



Studies on variability, heritability and genetic advance in some quantitative characters in Indian mustard [*Brassica juncea* (L.) Czern and Coss.]

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Abstract: Ten genotypes and their forty five crosses of Mustard were evaluated in Randomized Block Design (RBD) with three replications for yield and yield contributing traits during 2011-2012 to find out genetic variability, heritability and genetic advance in per cent of mean. Analysis of variance for the design of experiment showed significant for all the twelve characters. The magnitude of phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the characters in both timely sown (E_1) and late sown (E_2) conditions. The higher estimates of phenotypic coefficient of variation (>20%) were recorded for number of secondary branches per plant in both timely sown (E_1) and late sown (E_2) conditions and GCV and ECV was high for this character in timely sown (E_1), while number of primary branches per plant in timely sown (E_1). The high heritability estimates in narrow sense were recorded for days to 50% flowering, days to maturity and 1000-seed weight, in E_1 and E_2 while oil content only in E_1 . Genetic advance in per cent of mean was found to be high for secondary branches per plant (26.84%, 26.82%), number of siliquae on main raceme (24.36%, 22.69%) 1000-seed weight (28.09%, 41.77%), biological yield/plant (32.33%, 32.65%), seed yield per plant (30.92%, 26.28%) and harvest index (23.04%, 20.76%) in E_1 and E_2 conditions.

Kew words: Variability, Heritability genetic advance, Quantitative characters in Indian mustard

Introduction

Brassica (rapeseed mustard) is the second most important edible oilseed crop in India after groundnut and accounts for nearly 30% of the total oilseeds produced in the country. When compared to other edible oils, the rapeseed mustard oil has the lowest amount of harmful saturated fatty acids. It also contains adequate amount of the two essential fatty acids, linoleic and linolenic, which are not present in many of the other edible oils. Oilseed production assumes great importance in India because of gap in demand and supply of edible oils, which forced our country to import vegetable oils of millions of rupees, causing a heavy drain of the foreign exchange in past years. In India the total area under rapeseed-mustard during 2013-14, was 64.5 lakh ha with the production of 72.82 lakh tonnes and productivity of 1128 Kg/ha. (Anonymous, 2015). Heritability and genetic advance are important selection parameters in predicting the gain under selection. These estimates help the breeder in selection of elite genotypes for diverse genetic populations.

Methods and Materials

The material for present investigation comprised of 45 F_1 's developed by crossing 10 diverse lines viz., PRB-2004-3, CS-54, NDYR 29, NQR-8807-13, NDRS 2017, NDRS 2010-1-2, NDRE 08-4, RH-0749, Divya-33, and Maya in half diallel fashion design. Genotypes used for investigation were made available from the Oilseed section of Department of Genetics and

Plant Breeding, Narendra Deva University of Agriculture and Technology. The experimental material consisting 56 treatments (45 F_1 's + 10 parents + 1 standard variety Kranti) were sown in Randomized Block Design with three replications in two dates of sowing i.e. on October 11 timely sown (TS) and November 24 late sown (LS), 2011. The entries were sown in a single row plot of 3 m with inter and intra-row spacing of 45 cm and 15 cm, respectively. To avoid the border effects, the plots falling on the border were surrounded by non-experimental rows of varieties/strains. Recommended agronomic practices were adopted to raise a good crop. Observations on the following characters were recorded on five randomly selected plants leaving border plants in each replication. The data on days to 50% flowering and maturity were taken on the plot basis. The observations recorded on twelve characters viz., days to 50% flowering, days to maturity, plant height (cm), primary branches per plant, secondary branches per plant, number of siliquae on main raceme, length of main raceme (cm), 1000-seed weight (g), seed yield per plant (g), biological yield (g), harvest index and oil contents (%). The analysis of variance (Panse and Sukhatme 1967), heritability in broad sense (h^2_{bs}) and genetic advance (GA) (Crumpacker and Allard, 1962) and (Robinson *et al.*, 1949) were worked out.

Result and Discussion

The phenotype, genotypic and environmental coefficient of variability for all the twelve characters under both timely sown

Table-1: Analysis of variance for 11 quantitative characters in 11 x 11 diallel crosses in both (E₁ & E₂) conditions in Indian mustard [*Brassica juncea* (L.) Czern & Coss.]

S.No.	Source of Variation	d.f.	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of primary branches/plant	No. of secondary branches /plant	No. of siliquae on main raceme	Length of main raceme (cm)	1000-seed weight (g)	Biological yield/plant (g)	Harvest index (%)	Oil Content (%)	Grain yield/plant (g)
1	Replication E ₁	2	20.09	14.16	129.40	1.80	25.89	8.78	10.94	0.96	142.94	5.45	0.01	3.38
	E ₂		59.50	53.22	10.14	0.07	0.30	89.31	38.31	0.48	13.16	5.83	0.03	0.03
2	Treatments E ₁	55	13.69**	48.28**	309.33**	1.79**	8.50**	108.43**	164.77**	2.13**	191.00**	28.53**	1.33**	8.62**
	E ₂		40.40**	11.04**	373.94**	0.71**	3.64**	77.17**	100.47**	2.46**	71.44**	20.62**	1.99**	2.10**
3	Error E ₁	110	1.79	2.99	17.62	0.54	3.03	10.97	21.07	0.21	14.72	3.25	0.01	0.75
	E ₂		2.26	2.13	14.46	0.34	1.00	6.96	10.64	0.09	4.19	2.59	0.02	0.18

*,** Significant at 5% and 1% probability levels, respectively

Table-2 Estimates of range, grand mean, PCV, GCV, ECV, heritability in broad sense (h²b) and genetic advance in per cent of mean (\overline{Ga} %) for 12 characters in Indian mustard under timely sown (E₁) and late sown (E₂) conditions \overline{Ga} %

Characters	Range		G. Mean		PCV (%)		GCV (%)		ECV (%)		h ² (bs) (%)		\overline{Ga} % of mean	
	E ₁	E ₂	E ₁	E ₂	E ₁	E ₂								
Days to 50 Flowering	41.00-51.33	56.33-71.33	45.42	63.97	5.28	6.05	4.38	5.57	2.95	2.35	68.79	84.85	9.59	13.55
Days to maturity	107.66-133.00	117.33-124.33	124.58	120.95	3.41	1.86	3.11	1.42	1.38	1.20	83.46	58.17	7.52	2.86
Plant height (cm)	143.63-205.26	123.80-173.73	182.94	142.81	5.85	8.11	5.39	7.66	2.29	2.66	84.65	89.23	13.09	19.11
No. of primary branches per plant	2.66-6.33	2.66-5.00	4.64	3.79	21.09	17.98	13.91	9.21	15.84	15.44	43.55	26.24	24.24	12.45
No. of secondary branches per plant	4.66-11.66	2.66-8.00	6.34	4.92	34.74	27.90	21.28	19.06	27.47	20.38	37.51	46.67	34.40	34.37
No. of siliquae on main raceme	27.33-56.60	27.86-52.46	41.67	38.53	15.82	14.30	13.67	12.55	7.94	6.85	74.75	77.05	31.22	29.09
Length of main raceme (cm)	49.93-87.20	44-68.93	71.49	58.62	11.61	10.86	9.68	9.33	6.42	5.56	69.44	73.78	21.29	21.16
1000-seed weight (g)	3.14-6.60	2.38-5.55	5.07	4.15	18.18	22.60	15.74	21.40	9.09	7.24	75.00	89.72	36.00	53.53
Biological yield per plant (g)	23.00-59.33	15.66-38.00	43.66	27.41	19.63	18.81	17.55	17.26	8.78	7.46	79.96	84.25	41.43	41.84
Seed yield per plant (g)	6.02-13.18	4.27-7.63	9.50	5.49	19.33	16.56	17.03	14.53	9.13	7.93	77.66	77.05	39.63	33.69
Harvest index (%)	16.95-31.44	14.04-27.79	22.04	20.32	15.50	14.43	13.16	12.06	8.17	7.92	72.16	69.86	29.53	26.61
Oil content (%)	40.82-44.20	39.80-43.18	42.04	41.40	1.59	1.99	1.57	1.95	0.25	0.37	97.46	96.53	4.11	5.07

(E₁) and late sown (E₂) conditions have been given in Table 1. In general, the magnitude of phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the characters in both timely sown (E₁) and late sown (E₂) condition. The higher estimates of phenotypic coefficient of variation (>20%) were recorded for number of secondary branches per plant (34.74%) and (27.90%) in both timely sown (E₁) and late sown (E₂) conditions respectively and GCV (21.28%) and ECV (27.47%) is high for this characters in timely sown (E₁), while number of primary branches per plant (21.09) in timely sown (E₁) condition. The characters which exhibited moderate estimates (10-20%) of PCV under both the timely (E₁) and late sown (E₂) conditions were number of siliquae on main raceme (15.82%), (14.30%), length of main raceme (11.61%), (10.86%), biological yield per plant (19.63%), (18.81%), seed yield per plant (19.33%) (16.56%), and harvest index (15.50%) (14.43%). The characters which exhibited moderate GCV under timely sown (E₁) condition for 1000- Seed weight (15.74%), biological yield per plant (17.55%), seed yield per plant (17.03%), no. of siliquae on main raceme (13.67%) and harvest index (13.16%). The moderate PCV estimates under late sown (E₂) condition, GCV under timely sown (E₁) condition and ECV in both timely (E₁) and late sown (E₂) condition for primary branches per plant (17.98%), (13.91%), (15.84%) and (15.44%) showed conformity with finding of Pandey (2003), Muhammad *et al.* (2007), Kumar and Mishra (2007), Singh *et al.* (2008) and Ram and Verma (2010). The minimum variability for oil content was reported by Mishra *et al.* (2004)

Under late sown (E₂) condition, estimates of high broad sense heritability (>75%) were recorded, for days to 50% flowering (84.85%), plant height (89.23%), number of siliquae on main raceme (77.05%), 1000-seed weight (89.72%), biological yield per plant (84.25%), seed yield per plant (77.05%) and oil content (96.53%). Moderate heritability was observed for days to maturity (58.17%) and harvest index (69.86%), while low heritability (<50%) was recorded only for number of primary branches per plant (26.24%) under late sown (E₂) condition. The results are in conformity with Prasad *et al.* (2001), Singh and Lallu (2004), Ram and Verma (2010), Yadav *et al.* (2011) for 1000 seed weight. High genetic advance in per cent of mean (>20%) was recorded for number of primary branches per plant (24.24%), number of secondary branches per plant (34.40%), number of siliquae on main raceme (31.22%), length of main raceme (21.29), 1000-seed weight (36.00%), biological yield per plant (41.43%), seed yield per plant (39.63%) and harvest index (29.53%). Moderate genetic

advance in per cent of mean was found for plant height (13.09%) and low genetic advance in per cent of mean was recorded for days to 50% flowering (9.59%), days to maturity (7.52%) and oil content (4.11) under timely sown (E₁) condition.

Under late sown (E₂) condition estimates of high genetic advance in per cent of mean was observed for number of secondary branches per plant (34.37%) and number of siliquae on main raceme (29.09%). The characters which showed low ECV under both timely (E₁) and late sown (E₂) condition were number of siliquae on main raceme, 1000-seed weight (g), biological yield per plant (g), seed yield per plant and harvest index (%).

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