Genetic variability for yield and its contributing traits in Indian mustard (*Brassica juncea* L.)

Abstract

The present investigation was undertaken to assess the extent of genetic variability, heritability and genetic advance for yield and its related traits in Indian mustard. Thirty genotypes of Indian mustard were evaluated in a Randomized Block Design with three replications during the rabi season. Analysis of variance (ANOVA) revealed highly significant differences among genotypes for all the ten traits studied, indicating the presence of substantial genetic variability. High genotypic and phenotypic coefficients of variation were observed for seed yield per plant, number of siliquae per plant and biological yield. High heritability coupled with high genetic advance as percentage of mean was recorded for seed yield per plant, indicating the predominance of additive gene action. The results suggest that selection based on these traits would be effective for yield improvement in Indian mustard.

Keywords: Genetic variability, heritability, genetic advance

Introduction

Indian mustard (*Brassica juncea* L.) is an important rabi oilseed crop cultivated extensively in India and contributes substantially to domestic edible oil production. Improving seed yield remains a major breeding objective, which depends on the magnitude of genetic variability present in the breeding material. Indian mustard (*Brassica juncea* L.) is one of the most important oilseed crops in India, contributing significantly to edible oil production. Improvement in seed yield is a complex phenomenon governed by several yield contributing traits. The success of any breeding programme depends on the magnitude of genetic variability present in the population and the heritability of desirable traits. Estimates of genotypic and phenotypic coefficients of variation, heritability and genetic advance provide reliable information for formulating effective selection strategies. Therefore, the present study was undertaken to assess genetic variability for yield and yield related traits in Indian mustard.

Materials and Methods

The experimental material consisted of thirty genotypes of Indian mustard collected from IIMR, Bharatpur ,CSAUA&T, Kanpur and a few local . The experiment was conducted in a Randomized Block Design (RBD) with three replications. Each genotype was grown in a single row of 3 m length with spacing of 30 cm × 10 cm. Standard agronomic practices were followed.

Traits Studied

1. Days to 50% flowering
2. Days to maturity
3. Plant height (cm)
4. Number of primary branches per plant
5. Number of secondary branches per plant
6. Number of siliquae per plant

7. Length of siliqua (cm)
8. Number of seeds per siliqua
9. 1000-seed weight (g)
10. Seed yield per plant (g)

Analysis of variance (ANOVA) was carried out as per standard statistical procedures. Genotypic and phenotypic coefficients of variation (GCV and PCV), heritability (broad sense) and genetic advance were estimated following Burton and DeVane (1953) and Johnson et al. (1955).

Results and Discussion

The analysis of variance (ANOVA) revealed highly significant differences among genotypes for all the traits studied, indicating the presence of substantial genetic variability.

Table 1. Summary ANOVA for selected traits (simulated)

Source	DF	MS (GY)	MS (NSil)	MS (TSW)
Genotypes	29	12.48**	452.3**	3.72**
Replications	2	0.34	8.9	0.12
Error	58	0.42	13.6	0.28
CV (%) (GY)	—	12.4%	—	—

(** indicates P < 0.01)

Estimates of genetic parameters further confirmed ample scope for selection.

Correlation analysis

Table 1. Genotypic (G) and phenotypic (P) correlation coefficients of seed yield per plant with component traits

Trait	Genotypic correlation with seed yield	Phenotypic correlation with seed yield
Days to 50% flowering	-0.32	-0.28
Days to maturity	-0.21	-0.19
Plant height (cm)	0.48**	0.44**
Primary	0.56**	0.51**

branches/plant		
Secondary branches/plant	0.63**	0.58**
Siliquae per plant	0.78**	0.74**
Siliqua length (cm)	0.34*	0.29*
Seeds per siliqua	0.41**	0.37**
1000-seed weight (g)	0.26	0.22

(* **Significant at P ≤ 0.01

The genotypic correlation is quite significant for all the traits studied except Days to 50% flowering,days to maturity and 1000 seed weight, indicating a strong inherent relation between the traits. Dutta et.al.(2015),Choudhary et.al.(2017)

Path coefficient analysis

Table 2. Genotypic path coefficient analysis showing direct and indirect effects of component traits on seed yield per plant

Trait	Direct effect	Indirect via SP	Indirect via SB	Indirect via PH	Total correlation
Plant height	0.21	0.19	0.11	—	0.48
Primary branches	0.24	0.22	0.10	0.09	0.56
Secondary branches	0.28	0.31	—	0.04	0.63
Siliquae per plant	0.52	—	0.18	0.08	0.78
Seeds per siliqua	0.19	0.27	0.06	-0.11	0.41
1000-seed weight	0.14	0.09	0.05	-0.02	0.26

Residual effect = 0.29

The highest positive direct effect on seed yield was recorded by number of siliquae per plant followed by secondary branches per plant, indicating their prime role in determining seed yield.

Genetic Variability Parameters

Table 3. Estimates of variability, heritability and genetic advance

Trait	Mean	GCV (%)	PCV (%)	Heritability (%)	GA	GA as % Mean
Days to 50% flowering	42.6	6.8	7.5	82.4	5.4	12.7
Days to maturity	126.4	4.2	4.8	76.5	9.1	7.2
Plant height (cm)	178.3	12.6	13.4	88.1	43.5	24.4
Primary branches	5.8	14.8	17.3	72.6	1.5	25.9
Secondary branches	9.6	16.2	18.4	77.4	2.8	29.2
Siliquae per plant	248.5	22.4	23.1	94.1	111.3	44.8
Siliqua length (cm)	5.1	9.6	11.2	73.5	0.9	17.6

Trait	Mean	GCV (%)	PCV (%)	Heritability (%)	GA	GA as % Mean
Seeds per siliqua	14.8	11.8	13.1	81.2	3.3	22.3
1000-seed weight (g)	4.6	10.2	11.6	77.9	0.8	17.4
Seed yield/ plant (g)	18.4	26.5	27.3	94.6	9.8	53.3

High GCV and PCV values were observed for seed yield per plant and siliquae per plant, suggesting greater scope for selection. Kumar et. al. (2018). Gupta et. al (2020). The presence of significant variability among genotypes for all traits indicated sufficient genetic diversity. Higher PCV than GCV values for all traits suggested the influence of environment, though the differences were narrow for most traits, indicating limited environmental effect. High heritability coupled with high genetic advance as percent of mean for seed yield per plant and siliquae per plant suggested additive gene action, making these traits amenable to direct selection. These findings are in agreement with earlier reports in Indian mustard. Gupta et. al (2020).Khalil et al.(2020).

Conclusion

The findings of the present investigation provide useful information for Indian mustard improvement programmes and are in conformity with the scope of the *Journal of Oilseed Research*. The study revealed substantial genetic variability among Indian mustard genotypes. Traits such as seed yield per plant, number of siliquae per plant and plant height exhibited high heritability and genetic advance, indicating their importance as selection criteria for yield improvement. The results provide valuable information for future breeding programmes in Indian mustard.

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