https://doi.org/10.29321/MAJ.10.A03552

Morphological and Genetic Variabilities in Brown Sarson (*Brassica campestris* var. Brown Sarson)

by

R. P. BHARDWAJ[1] and R. R. SINGH[2]

Introduction: It is necessary to break up the observed variability in phenotypic expression into its heritable and non-heritable components in order to fully assess the exact contribution of environment in producing the sum total effect *ie.* the phenotypic. Brown Sarson (*Brassica campestris*) offers a great deal of variability and to the best of the knowledge of the authors, the variability has not been exploited in this crop. An attempt has, therefore, been made in the present investigation to break up the variability into its components with the hope that the result might be of use to the plant breeders in doing plant selection.

Material and Methods: Fifty four varieties collected from Bihar, Punjab, U P and Rajasthan were used for the study. The experiment was conducted at Govt. Agricultural Research Farm, Sri Ganganagar during 1967 *rabi* in randomised block design with four replications. The plot size was 9.0×2.4 meters having row to row 30 cm and plant to plant 23 cm distance. Ten plants were selected at random from each varieties in each replication and detailed observations were recorded on the seven characters *viz.* plant height, branches per plant, pods per plant, grains per pod, 1000-grain weight, pod length and grain yield per plant for statistical analysis.

The mean, standard error, and crictical difference for each of the seven characters were worked out by the method adopted for analysis of variance for randomised block design. The mean sum of squares for varietal level and error level were used for obtaining phenotypic variance and error variance. Genotypic variance was calculated by substracting error variance from phenotypic variance.

The genetic Co-efficient of variation was calculated from the formula (Burton 1952)

$$\frac{100 \times \delta g}{\bar{X}}$$

where, δg is the genotypic variance and $\bar{X}$ is the population mean of the traits under study. Heritability in the present investigation was calculated in the

---

1. Assistant Cotton Botanist

2. Assistant Plant Pathologist, Agricultural Research Station, Sri Ganganagar, Rajasthan.

Received on 31—5—1968.

broad sense (Lush, 1949) by the formula suggested by Hanson, Robinson and Comstock (1955)

$$H = \frac{\delta 2g}{\delta 2ph} \times 100$$

where H = Heritability, $\delta 2g$ = genotypic variance $\delta 2ph$ = phenotypic variance. The expected genetic advance was calculated as suggested by Lush (1949) and Johnson *et al* (1955)

$$\text{Genetic advance} = \frac{\delta 2g}{\delta 2ph} \times K\delta ph = \frac{\delta 2g}{\delta ph} \times K$$

$$\text{Genetic advance expressed in percentage of mean} = \frac{\text{G. A.}}{\text{population mean}} \times 100$$

Where $K\delta ph$ is the selection differential expressed in phenotypic standard deviation. In the present study K has the value 2.06, which is the expectation in the case of 5% selection in large samples (Lush 1949, Miller *et al* 1958).

Results: a) *Phenotypic variation in certain plant characters:* Components analysis for each character worked out the method of analysis of variance indicated significant differences among the varieties in almost all the characters under studies.

The estimates of mean, range, standard error of mean, F value and critical differences for each of the seven characters are presented in Table 1.

TABLE 1: *Phenotypic variance in seven characters in Brown Sarson.*

Character	Range	Mean	F. Value	S.E.	C.D. at 5% level
Plant height (cm)	0.65— 2.00	1.65	20.76**	0.05	0.14
Number of branches per plant	7.00— 90.00	47.52	76.77**	1.65	4.54
Number of pods per plant	440.50—899.40	677.88	4.17**	58.49	161.65
Grains per pod	6.20— 16.60	11.06	5.71**	0.26	0.72
Pod length (cm)	3.00— 5.70	3.97	122.50**	0.04	0.11
1000-grain weight (g)	2.00— 6.70	4.16	75.23**	0.14	0.40
Grain yield per plant (g)	9.50— 81.31	26.37	17.29**	3.16	8.73

** Values significant at 1% level.

The differences among the varieties were significant for all characters. A wide range of phenotypic variation was observed in characters like plant height, number of branches per plant, pods per plant, grains per pod and grain yield per plant, while other characters showed a low range of variability.

b) *Study of Phenotypic, Genotypic, error variance, Genetic Co-efficient of variation, Heritability and Genetic advance expressed in percentage of mean:*

The values obtained are presented in Table No. 2.

TABLE 2: *Phenotypic, Genotypic, error variance, Genetic Co-efficient of variation Heritability estimates, Genetic advance of seven characters in Brown Sarson*

Character	Variances			Genetic Co-efficient of variation	Heritability percentage	Genetic advance expressed as percentage of mean
	Phenoty-pic	Genoty-pic	Error Variance			
Plant height	0.23	0.21	0.02	21.61	93.2	57.0
Number of branches per plant	836.89	825.94	10.95	60.47	98.6	123.7
Number of pods per plant	57194.27	43508.31	13685.96	97.30	76.5	58.7
Pod length	0.98	0.97	0.01	24.83	99.1	56 8
Grains per pod	16.01	15.73	0 28	35 85	98.2	36.2
1000-grain weight	6.47	5.59	0 88	50.74	86.5	108 6
Grain yield per plant	695 00	654.58	40 42	56.99	94 1	117.5

The Genetic co-efficient of variation for all the characters varied from 24.61 for plant height to 97.30 for number of pods per plant. High degree of Co-efficient of variation was observed for branches per plant, grain yield per plant and 1000-grain weight, while other characters showed low range of degree of Co-efficient of variation.

Heritability value ranged from 76.5 percent for pod per plant to 99.1 percent for pod length. All the plant characters showed a high degree of heritability. The high values of heritability indicate that it is advantageous to practise selection in these characters. A very high genetic advance in percentage of mean was obtained for number of branches per plant, 1000-grain weight, and grain yield per plant while other characters showed low range of genetic advance.

Discussion: The data obtained in the present studies indicate that characters like number of branches per plant, 1000-grain weight and grain yield per plant exhibited higher genetic co-efficient of variation and thus offered scope for their improvement. The same characters also showed higher genetic advance expressed in percentage of mean. It indicates the genetic variability present in these characters and enable us to compare with that present in other characters. The plant height, pod length and grains per pod which had the least co-efficient variation, also had the lowest expected genetic improvement. The character like pods per plant had high genetic co-efficient of variation but had lower heritability must have marked influence of environment on its expression.

High heritability have been obtained in characters like plant height, number of branches per plant, pod length, grains per pod and grain yield per plant while lower values have been found in the case of characters like pod per plant and 1000-grain weight. A high heritability accompanied by similar genetic gain will really help the plant breeder to predict the effect of selection of the best type. In the present study characters showing high heritability namely plant height, pod length and grain per pod have shown low value of genetic advance, however total number of branches per plant, 1000-grain weight and grain yield per plant have fairly good value of genetic advance and these characters may be considered realiable for selection in Brown Sarson.

Summary: The investigation presents the genotypic and phenotypic variabilities worked out in a varietal collection of Brown Sarson studied under irrigated conditions in Rajasthan at Govt. Agriculture Research Farm, Sri Ganganagar. The characters like branches per plant, pod per plant, grain per pod and grain yield per plant showed a wide range of variability. High heritability was obtained for all characters. The genetic Co-efficient of variation was higher for branches per plant, 1000-grain weight and grain yield per plant than other characters. It appears that phenotypic selection for branches per plant, 1000-grain weight and grain yield per plant should be effective for practical purposes.

Acknowledgement: Thanks are due to Mr. T. C. Kala, Director of Agriculture, Rajasthan, Jaipur and Mr. H. S. Budhiraja for providing facilities and help in statistical analysis, respectively.

REFERENCES

Burton, G. W. 1952. Quantitative inheritance in grasses. *Proc. 6th International Grass Land Cong.* 1. 277–83.

Hanson, C. H., H. F. Robinson and R. E. Comstock 1955. Biometrical studies of yield in sequaregating population of Korean lespedesa. *Agron. J.* 48 : 262–72.

Johnson, H. W., H. F. Robinson and R. E. Comstock. 1955. Estimates of genetic and environmental variability in Soyabeans. *Agron. J.* 47 : 314–8.

Lush, J. L. 1949. Heritability of quantitative characters in Farm animals. Proc. 8th International Cong. Genetics. 1948. *Heriditas* (Suppl) 356–7.

Miller, P. A., J. C. Williams, H. F. Robinson and R. E. Comstock. 1958. Estimates of genotypic and environmental variances and co-variances in upland cotton and their implication in selection. *Agron J.* 50 : 126–31.