Study of GCV, PCV, Heritability and Genetic Advance for Seed Yield and Its Contributing Traits in Mustard (*Brassica juncea* L.)

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Abstract

The results of the study, the harvest index (30.68), biological yield (21.74), and days to maturity (3.30) showed the most genetic variation (GCV). Both the quantity of seeds per silique (17.83) and the seed output per plant (17.06) were moderate. The harvest index (30.71), biological yield (21.74), number of primary branches per plant (8.44), and days to maturity (3.30) all had the highest PCV values. Plant height, the number of siliquae per plant, biological yield, and the length of the major raceme all showed greater estimates of heritability. The number of secondary branches per plant, days to 50% flowering, days to maturity, 1000 seed weight, harvest index, and seed output per plant were all determined to have moderate estimates.

Keywords: Indian Mustard, GCV, PCV, Heritability, Genetic Advance.

Introduction

In India, mustard, or Brassica juncea L., is a heavily grown oilseed crop. The genus Brassica and family Brassicaceae include mustard [1]. It is thought that central Asia and western and central China are the primary and secondary origins of mustard, respectively.With a chromosomal number of 2n=2x=36, mustard is an amphidiploid species according to cytology [2,3]. Brassica species B. napus evolved by hybridization between B. nigra X B. oleracea, B. carinata = B. nigra X B. campestris, and B. juncea = B. nigra X B. campestris. It is primarily self-pollinating; entomophily is thought to be responsible for 2-15% of cross-pollination [4,5].When it comes to the possibility of developing breeding programs even further, the genetic heterogeneity in the gene pool is more valuable. The basic prerequisite for genetic upgrading through structured breeding programs is the convenience of genetic variety. Natural selection always favors plants with a wide range of adaption options. It is a proven truth that increasing the variety of plants increases the likelihood of achieving positive improvement [6,7,8]. Selection is frequently used in conjunction with hybridization techniques to fine-tune a genotype's genetic makeup. Therefore, in order to make effective selection decisions, assessments such as the phenotypic coefficient of variation (pcv), genotypic coefficient of variation (gcv), and genetic progress are required [22,23,24]. For instance, lowering the amount of erucic acid in seed oil is one of the main breeding goals for mustard. In terms of heritability, genetic heterogeneity within genotypes is necessary for a crop improvement program [9,10,11,12].

Materials and Methods

During the Rabi season of 2021–2022, twenty genotypes were investigated in three replications using Randomized Block Design at the Research Farm (Genetics and Plant Breeding) at AKS University, Satna, M.P. Plants were spaced 45 cm apart from one another, and thinning was used to maintain the right number of plants. The suggested farming methods were adhered to. For every genotype in each replication, five randomly chosen plants were used to record data for different yield traits. Genotypes Studied – Swarnjyoti, PM 25, Sej- 2, Shraddha, JM 3, Krishna, Pusa Jaikishan, Rohini, Maya, Kranti, PM 26, NRCDR 2, Vasundhara, RVM 3, Varuna, Pusa Jagannath, RVM 2, Giriraj, Pusa Vijay, RH 725.

Results and Discussion

GCV and PCV

Genotypic coefficient of variation (GCV)

harvested index (30.68%) was found to be the highest, followed by biological yield (21.74%), number of seeds per silique (17.83%), seed yield per plant (17.06%), length of main raceme (14.00%), number of siliques per plant (13.94%), number of secondary branches per plant (13.52%), plant height (12.33%), 1000 seed weight (10.80%), days to 50% flowering (10.43%), and the characters (number of primary branches per plant (8.41%) followed by days to maturity (3.30%) showed lower genotypic coefficient of variation [8,10,12,13].

Phenotypic coefficient of variation (PCV)

was greater for all the characters in the research than the genotypic coefficient of variation. Harvest index (30.71%) had the highest percentage of variation (pcv), followed by biological yield (21.74%), number of seeds per silique (17.86%), seed yield per plant (17.12%), length of main raceme (14.00%), number of siliquae per plant (13.94%), number of secondary branches per plant (13.54%), plant height (12.33%), days to 50% flowering (10.44), and characters with lower phenotypic coefficient of variation, such as number of primary branches per plant (8.44%) and days to maturity (3.30%) [8,12,13,14].

Heritability

The concept of trait transmissibility from one generation to the next is conveyed by heredity. All of the characteristics' broad heritability evaluations were totaled. The percentage of plants with primary branches (99.20%) and the percentage of plants with siliques (100.00%), as well as the length of the main raceme, plant height, and biological yield, all showed heritability. Plant height, the number of siliques per plant, biological yield, and the length of the main raceme characteristics all exhibited higher estimates of heritability in the broad sense (100.00%), whereas characters like the number of primary branches per plant (99.20%) and seed yield per plant (99.30%) showed lower estimates. Days to 50% flowering (99.90), days to maturity (99.90), number of seeds per silique, and number of secondary branches per plant (99.60) were determined to have modest estimate heritability [16,18,19,21].

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Genetic advance

In terms of percentage of mean, the genetic advance varied from 6.79% for days to maturity to 63.13% for harvest index. The harvest index (63.13%) revealed high estimates of genetic advance in percentage of mean, followed by biological yield (44.78%). Moderate estimates (5%) were noted for length of main raceme (28.84%), number of silique per plant (28.71%), number of secondary branches per plant (27.79%), plant height (25.40%), days of 50% flowering (21.48%), number of primary branches per plant (17.24) and days to maturity (6.73%) [17,19,20,24].

Conclusion

The study found that the highest genetic variation (GCV) was observed in harvest index (30.68), biological yield (21.74), and days to maturity (3.30). Seed yield per plant (17.06) and number of seeds per silique (17.83) had moderate values. The highest (PCV) was recorded in harvest index (30.71), biological yield (21.74), number of primary branches per plant (8.44), and days to maturity (3.30). Heritability estimates were higher for plant height, number of siliquae per plant, biological yield, and length of main raceme. Moderate estimates were found for secondary branches per plant, days to 50% flowering, days to maturity, number of seeds per silique, 1000 seed weight, harvest index, and seed yield per plant.

Application of research: This piece of research contributes to further understand the concept of path coefficient in Indian mustard.

Research Category: Genetics and Plant Breeding

Abbreviations: RBD- Randomized Block Design

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Cultivar / Variety / Breed name: Indian Mustard (*Brassica juncea* L.)

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Ethical Committee Approval Number: Nil

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Table 1. Genotypic and phenotypic coefficient of variation of 20 genotypes for 12 quantitative characters in mustard.

Traits	GCV (%)	PCV (%)	ECV (%)	C.V.	S.E.	C.D. 5%	C.D. 1%
No. of primary branches/plant	8.41	8.44	1.33	1.33	0.07	0.20	0.27
Number of secondary branches per plant	13.52	13.54	1.40	1.40	0.17	0.48	0.64
Days to 50% flowering	10.43	10.44	0.58	0.58	0.16	0.45	0.60
Length of main raceme	14.00	14.00	0.27	0.27	0.12	0.34	0.45
Plant Height	12.33	12.33	0.17	0.17	0.16	0.47	0.63
Number of silique per plant	13.94	13.94	0.27	0.27	0.13	0.38	0.50
Days to Maturity	3.30	3.30	0.14	0.14	0.10	0.28	0.37
Number of seeds per silique	17.83	17.86	1.74	1.74	0.11	0.32	0.42
1000 seed weight	10.80	10.81	0.91	0.91	0.02	0.06	0.09
Biological Yield	21.74	21.74	0.02	0.02	0.02	0.05	0.06
Harvest Index	30.68	30.71	2.30	2.30	0.31	0.89	1.20
Seed yield per plant	17.06	17.12	2.46	2.46	0.43	1.24	1.66

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Table 2. Heritability and genetic advance of 20 genotypes for 12 quantitative characters in mustard.

Traits	Heritability (%)	GA	GA as 5% of Mean
Number of primary branches per plant	99.20	1.59	17.24
Number of secondary branches per plant	99.60	5.72	27.79
Days to 50% flowering	99.90	10.15	21.48
Length of main raceme	100.00	22.12	28.84
Plant height	100.00	43.41	25.40
Number of siliques per plant	100.00	24.39	28.71
Days to maturity	99.90	8.11	6.79
Number of seeds per silique	99.70	4.02	36.66
1000 seed weight	99.80	0.94	22.22
Biological yield	100.00	61.12	44.78
Harvest index	99.80	14.84	63.13
Seed yield per plant	**99.30**	**10.67**	**35.03**