COMPREHENSIVE GENETIC DIVERSITY ANALYSIS IN SOYBEAN THROUGH MORPHO-PHYSIOLOGICAL ATTRIBUTES

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ABSTRACT

Soybean is important for sustainable crop production to convene future food demands. Genetic diversity is used for the analysis of variance revealing significant differences among the mutants for ten morphological traits. An experiment was conducted in 2018 to study genetic variability and genetic diversity among 22 soybean genotypes. All genotypes were evaluated in a randomized complete block design with three replications. The study of all genotypes exhibited a high degree of variance concerning all the traits viz., plant height, intermodal length, number of trifoliate leaves per plant, pods per plant, seeds per plant, 100-seed weight, pod weight, and seed yield plant. The phenotypic variance was higher than the corresponding genotypic variance for most of the characters. Seeds plant (115.2) exhibited the highest mean value followed by days to maturity (88.91 days) and plant height (68.48 cm) while the lowest mean was recorded in intermodal length (5.586). Column statistical data of the p-value of all Quantitative traits was revealed as non-significant (P>0.10). The considerable range of variation expressed for the traits indicated good scope for genetic improvement all the genetic parameters of variations. Good contract was observed between the magnitudes of phenotypic with genotype variance. The highest genotypic variance was observed for the attribute seeds per plant (GV = 2.293). The highest phenotypic variance was observed for the attributes Seeds per plant (PV = 0.787). Estimation of the coefficient of variations which takes into account the mean of each character gives the actual basis for the comparison. Considering the genetic variability, heritability, and analysis of correlation, importance should be given to morphological characters through the selection of phenotypic and inter-genotypic distances for the genotypic selection for development of high-yielding genotypes of soybean.

KEYWORDS: Genetic diversity, Genetic Variability, Morphological traits, Soybean.

1. INTRODUCTION

Soybean is a yearly seed legume crop grown largely in the central Indian region known as annual plant. Soybean is used as an important alternative for animal protein in the family diet and has also become a major source of household income (Dashiell, et.al., 1987). It belongs to the Legumenosae family which provides both protein and oil for the human diet (Dragoljob, et. al., 1999). Soybean a native of China is an important legume crop cultivated worldwide as a source of vegetable oil and protein (Olufemi, et. al., 2010), It contributes to 25 percent of edible oil and most of the protein used for livestock feeding (Agrawal, et. al., 2013).

Soybean (Glycine max) is a source of the nutrient supplier as a high-valuable protein (Lubungu, et. al., 2013). It is an economically essential bean in the world for providing protein to millions of people and ingredients for hundreds of chemical products. It is described as a "Golden bean" or "Miracle crop" because it's used for various aspects of human health and it is a cheap, protein-rich grain. It contains high-quality protein which is a good balance source of amino acids (Singh, et. al., 1987; Weingartner, 1987).

It is also called Soja bean and has, therefore, incredible potential to improve the dietary status and benefit of the families of resource-poor farmers**.** Soybean has abundant protein for all food and it is second in oil content after groundnut (Fekadu, et. al., 2009; Alghamdi, 2004).

Soybean is an industrial crop (Yusuf and Idowu, 2001) and it is used for different food products made by soybean seeds substantial effort has been placed on increasing the yield of soybeans to feed the world population (Stupar, 2010; Van, et. al., 2004; Kim, et. al., 2010). Soybean oil is 85% unsaturated and cholesterol-free when compared with other legumes and other animal sources. In additionally, it contains a perfect amount of minerals, salts, and vitamins (thiamine and riboflavin) and its sprouting grains contain Vitamin C. Soybean is an important supplier of vegetable oil worldwide (Yadav, et. al., 2018).

It is the Kharif crop. According to this study, in Madhya Pradesh present area of soybeans is 6.31 million hac, the production of soybeans is 5.24 million tones, and their productivity is 831 kg/ha (Marabi, et. al., 2017). In many countries, it has emerged as one of the important commercial crops. One of the reasons soybeans are widely cultivated is because they contain more protein per acre of land than any other crop. It grows up to 55-60cm in height and is a green, low-lying plant. Further, soybeans are filled in packets and packed with different necessary nutrients, making them especially important for people on diets, those who need to improve their overall health, and vegetarians and vegans throughout the world. Products of soybean hence, appear in a maximum variety of processed foods (Economic Survey of India, 2017). It is highly used in the industry for the production of different antibiotics. Soybean is the cheap and easiest source of the vast multiplicity of uses as industrial products hence, called a wonder crop. The bean contains an important amount of dietetic minerals and phytic acid. Soybean is the largest part of important protein resource for a feed from animals (that in turn yields animal protein for human consumption). It's responsible for the containing and storage of globulin protein (Hymowitz, et. al., 1981).

Soybean is used as an important source for the diagnosis of many diseases in human beings. It contains necessary heart-friendly Omega-3 fats (Kuzniar, et. al., 2016).

Soybean has been conventionally grown in a minute amount in Himachal Pradesh. After China, it is the secondary center for the domestication of the crop (Khoshoo, 1995 Singh, et. al., 1999). India ranks 5^{th} in world production of soybeans with seven million tons after Brazil, Argentina, the USA, and China (Masuda, et. al., 2009). Soybean is the second oil seed in India after groundnut (Wandkar, et. al., 2012). It is one of the most valuable and most commonly cultivated crops (Kumar, et. al., 2006).

In current study is based on an analysis of genetic diversity by using the Morphophysiological attributes of soybeans.

2. MATERIALS AND METHODS

2.1. Analysis of genetic diversity based on morpho-physiological attributes:

The requirement for initiating crop improvement program is based on Studies on the magnitude of genetic variability and genetic diversity prevailing in the germplasm of any crop plant. Analysis of genetic variability and character association indicate the breeding values as well as criteria for the selection of traits for further improvement in yield and quality. Genetic diversity studies, on the other hand, reveal the genetic distance amongst the germplasm which is very much helpful in the selection of parents for the hybridization program. Soybean is not only a crop of global importance but also an important crop in India. The crop offers great commercial significance in central India. Although soybean is not grown on a commercial scale in this region, a lot of native genotypes have been well-known to grow under wild and cultivated forms in this region.

2.2. Collection of samples

The materials required for the genetic diversity analysis based on morpho-physiological attributes comprised the bunch of twenty-two soybean genotypes representing the native soybean germplasm of central India. The experiment on "Classification of different varieties and new accessions of soybean-based on qualitative traits and assessment of genetic diversity" was carried out at the Department of Biotechnology, A.K.S. University Satna (M.P.) and Department of Horticulture, Agriculture College of Rewa, (M.P.). The materials comprised 22 well-known varieties for experimental work. The 10 morphological qualitative traits were considered for the present investigation as per the universal format of descriptors for soybeans.

Table No. 2.1

Verity of Soybean germplasm with source collection

S.No.	Verity	Source of Collection
1.	JS 20-35	College of Agriculture, Rewa (M.P.).
2.	KDS 699	College of Agriculture, Rewa (M.P.).
3.	MAUS 504	College of Agriculture, Rewa (M.P.).
4.	RKS66	College of Agriculture, Rewa (M.P.).
5.	NRC89	College of Agriculture, Rewa (M.P.).
6.	DS9814	College of Agriculture, Rewa (M.P.).
7.	VLS81	College of Agriculture, Rewa (M.P.).
8.	AMS 56	College of Agriculture, Rewa (M.P.).

9.	JS 20-38	College of Agriculture, Rewa (M.P.).
10.	PS 1503	A.K.S. University, Satna (M.P.).
11.	MAUS609	A.K.S. University, Satna (M.P.).
12.	AMS 155	A.K.S. University, Satna (M.P.).
13.	KSO 184	A.K.S. University, Satna (M.P.).
14.	CSB 09-03	A.K.S. University, Satna (M.P.).
15.	ASB 18	A.K.S. University, Satna (M.P.).
16.	KS 112	A.K.S. University, Satna (M.P.).
17	KDS 378	A.K.S. University, Satna (M.P.).
18.	RKS68	Local Farmer, Satna (M.P.).
19	KSO 184	Local Farmer, Satna (M.P.).
20.	DS 9712	Local Farmer, Satna (M.P.).
21.	MAUS611	Local Farmer, Satna (M.P.).
22.	AMS 155	Local Farmer, Satna (M.P.).

2.3. Observations recorded

Eight quantitative traits were used for recorded Observations viz., Plant height (PH), Intermodal length (IL), number of trifoliate leaves of plant^{-1} (TL), Pod of plant^{-1} (PP), Seed of plant^{-1} (SP), Seed Weight 100 (SW), Pod weight of plant (PW), and Seed yield (SY) as average of ten randomly taken samples (single plant) Per plot. Days to flowering (DF) 50 percent and Days to maturity of the plant, (DM) were recorded based on the whole plot of the plant. Data on the above traits were recorded based on the following criteria:

Table No. 2.2

Details of the traits considered for observation under the present study;

Sr.	Trait	Criteria for recording
1.	Days to 50 % flowering (DM)	Number of days in which 50 % of the plants in the the plot comes into flowering
2.	Days to maturity (DF)	Number of days in which 80 % of the pods come to maturity.
3	Plant height (PH) in cm	Plant height from ground to stem tip; Measured at maturity.
4.	Internodal Length (IL) in cm	Length of the third internode from the base.
5.	Number of trifoliate leaves plant^{-1} (TL) in g	Total number of trifoliate leaves from the ground to tip.
6.	Pods plant^{-1} (PP)	Total number of pods per plant at maturity

7.	Seeds plant^{-1} (SP)	Total number of seeds at maturity
8.	Pod weight (PW) in g	Weight of all pods per plant
9.	100- Seed weight (SW) in g	Weight of 100 seed
10.	Seed yield plant^{-1} (SY) in g	Weight of all seeds per plant

2.4. Statistical analysis:

The Observed data based on ten morpho-physiological traits pooled over the two years were analyzed by Variance (ANOVA) of Randomized for Complete Block Design using three replications following Panse and Sukhatme, (1967). The mean sum of square results obtained from Variance (ANOVA) was subjected to estimation of genetic parameters of variation as per Singh and Choudhury, (1985). Estimates of variability parameters, the heritability of genes, and genetic advances were calculated using the standard methods of Burton and Devane, (1953) and Johnson, et. al, (1955a). Frequency distribution for all traits was computed. Numbers of intervals were considered ten as per convenience by using the software STATISTICA. Phenotypic and genotypic correlation coefficients were calculated by using the method adopted by Johnson, et. al., (1955b).

2.5. Principle Component Analysis

The principal component analysis method, (PCA) was carried out for ten quantitative traits using the software STATISTICA. A two-dimension graph was constructed using extracted Eigenvectors and the cumulative percentage of contribution to variation of different traits to Eigenvectors was also computed. The percentage of contribution to variability was computed for different traits.

3. RESULTS

3.1. Analysis of genetic diversity based on morpho-physiological attributes

The analysis of genetic diversity based on morpho-physiological attributes provides insights into the variation in physical traits and physiological responses within a species. This approach helps in understanding the genetic makeup of populations, contributing to breeding programs, conservation efforts, and the improvement of desirable traits.

3.1.1. Variation in morphological trait of soybean genotypes

The mean values of all ten morpho-physiological traits for twenty-two soybean genotypes are presented in Table No. 3.1. All the genotypes under study exhibited high degree of variances concerning all the traits viz., plant height (PH), intermodal length (IL), number of trifoliate leaves plant^{-1} (TL), pods plant^{-1} (PP), seeds plant^{-1} (SP), 100 - seed weight (SW), pod weight (PW), and seed yield plant^{-1} (SY). Seeds plant^{-1} (115.2) exhibited the highest mean value followed by days to maturity (88.91 days) and plant height (68.48 cm) while the lowest mean was recorded in intermodal length (5.586). Column statistical data of the p-value of all Quantitative traits was revealed as non-significant ($P > 0.10$). All quantitative traits are not significantly different. Seeds of plant^{-1} (SP) have maximum variability (2.471) among the all-quantitative traits but no significant difference.

The variance analysis revealed a mean with a significant sum of squares for all the traits reflecting the presence of maximum variability among the genotypes. The considerable range of variation expressed for the traits indicated good scope for genetic improvement which is revealed in Table no. 3.2, listing all the genetic parameters of variations. Good agreement was observed between the magnitudes of phenotypic with genotype variance. The highest genotypic variance was observed for the attribute seeds plant^{-1} (GV = 2.293) followed by the number of trifoliate leaves plant^{-1} (TL) in g (GV = 1.272) and Pods plant^{-1} (GV = 1.263,). Thus highest phenotypic variance was observed for the attributes Seeds plant^{-1} (PV = 0.787) followed by Number of trifoliate leaves plant^{-1} (PV = 0.482) and Days to maturity (PV = 0.478). Here the study of magnitudes of variance does not justify or validate the comparison of variability exhibited by the various traits. Estimation of the coefficient of variations which takes into account the mean of each character, gives the actual basis for the comparison.

In our study, the number of trifoliate leaves plant^{-1} (TL) in g exhibited the highest coefficient of variance at genotypic (GCV = 7.773) and phenotypic coefficient of variance at (PCV = 2.945) followed by Seed yield plant^{-1} (SY) in g (GCV = 5.984, PCV = 2.031). The highest percentage of heritability was recorded in Pod weight in g (46.588) whereas lowest percentage of heritability was found in Seed yield plant^{-1} (SY) in g (33.947). Thus the highest and lowest percentage of Genetic Advance was found in the Number of trifoliate leaves plant^{-1} (TL) in g (1.555) and Plant height (PH) in cm (0.148) respectively (see table no. 3.3).

DISCUSSION

Soybeans are an important legume crop placed in the world's cultivation of oilseed scenario, because of their high productivity, profitability, and vital contributions of soybean towards maintaining the fertility of the soil. The crop also has a famous seed legume, which contributes about 25% to the total vegetable oil production, about two, thirds part of the whole protein in the world which is required for the feeding of livestock, and is a valuable ingredient in formulated feeds for poultry and fish. About 85% of the world's soybeans are processed in per annum into soybean meal and oil.

Approximately 98% of the soybean meal is flattened and further, it is used for processing into animal feed with the balance used to make soy flour and also proteins. Of the fraction of oil in soybean, about 95% is utilized as a form of edible oil, and the part of remaining soybean is used in industry for making industrial products like fatty acids, different soaps, and also biodiesel (Lala, et. al., 1999). Study of soybean by Jain, et. al., 2017. Suggested, that Soybean is an oil seed crop that has 20% oil and 38 - 43% protein and has many biological values as meat and fish protein.

Study on soybean by Jain, et. al, 2017. Suggested, that Soybean is an oil seed crop which has 20% oil and 38 - 43% protein has contains many biological values as meat and fish protein.

The method of molecular fingerprinting has been widely used to characterize different species of trees, crops, and medicinal plants (Yadav and Waoo 2020). Unlike morphological identifiers, DNA-based indicators are independent of changes in the surrounding environment. The genetic variances in 24 genotypes of soybean and their observations on 9 characters were recorded. The variance analysis indicated that considerable variation was present among the different types of soybean genotypes for all traits under the study.

Our study also revealed the diversity of soybeans in central India. The mean values of all the ten morpho-physiological characters (traits) for twenty-two genotypes of soybean are presented in Table No. 3.1. All the genotypes under study exhibited high degree of variances concerning all the traits viz., plant height (PH), intermodal length (IL), number of trifoliate leaves plant^{-1} (TL), pods plant^{-1} (PP), seeds plant^{-1} (SP), 100-seed weight (SW), pod weight (PW), and seed yield plant^{-1} (SY). Seeds plant^{-1} (115.2) exhibited the highest mean value followed by days to maturity (88.91 days) and plant height (68.48 cm) while the lowest mean was recorded in intermodal length (5.586). Column statistical data of the p-value of all Quantitative traits was revealed as non-significant (P>0.10). All quantitative traits are not significantly different. Seeds plant^{-1} (SP) has maximum variability (2.471) among all quantitative traits but no significant difference.

Statistical data from the variance analysis revealed a highly significant mean sum of the squares for all the characters reflecting the presence of high variability among the genotypes. The considerable range of variation expressed for the traits indicated good scope for genetic improvement which is revealed in Table no. 3.2, listing all the genetic parameters of variations. Good contract was observed in the phenotypic as well as genotypic variance magnitudes. The highest genotypic variance was observed for the attribute seeds plant^{-1} (GV = 2.293) followed by the number of trifoliate leaves plant^{-1} (TL) in g (GV = 1.272) and Pods plant^{-1} (GV = 1.263,). Thus, highest phenotypic variance was observed for the attributes Seeds plant^{-1} (PV = 0.787) followed by Number of trifoliate leaves plant^{-1} (PV = 0.482) and Days to maturity (PV = 0.478). The Number of trifoliate leaves plant^{-1} (TL) in g exhibited the highest coefficient of variance at genotypic (GCV = 7.773) and phenotypic coefficient of variance was at (PCV = 2.945) followed by Seed yield plant -1 (SY) in g (GCV = 5.984, PCV = 2.031). The highest percent of heritability was recorded in the Pod weight in g (46.588) whereas the lowest heritability percentage which found in the Seed yield plant^{-1} (SY) in g (33.947). Thus, the highest and lowest percentage of Genetics found in the Number of trifoliate leaves plant^{-1} (TL) in g (1.555) and Plant height (PH) in cm (0.148) respectively (see table no. 3.3). The conclusion of Malek, et. al., 2014 support our work. They suggested that Genetic diversity is very useful for the crop improvement of the soybean. Another study by Kachare, et. al., revealed that the Genetic diversity with 45 genotypes of soybean was assessed.

The mean values of all ten morphological traits for twenty-two soybean genotypes are shown in Table No. 1. All the genotypes during the study exhibited a high degree of variance concerning all the characters (Traits)such as plant height (PH), intermodal length (IL), number of trifoliate leaves plant^{-1} (TL), Pods plant^{-1} (PP), Seed Plant^{-1} (SP), 100-Seed weight (SW), Pod weight (PW), and Seed Yield Plant^{-1} (SY). Seed Plant^{-1} (115.2) exhibited the highest mean value followed by days to maturity (88.91 days) and Plant height (68.48 cm) while the lowest mean was recorded in intermodal length (5.586). In this study, statistical data of the p-value of all quantitative traits was revealed non-significant (P>0.10). Mean all quantitative traits having are not significantly different. Maximum variability (2.471) found in seeds of Plant^{-1}.

In this variance analysis, the revealed mean with significance was calculated by the sum of squares for all the traits (characters) which reflects the presence of maximum variability between the genotypes.

The range of variation expressed for all the characters indicated good quality scope for improvement on a genetic level. Good contract was completely observed between the magnitudes of phenotype with genotype variance.

The highest genotypic variance was observed for the attributes seeds Plant^{-1} (GV=2.293), followed by the number of trifoliate leaves Plant^{-1} (TL) in g (GV=1.272) and Pods Plant^{-1} (1.263). Thus, the highest phenotypic variance was observed for the seeds Plant^{-1} (PV=0.787), which was followed by several trifoliate leaves Plant^{-1} (PV=0.482) and Days to maturity (PV= 0.478).

In this study found magnitudes of variance which does not justify which exhibited by the various traits. Estimation of the coefficient of variations takes into account the mean of each character, which gives the actual basis for the comparison. The highest coefficient of variance exhibited in number of trifoliateleavesPlant^{-1} (TL) in g at genotypic variance (GCV=7.773) and phenotypic coefficient of variance was at (PCV=2.945) followed by seed yield Plant^{-1} (SY) in g (GCV=5.984, PCV=2.031). The highest percentage of heritability was recorded in Pod weight in g (46.588) whereas lowest percentage of heritability was found in seed yield Plant^{-1} (SY) in g (33.947).

CONCLUSION

This is concluded that soybeans play a significant role in total oilseed production for the food and nutritional properties of the growing population in the state of Madhya Pradesh as well as in India. The study also revealed that the introduction of soybeans in the Vindhya Region, state, Madhya Pradesh. Several cultivars were first released in India, from the different soybean centers for growing under many agro-climatic conditions by an introduction, hybridization, mutation, and also germplasm through systemic breeding and programs of evaluation.

Generations of new and improved cultivars can be enhanced by the genetic variation it is a new source, and criteria for parental stock selection need to be considered not only by agronomic value but also for genetic dissimilarity therefore, understanding about the genetic diversity of the germplasm of soybean is essential to widen the base of genetics and further exploit in the program of breeding.

Table No. 3.1: Genetic parameters of variation in twenty-two soybean genotypes (Glycine max.) under study for 10 quantitative traits.

Thus, the highest and lowest percentages of genetic advance which found in the number of

S. No.	Quantitative traits	Mean	S. D	Range	Variance	Coefficient of variation	Standard Error	P value
1.	Days to 50 % flowering (DF)	26.95	0.898	22-29	0.806	3.33	0.191	P>0.10ns
2.	Days to maturity (DM)	88.91	1.231	91-87	1.515	1.38	0.262	P>0.10ns
3.	Plant height (PH) in cm	68.48	0.604	69.45-67.47	0.364	0.88	0.128	P>0.10ns
4.	Internodal Length (IL) in cm	5.586	0.405	6.12-4.87	0.164	7.26	0.086	P>0.10ns
5.	Number of trifoliate leaves plant^{-1} (TL) in g	23.14	1.246	25-21	1.552	5.38	0.265	P>0.10ns
6.	Pods plant^{-1} (PP)	45.55	1.184	48-44	1.401	2.60	0.252	P>0.10ns
7.	Seeds plant^{-1} SP)	115.2	1.572	118.5-112.8	2.471	1.36	0.335	P>0.10ns
8.	Pod weight (PW) in g	34.36	0.759	35.47-33.14	0.576	2.21	0.161	P>0.10ns
9.	100- Seed weight (SW) in g	18.45	0.506	19.22-17.54	0.256	2.74	0.107	P>0.10ns
10.	Seed yield plant^{-1} (SY) in g	17.96	0.890	19.47-16.24	0.7921	4.96	0.189	P>0.10ns
ns = non-Significant								

trifoliate leaves Plant^{-1} (TL) in g (1.555) and Plant height (PH) in cm (0.148) respectively. This research finds statistical data of morphological analysis, the mean values of all ten morphological traits for the twenty-two soybean genotypes. In this study, statistical data of the p-value of all quantitative traits was revealed non-significant (P>0.10). Mean all quantitative traits having are not significantly different. Maximum variability (2.471) found in seeds of Plant^{-1}. PIC is used to measure of degree of informativeness of molecular markers.

Table No. 3.2: Two-way ANOVA of selected Quantitative traits of twenty-two soybean genotypes.

SR.	Quantitative traits	Mean of Square			P value	G.V.	E.V.	P.V.
		Replication	Genotype	Error				
		Degree of Freedom						
		2	21	42				
1.	Days to 50 % flowering (DM)	0.015	2.251	0.110	0.872	0.713	0.110	0.274
2.	Days to maturity (DF)	0.242	3.700	0.305	0.459	1.131	0.305	0.478
3.	Plant height (PH) in cm	0.033	0.844	0.095	0.705	0.249	0.095	0.114
4.	Inter-nodal Length (IL) in cm	0.005	0.465	0.007	0.505	0.152	0.007	0.053
5.	Number of trifoliate leaves plant-1 (TL) in g	0.318	3.991	0.175	0.175	1.272	0.175	0.482
6.	Pods plant-1 (PP)	0.045	3.897	0.108	0.661	1.263	0.108	0.457
7.	Seeds plant-1 (SP)	0.1459	6.949	0.069	0.136	2.293	0.069	0.787
8.	Pod weight (PW) in g	0.161	1.446	0.171	0.398	0.425	0.171	0.198
9.	100- Seed weight (SW) in g	0.064	0.531	0.043	0.234	0.162	0.043	0.068
10.	Seed yield plant-1 (SY) in g	0.018	2.295	0.014	0.303	0.760	0.014	0.258

G.V.= Genotype Variance, E.V. =Environmental Variance, P.V.= Phenotype Variance

Table No. 3.3: Two-way ANOVA of selected Quantitative traits of twenty-two soybean genotypes.

S. No.	Quantitative Traits	GCV%	ECV%	PCV%	H2%	GA%
1.	Days to 50 % flowering (DM)	3.741	0.577	1.437	38.429	0.768
2.	Days to maturity (DF)	1.798	0.485	0.760	42.263	0.446
3.	Plant height (PH) in cm	0.514	0.196	0.235	45.783	0.148
4.	Inter-nodal Length (IL) in cm	3.848	1.772	1.341	34.868	0.626
5.	Number of trifoliate leaves plant'1 (TL) in g	7.773	1.069	2.945	37.893	1.555
6.	Pods plant-1 (PP)	3.921	0.335	1.418	36.183	0.711
7.	Seeds plant-1 SP)	2.814	0.084	0.966	34.321	0.461
8.	Pod weight (PW) in g	1.749	0.703	0.814	46.588	0.529
9.	100- Seed weight (SW) in g	1.241	0.329	0.521	41.975	0.298
10.	Seed yield plant^{-1} (SY) in g	5.984	0.110	2.031	33.947	0.957

GCV= Genotype Coefficient of Variance, ECV= Environmental Coefficient of Variance, PCV= Phenotype Coefficient of Variance, H^2 = Heritability, GA= Genetic Advance.

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