (%)	RI-151, RI-142, RI-1(9808), RI-158, RI150, RAUI-N-I, RAUI-Ja-2, HI-2	- -	RI-137, RI-138, RAUI-N-III, GI-2
Seed yield/plant (g)	RI-138, RI-3004, RI-166, RI-155, RAUI-Ja-2, RAUI-Ja-3, RAUI-B, RI-89, HI-2, GI-4, Niharika	RI-158	RI-142, RI-1(9808), GI-2

per plant, harvest index and seed yield per plant. The statistical analysis was done following Eberhart and Russell [5].

Analysis of variance indicated the presence of genetic variability among genotypes as well as environments for all the traits. The mean squares due to E + (G x E) were also found to be significant for all the traits revealed that the significant proportion of G x E was due to linear component. The significance of linear G x E component was observed for all the characters. It is obvious from results that majority of genotypes, the performance with respect to yield and its components were predictable. The significant variance due to pooled deviation was observed for harvest index and seed yield per plant which suggested that there was considerable unpredictable genetic diversity also present in the experimental material. The results confirmed the earlier finding of Godawat and coworker [8]. The non-significant variance due to pooled deviation was recorded for plant height, number of effective tillers per plant, spike length, number of seed per spike, 1000-seed weight and biological yield indicated that genotypes differs with respect to their stability. It is apparent from the Table 1. that linear component of G x E interaction were relatively larger than non-linear component for almost all the traits indicating that the performance of genotypes for traits could be reliable and predictable .

Seed yield of all thirty six genotypes showed stability over diverse environment as indicated by their non significant S^2di values. A simultaneously consideration of all the three parameters ($\bar{X}$, bi and S^2di) showed that only genotype RI-158 had high seed yield, regression coefficient around unity (b = 1) and non significant deviation from regression (S^2di) indicating that this genotype was most adaptable and stable in varying environmental conditions (Table 2). Genotype HI-2 owing its recorded highest seed yield (11.25 g) against 5.42 g of the population mean, regression value more than one and deviation from regression least and non-significant, appeared to be suitable under rich environment. This is also suitable for other traits like no. of tillers, spike length, 1000-grain wt. biological yield and harvest index. In addition to this RI-138 for grain yield, biological yield, 1000-grain weight, and no. of tillers: RI-166, RI-155 RAUIJA-2, RAUI-Ja-3 and GI-4 for seed yield, biological yield, spike length and no. of tillers also fell under this group. These genotypes also had highest seed yield in all the three environments. Further, this is suggested that these genotypes could be recommended for timely sown conditions. The entries RI-142, RI-1 (9808) and GI-2 appeared to be suitable in low yielding environment. There stability parameters were of high mean, $b_i < 1$ and least S^2di. Both linear and non-linear component of G x E interaction were significant for this trait. The results confirmed the findings of Lal *et al*. [9]. In general the genotype RI-158 was most ideal as this had high see yield and adaptability to wide range of climatic conditions while genotype RI-142 was also most stable to low responsive environment. Dhar *et al*. [10] have reviewed the reseave wale on *Plantago* and explain sized that efforts should confine to improve this important medicinal plant.

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