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Variability Studies in M₄ Generation for Yield and Seed Yield Attributing Traits of Isabgol

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ABSTRACT

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An experiment entitled “Evaluation of M₄ progenies for seed yield and its attributes in Isabgol (*Plantago ovata* Forsk.)” was carried out at Research Farm, College of Agriculture, Swami Keswanand Rajasthan Agricultural University, Bikaner during winter season *i.e.* rabi 2011-12. The observation were recorded for fourteen yield and yield attributing traits viz., days to 50% flowering, days to maturity, plant height, number of effective tillers per plant, spike length, biological yield per plant, harvest index, seed yield per plant, husk %, test weight, swelling percent, protein percent, sugar percent, chlorophyll content at 75 DAS. The experiment was laid out in Augmented Design with 121 mutant lines. In present experiment all the characters significant Maximum variability was observed for the characters like number of effective tillers per plant (12.15–53.77), sugar content (57.16–87.02%), biological yield per plant (13.22–42.37g) and harvest index (18.04–39.14) respectively. High heritability coupled with high genetic advance as percentage of mean was observed of seed yield/plant, total chlorophyll content, biological yield/plant and number of tiller per plant.

Introduction

Isabgol is a major export oriented medicinal crop of India. India at present ranks first in the production and trade of Isabgol in the global market and there by earns a sizeable foreign exchange (Anonymous, 2013). The genetic variability available in this crop is limited owing to the narrow gene pool existing in our country. It is a medicinal plant known for its high quality dietary fiber. The productivity of isabgol is far below then the desired levels and India is not able to meet our global demand. If India has to retain monopoly in production and export of the important foreign exchange earning

intensive efforts will have to be made and development of high yielding varieties with good swelling capacity of husk. There is an ample scope to increase the productivity of isabgol through genetic improvement. Yield is a complex polygenic character depends on number of characters influenced by the genotype of plant and environment where it grows. The genetic improvement is primarily depends upon the nature and magnitude of variability in plant characters, overall genetic diversity among genotypes and association between characters. The limited existing genetic variability is major bottleneck for the

improvement of the isabgol because of small size and closely borne florets, narrow genetic base on account of low chromosome number, small chromosome size, presence of high heterochromatin in the chromosomes, low chiasmata frequency and low recombination index and high selfing rate (Dalal and Sriram, 1995; Sareen *et al.*, 1991). So that new innovative approaches are needed for increasing variability mutation breeding is one of the most promising techniques. It provides raw material upon which other factor of evaluation act and therefor all the new species ultimately arises from the mutation.

Mutagens are known to widen range of genetic variation for characters in plant. Therefore, induced mutation breeding was initiated for augmenting its productivity. Result of this investigation presented in this paper.

Materials and Methods

The experimental material comprised of 121 mutant lines of Isabgol. The material was developed in isabgol project of department of Plant Breeding and genetics, COA, SKRAU Bikaner which were differing in growth and morphological characters.

One hundred twenty one mutant line of isabgol were raised in augmented design (Federer, 1956) with 12 block and each having 10 test genotypes and 4 check varieties namely RI-89, GI-2, NIHARIKA and HI-5 at research farm of College of Agriculture, Bikaner.

Statistical analyses were done according to standard statistical procedure. The data were recorded for fourteen characteristics in following manner and analysed to work out the genetic coefficient of variance, phenotypic coefficient of variance, heritability and genetic advance.

Results and Discussion

Assessment of variance has been the most dependable statistical measure to find the mutagen effect on the polygenes. Estimation of genotypic variability in M4 population would reveal the heritable portion of total variation created. GCV provides a mean study of the genetic variability generated in quantitative traits. In the present study, GCV and PCV were higher for characters like biological yield per plant, seed yield per plant, number of effective tillers per plant and harvest index, 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 reported by Godawat and Sharma (1994); Verma *et al.*, (1998); Lal *et al.*, (1999); Sivanson and Ranwah (2009) in Isabgol.

An enhanced genetic variability that was observed seed yield and its component characters in M4 generation of the present study indicated scope for effective selection. The genetic variability in term of GCV and PCV alone is not sufficient for determination of amount of heritable variability. In addition, estimation of heritability and genetic advance as percent of mean also needed to assess the heritable portion of total variation and extent of genetic gain expected for effective selection. As heritability in broad sense includes both additive and epistatic gene effects, it will be reliable only if accompanied by high genetic advance. In mutant lines of Isabgol maximum was heritability recorded for biological yield per plant (92.27%), number of tillers per plant (91.60%), seed yield per plant (75.12%) and total chlorophyll content (75%). However, Bhagat (1980); Singh *et al.*, (1985); Verma (1998); Yadav *et al.*, (2001); Sivaneson and Ranwah (2009); Sarkar and Lal (2015) reported high heritability for seed yield and most of characters in isabgol.

Table.1 Overall mean value of mutant lines, their mean range, genotypic and phenotypic coefficient of variation, heritability (broad sense %), genetic advance and genetic gain

Character	Mean	Range	CV	G.C.V.	P.C.V.	Heritability (%)	Genetic advance	Genetic gain (%)
(1) Days to 50% flowering	65.621	59.39-70.89	2.82	3.927	4.837	65.909	6.567	10.00
(2) Days to Maturity	118.278	111.62-128.37	1.66	2.041	2.633	60.085	3.259	2.75
(3) Plant height (cm)	29.65	23.01-34.66	5.15	6.840	8.564	63.787	11.254	37.95
(4) Spike length (cm)	5.347	3.76-7.10	8.81	8.631	12.334	48.966	12.442	232.9
(5) Number of tillers per plant	30.530	12.15-53.77	7.44	24.595	25.698	91.601	48.491	158.8
(6) Test weight (g)	1.54	1.33-1.78	4.59	4.106	6.158	44.444	5.638	366.1
(7) Swelling %	10.78	8.90-13.30	6.17	5.149	8.035	41.067	67.798	628.9
(8) Total chlorophyll (mg/g)	1.545	1.15-1.79	2.04	3.546	4.094	75.000	6.326	410.7
(9) Protein %	15.45	13.20-18.07	5.55	4.471	7.124	39.389	5.781	37.41
(10) Husk %	28.131	23.25-34.23	6.33	5.935	8.678	46.770	8.361	29.72
(11) Sugar content%	73.567	57.16-87.02	6.20	5.158	8.071	40.846	6.791	9.13
(12) Biological yield per plant (g)	20.228	13.22-42.37	9.08	31.410	32.698	92.274	62.154	307.3
(13) Harvest index	27.15	18.04-39.14	11.11	13.540	17.487	59.634	21.482	79.1
(14) Seed yield per plant (g)	5.51	2.68-10.28	14.50	25.207	29.082	75.127	45.007	816.8

Genetic advance is the improvement in the mean of selected families over the base population. It is also expressed as the shift in gene frequency towards superior side on exercising selection pressure. Genetic advance under selection depends upon the phenotypic variability among different plants or families in the base population, the heritability of the character under selection and intensity of selection. Genetic advance in terms as per cent of mean was ranged from 2.75 for days to maturity to 816.8 for seed yield per plant. The estimates of genetic advance as per cent of mean genetic gain. The highest genetic gain was observed for seed yield/plant (816.8) followed by swelling percent (628.9), total chlorophyll

content (410.7), test weight (366.1), biological yield per plant (307.3), and spike length (232.9) and number of effective tiller/plant (158.8). Such studies have also been reported by Bhagat (1980); Punia *et al.*, (1985); Godawat and Sharma (1994); Verma (1998); Lal *et al.*, (1999) and Sivaneson and Ranwah (2009) in isabgol. Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone (Lush, 1949; Johnson *et al.*, 1955; Gandhi *et al.*, 1964).

In the present investigation high heritability coupled with high genetic advance as percentage of mean was observed of seed

yield/plant, total chlorophyll content, biological yield/plant and number of tiller per plant which indicated presence of additive gene action. Therefore trait might be highly amenable to direct selection for their genetic improvement (Panse, 1957) (Table 1). In such cases, recurrent selection and diallel selective mating may be followed. These results are in agreement to the earlier findings of Lal *et al.*, (1999) Punia *et al.*, (1985) Verma (1998); Yadav *et al.*, (2001) seed yield per plant and other characteristics in Isabgol.

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