

Original Research Article

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To Study the Genetic Variability, Heritability and Genetic Advance for Different Quantitative Characters in Indian Mustard (*Brassica juncea* L. Czern & Coss)

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ABSTRACT

Thirty six diverse genotypes of Indian mustard (*Brassica juncea* L. Czern and Coss.) were evaluated for ten quantitative. The variability indicates that Genotypic coefficient of variation (GCV) was moderate for 50% flowering, days to maturity, total no. of siliqua per plant, biological weight, test weight and seed yield; low for plant height, no. of siliqua on main shoot, no. of seed per siliqua and harvest index. The estimation of phenotypic coefficient of variation (PCV) was high for biological weight; moderate for all characters except no. of seed per siliqua, it has low PCV. high heritability was recorded for the character days to maturity (94.1%) followed by 50% flowering (92.4%) and Test weight (92.0%). The high heritability denotes high proportion of genetic effects in the determination of these characters and can be adopted for improving seed yield. Where as the low heritability was observed for the characters total number of siliqua per plant (48.7%), Plant height (43.8%), Number of seed per siliqua (39.8%), number of siliqua on main shoot (22.3%) biological Weight (17.9%) and Harvest Index (7.1%). Genetic advance as percentage of mean was observed high for the character is highest in days to 50% flowering (20.995%), days to maturity (21.320%), total no of siliqua per plant (20.066%) and test weight (35.936%). The value of genetic advance for plant height, no. of siliqua on main shoot, No. of seed per siliqua, biological weight, harvest index and seed yield are low. After studying such quantitative characters it was revealed that selection for number of test weight, total number of siliqua per plant, days to 50 % flowering and days to maturity would be effective for improvement of seed yield in this population.

Keywords

Brassica juncea L.
Genetic variability,
Heritability,
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Introduction

Indian mustard (*B. juncea* (Linn) Czern and Coss) popularly known as rai, raya or laha is one of the most important oil seed crops of the country and it occupies considerably large acreage among the Brassica group of oil seed crops. It is estimated the total production of

mustard seed in India about more than 72.82 lakh tones significantly. Rapeseed–mustard group of crops is the major oilseed crop of India. India holds the premier position in rapeseed-mustard economy of the world with 2nd and 3rd rank in area and production respectively. Rapeseed-mustard oil is used primarily for edible purposes and is the

principle cooking oil in the mustard growing areas of the country. Known for its great taste and subtle flavor, this vegetable oil is the world's second leading source of protein meal. Besides seeds, it is also used as condiments. Among rapeseed and mustard, rai (*B. juncea*) is very popular among the farmers due to higher yield and greater tolerance against lodging, shattering, drought condition, and relative diseases as well as the saline sodic conditions.

Brassica also performs well on neglected sites problems like soil acidity, low available nutrient content, poor drainage, drought, and soils with topographical limitations exist germplasm, which is prerequisite for any breeding programme, serves as a valuable source material as it provides scope for building for genetic variability. Study of variability, heritability and genetic advance in germplasm will help to ascertain the real potential of the genotype. Hence, this present study was planned to assess the variability, heritability and genetic advance for yield and other characters in a set of genotypes.

Materials and Methods

The present study was administered at the Agricultural research Farm Santiniketan, Department of Genetics and Plant Breeding (Palli Siksha Bhavana), Visvabharati University, Birbhum during rabi, 2017-18 and 2018-2019. Thirty -six diverse genotypes of Indian mustard (*B. juncea*) were planted in randomized block design with three replications in plot size of 1.5 × 3 m. The row to row and plant to plant distance was maintained at 30 × 30 cm. All recommended package of practices was applied to boost an honest crop. the info were recorded on ten characters, viz. days to maturity, plant height (cm), days to 50% flowering, total number of siliqua per plant, number of seeds per siliqua, number of siliqua on main shoot, arrangement

of siliqua based upon angle from main shoot, seed yield per plant (g), 1000- seed weight (g), Harvest index (%) and Biological weight (g).

Results and Discussion

Variability, heritability and genetic advance

The mean performances of mustard germplasm accessions for quantitative ten traits are presented in Table 1. The value mean, range, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability, genetic advance and genetic advance expressed as per cent mean for all the ten studied are presented in Table 1.

Genotypic and phenotypic coefficient of variation

Genotypic and Phenotypic coefficients of variation are simple measures of variability; these measures are commonly used for the assessment of variability. The relative values of coefficient give an idea about the magnitude of variability present in a genetic population. Thus, the components of variation such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were computed.

The phenotypic coefficients of variation were marginally higher than the corresponding genotypic coefficient of variation indicated the influence of environment in the expression of the character under study. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are categorized as low (less than 10%), moderate (10-20%) and high (more than 20%) as suggested by Sivasubramaniam and Madhavamenon (1973).

Table.1 Phenotypic and Genotypic coefficients of Variability, Heritability and Genetic Advance for ten quantitative characters for mustard germplasm

	Grand mean	Range		Coefficient of variance (%)		Heritability (%)	Genetic advance	Genetic advance as a percent of mean
		Max	Min	GCV	PCV			
50% flowering	43.949	51.3333	33.0000	10.602	11.029	92.4	9.277	20.995
Plant height	156.338	181.3000	128.4667	7.171	10.834	43.8	15.285	9.777
Days to maturity	122.572	146.2667	94.8000	10.626	10.956	94.1	26.033	21.320
No of silique on main shoot	32.071	39.1333	25.2667	7.748	16.417	22.3	2.416	7.352
Total no siliqua per plant	73.073	96.4867	55.2200	13.953	19.988	48.7	14.3	20.066
No of seed per silique	22.190	14.0333	10.8667	5.159	8.176	39.8	0.858	6.705
Biological weight	12.798	28.3050	17.2133	10.247	24.249	17.9	1.979	8.919
Test weight	4.477	6.4300	3.4333	18.199	18.969	92.0	1.610	35.936
Harvest Index	15.928	18.6033	13.5583	4.771	17.904	7.1	0.417	2.620
Seed Yield	3.969	5.6200	3.3650	12.817	18.182	49.7	0.739	8.919

The genotypic and phenotypic variances are of little meaning as they do not have any clear limit and at the same time the categorization of the genotypic variance as low or high is difficult, rendering them unsuitable for comparison of two populations with desired precision when expressed in absolute values. To overcome this difficulty, the genotypic and phenotypic coefficient of variation, which are free from the unit of measurement, can be conveniently employed for making comparison between populations and different metric characters of population. In general phenotypic coefficient of variance was found to be higher than their genotypic coefficient of variance but the extent was quite small, indicating very less environmental influence on the expression of the characters. Genotypic coefficient of variation (GCV) was moderate for 50% flowering, Days to maturity, Total no. of siliqua per plant, biological weight, test weight and seed yield; low for plant height, no. of siliqua on main shoot, No. of seed per siliqua and harvest index. The estimation of phenotypic coefficient of variation (PCV) was high for biological weight; moderate for all characters except No. of seed per siliqua, it has low PCV. These findings are similar in agreement with earlier reported by Rai *et al.*, 2005; Kumar and Mishra, 2006; Kumar *et al.*, 2007; Nigam *et al.*, 2009; Singh and Singh, 2010; Yadava *et al.*, 2011; Yadav *et al.*, 2012. The present study indicated higher contribution of biological yield per plant and 1000 seed weight towards genetic variability and there by suggesting that the parents chosen on the basis of these characters may be utilized in the crossing programme for obtaining good transgressive segments.

The estimates of PCV and GCV values for harvest index, number of siliqua on main shoot and biological weight which indicates the greater role of environmental factor influencing the factor of the component, on the other hand a very low difference was

showed in days to 50% flowering, days to maturity and test weight indicates low sensitivity to environment and consequently greater role for genetic factor influencing the expression of these characters.

Heritability and genetic advance

The coefficient of variation indicates only the extent of variability existing for various characters but does not give any information about the heritable portion of it. Therefore, it is essential to know the heritability that permits the greater effectiveness of selection by separating out environmental influence from the total variability.

This indicates the accuracy with which genotypes can be identified by phenotypic performance. Breeder can attain maximum selection response if existence of variance is largely due to additive genes and estimated in terms of heritability.

In the present investigation an attempt has been made to estimate the heritability in broad sense by variance component analysis. The prediction regarding this aspect was made on the basis of percentage *viz.*, low (<50%), moderate (50-70%) and high (>70%) as suggested by Robinson (1966).

In present investigation the high heritability was recorded for the character Days to maturity (94.1%) followed by 50% flowering (92.4%) and Test weight (92.0%). The high heritability denotes high proportion of genetic effects in the determination of these characters and can be adopted for improving seed yield. Where as the low heritability was observed for the characters total number of siliqua per plant (48.7%), Plant height (43.8%), Number of seed per siliqua (39.8%), number of siliqua on main shoot (22.3%) biological Weight (17.9%) and Harvest Index (7.1%). High or moderate heritability

estimates for most of the traits had been reported earlier by Singh *et al.*, (2003); Chauhan and Singh, (2008); Singh *et al.*, (2011), Akabari and Niranjana (2015), Lyngdoh *et al.*, (2017), Kumar *et al.*, (2018).

Genetic advance as percent of mean

The heritability value alone however, provides no indication of the amount of genetic improvement that would result from selection of superior genotypes. The heritability estimates would be dependable if it is limited in a broad sense; additive and non-additive gene effects are accompanied with high genetic advance. To facilitate the comparison of progress in various characters of different genotypes, genetic advance was calculated as percentage of mean.

The magnitude of genetic advance as percentage of mean was categorized as high (>20%), moderate (10% - 20%) and low (< 10%). Genetic advance as percentage of mean was observed high for the character is highest in days to 50% flowering (20.995%), days to maturity (21.320%), total no of siliqua per plant (20.066%) and test weight (35.936%). The value of genetic advance for plant height, no. of siliqua on main shoot, No. of seed per siliqua, biological weight, harvest index and seed yield are low. Same result observed by Singh *et al.*, (2012), for plant height and biological weight by Goyat *et al.*, (2012). High heritability with high genetic advance as percent of mean for days to 50% flowering, days to maturity and test weight suggesting predominant role of additive gene action for expression of these traits. As additive gene action is pronounced in the expression of these characters. Similar result were reported by Rai *et al.*, (2005), Tripathi *et al.*, (2013), Singh *et al.*, (2013), Shekhawat *et al.*, (2014), Lodhi *et al.*, (2014), Hussain *et al.*, (2016) and Samahegn and Tesfaye (2016), Kumar *et al.*, (2018). Kumar *et al.*, (2018) revealed the

existence of considerable genetic variation among the breeding lines for the characters under study, which can be used for further selection and hybridization. Low heritability with low genetic advance as percent of mean for plant height, number of seed per siliqua, number of siliqua on main shoot, biological weight, harvest index and seed yield, showed the importance of dominance and epistatic effects in the inheritance of these characters and selection for these characters would be less effective.

A perusal of the table % where the results of PCV, GCV, heritability and genetic advance have been furnished revealed that selection for number of test weight, total number of siliqua per plant, days to 50 % flowering and days to maturity would be effective for improvement of seed yield in this population.

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