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GENETIC EVALUATION OF INDIANMUSTARD (*BRASSICA JUNCEA* L.) GENOTYPES FOR YIELD AND QUALITY PARAMETERS

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Abstract

Twenty eight diverse genotypes of Indian mustard *Brassica juncea* (L.) were evaluated for fourteen quantitative traits. For important traits the genotypic and phenotypic variation is higher for harvest index, siliquae length, seed yield per plant and number of secondary branches of plant. Heritability accompanied with high genetic advance was noticed for harvest index, siliquae length, days to 50% flowering, seeds per siliquae and number of secondary branches of plant. The correlation of seed yield per plant shows the positive correlation with siliquae on main shoot, length of main shoot, plant height, 1000 seed weight, harvest index and days to flowering. Path analysis exhibited positive direct effect on seed yield per plant via plant height, siliquae on main shoot, days to flowering, 1000 seed weight, seeds per siliquae, harvest index and oil content.

Key words: Variability, GCV, PCV, correlation, path analysis, oil seed

Introduction

Indian mustard (*Brassica juncea* L.) is one of the essential oil seed crop. Mustard and rapeseed mainly grown in China, India and Pakistan. Among the brassica group of oilseed crops large acreage occupied by *Brassica juncea*. In most parts of country mustard predominantly grown as an oil seed crop (85-90%) in addition to vegetable crops after groundnut the *Brassica juncea* is the second important edible oil seed crop and total oil seed crop and total oil seed produced is nearly 30% of the country. In India area of mustard crop was 567.62 lakh hectare production 68.22 lakh tones and productivity 1184 kg per hectare (2016) (Akbari and niranjana2015). It is major *rabi* crop and sowing season is between October to March and mainly cultivated in Northwest India, and contributes nearly 27 per cent to edible oil pool of the country.

Simple selection was not beneficial in this particular self-pollinated crop. Breeding for superior varieties requires selection of parent's compatible to each other and for the selection of good parents one needs to know in complete about the existing best varieties which can be achieved by finding out the genetic variability between the existing varieties. Based on above findings choosing parents for hybridization should be upon combining ability. Breeding programmes success is largely depend on heritability genetic advance and genetic variability present in the base population. Path coefficient analysis makes the situation clearer and also provides relatively more realistic pictures of complex situation that exists at correlation level worked out only at genotypic level separately for morphological attributes.

Materials and Methods

The present experimental research on mustard was mustard was conducted during *rabi* season of 2017-18 at Agricultural Research Farm of School of Agriculture, Lovely professional university, Phagwara. In respect of topography and fertility at latitude longitude range of 31.2554° and 75.7058° E the area is quite uniform. The experimental site soil was sandy loam. The climate of Punjab is classified into humid subtropical climate with variations between summer and winter temperatures. Twenty eight cultivars of mustard were collected from different sources and sownin five rows of 4 m length having a spacing of 50x15cm,by putting two seed per hill to keep the plant population at optimum level in three replication, by using Randomized complete block design. The observations were recorded for fourteen traits like seed yield per plant, siliquae length, harvest index,1000 seed weight, oil content, number of secondary branches ,days to 100% flowering, days to flowering, siliquae on main shoot ,length of main shoot, number of primary branches ,plant height, days to 50% flowering, days to 100% flowering and siliquae length. The heritability, genotypic and phenotypic coefficient of variation, (PCV and GCV), path coefficient analysis, correlation coefficients (genotypic, phenotypic), genetic advance, enumerate using statistical method.

Results and Discussion

The estimates of phenotypic and genotypic coefficient of variations were high for seed yield per plant, siliquae length, seeds per siliquae and harvest index and moderate for siliquae on main shoot, number of primary branches of plant,1000 seed weight and length of main shoot and low for days to 50% flowering, plant height, days to flowering, oil content. High GCV and PCV in Indian mustard for secondary branches, seeds per siliquae, siliquae length and seed yield per plant, were similarly observed by Raj *et al.* (1998), Das *et al.* (1998), Shalini *et al*. (2000), Singh (2000), Maurya (2001), Chaudhary *et al.* (2003), Hussain *et al.* (1998), Ghosh (2001), Amit Singh *et al*. (2013) and Devmani *et al*. (2014).

The estimate of heritability can be utilized for the prediction of genetic gain, which indicates the genetic improvement that would result from the selection of best individuals. Hence, estimate of heritability is an essential pre-requisite for formulation of an effective selection method for genetic improvement. Heritability is high accompanied with high genetic advance and it indicates that selection may be effective due to additive gene effect. High heritability coupled with genetic advance is low so that it indicates the non-additive gene action and if heritability is low it is due to environmental interaction. The genetic advance along with heritability are helpful in concluding the genetic gain. The character which shows the high heritability also exhibit high genetic advance is not necessary. In the present study highest heritability in broad sense has estimated for siliquae on main shoot, siliquae, length, 1000seedweight, oil content, number of primary branches of plant, number of secondary branches of plant, harvest index. These results were consistent with the findings for days to fifty percent flowering, Seed yield per plant, siliquae length, secondary branches. Acharya and Pati (2008), Singh *et al*. (2003), Prasad *et al*. (2001), Mondal(2000), Lekh *et al.* (1998), Uddin *et al*. (1995) and Singh *et al*. (1975). For yield and quality characters the percentage mean of genetic advance of selection intensity was noticed for yield, quality characters. Genetic advance as a percent mean estimates of selection intensity is highest for seed yield per plant 1000 seed weight, length of main shoot, seeds per siliquae, number of primary branches of plant, number of secondary branches of plant and siliquae length. Moderate estimates of genetic advance was observed for days to flowering, days to 50% flowering, plant height. Low estimates for oil content, days to100% flowering found similar results with Amit *et al.,*(2013*)* for secondary branches and siliquae length, seed yield per plant, Balvir *et al.* (2014), Kumar and Sangwan (1994) Hussein *et al.* (1998), Acharya and Pati(2008), Das *et al.* (1998) and Choudhary *et al.* (2003) (Table:1).

The seed yield per plant had positive correlation with days to flowering and plant height the correlation coefficient is significantly high for length of main shoot harvest index, 1000 seed weight and positive (non significant) with number of primary branches of plant, days to flowering. The negative correlation (non significant) for seeds per siliquae, oil content, highly positive correlation (significant) with siliquae on main shoot. In the present study positive association was observed for the plant height, siliquae on main shoot ,primary branches and secondary branches, Asheesh *et al.* (2016), Dilekbasalma (2008), Balvirlodhi (2016), Thakul (2016), Acharya (2006), Singh *et al.* (1979), Reddy (1991), Uddin *et al.* (1995), Singh *et al.* (1997), Das *et al.* (1998), Khulbe and Pant (1999), Larik and Rajput (2000), Shalini *et al.* (2000), Pant *et al.* (2002), Shah *et al.* (2002) and Mahla *et al.* (2003) (Table:2,3).

Path coefficient analysis is determined using genotypic and phenotypic correlation coefficients taking seed yield plant per plant as the dependent variable in order to identify the best components which are responsible for producing grain yield and seed yield per plant shows the positive direct effect on days to flowering, plant height, days to 100% flowering, siliquae on main shoot, seeds per siliquae, harvest index, oil content and1000 seed weight negative direct effect on days to 50% flowering and siliquae length. Genotypic path coefficients of different characters shows that it had high positive direct effect on seed yield per plant. Similar findings for path coefficient analysis of seed yield per plant and plant height were studied by Shahidul(2015), Balvir (2016), Kulbe and Pant (1999), Patel *et al*. (1999), Shalini *et al*. (2000), Jankowski and Budzynski (2003), Kardam and Singh (2005), Verma (2005), Patra *et al.* (2006) and Muhammad *et al.* (2007) (Table 4, 5).

Table 1 : Parameters of genetic variability for morphological traits of Mustard genotypes

Characters	General mean	Range		Coefficient of variation		Heritability (%)	Genetic advance (%)	G.A. as percentage of mean
		Mini.	Max.	Genotypic	Phenotypic			
Days to flowering	67.643	56.333	77.333	7.17	8.102	78.32	8.842	13.072
Days to 50% flowering	82.917	71.333	92.333	6.239	6.471	92.945	10.274	12.39
Days to 100% flowering	82.917	120.333	137.66	3.93	4.077	92.898	10.097	7.803
Plant height	175.17	153.417	199.933	7.634	9.483	64.814	22.178	12.661
Number of primary branches of plant	6.807	4.6	9.867	15	18.739	64.08	1.684	24.736
Number of secondary branches of plant	15.041	11.3	19.567	21.6	22.244	94.294	6.499	43.208
Length of main shoot	66.742	52.333	89.217	17.343	20.031	74.969	20.246	30.935
Seed yield per plant	43.423	24.7	56.667	21.273	24.318	76.525	16.646	38.336
Seeds per siliquae	14.877	3.823	23.333	23.094	23.99	76.524	6.813	45.798
Siliquae on main shoot	60.882	43.6	73.133	14.044	15.046	87.123	16.441	27.004
Siliquae length	5.937	4.8	8.367	20.987	21.97	91.214	2.451	41.297
1000 seed weight	10.635	7.3	13.167	16.817	16.857	79.545	3.675	34.561
Harvest index	79.545	15.733	38.433	24.222	27.159	99.527	11.489	44.503
Oil content	38.293	35.667	40.483	4.428	4.552	94.616	3.398	8.872

Table 2 : Genotypic and phenotypic correlation coefficient for agronomic traits

	Seed yield per plant (g)	Days to flowering	Days to 50% flowering	Days to 100% flowering	Plant height	Number of primary branches of plant	Number of secondary branches of plant
Days to flowering	0.093 0.058						
Days to 50% flowering	0.070 0.040	1.004** 0.924**					
Days to 100%flowering	0.284* 0.246*	0.743** 0.633**	0.716** 0.667**				
Plant height	0.472** 0.337**	0.245* 0.206	0.203 0.183	-0.098 -0.087			
Number of primary branches of plant	0.069 0.031	-0.267* 0.184	-0.238* -0.181	-0.373** -0.306**	0.379** 0.189		
Number of secondary branches of plant	0.173 0.136	0.063 0.033	0.049 0.050	-0.267* -0.245*	0.612** 0.472**	0.716** 0.608*	
Length of main shoot	0.436** 0.347**	0.178 0.121	0.167 0.138	-0.222* -0.183	0.895** 0.777**	0.471** 0.311*	0.456** 0.402**

Table 3 : Genotypic and phenotypic correlation coefficient of seed traits

Traits		Seed yield per plant	Siliquae on main shoot	Seeds per siliquae	siliquae length	Harvest index	1000seed weight
Siliquae on main shoot	Rg Rp	0.347** 0.272					
Seeds per siliquae	Rg Rp	-0.173 -0.164	-0.297** -0.244*				
siliquae length	Rg Rp	0.125 -0.107	-0.453** -0.373**	0.821** 0.790**			
Harvest index	Rg Rp	0.889** 0.865**	0.102 0.073	-0.163 -0.148	0.013 0.013		
1000seed weight	Rg Rp	0.274* 0.239*	0.059 0.061	0.076 0.074	0.117 0.114	0.293** 0.261	
Oil content	Rg Rp	-0.186 -0.163	-0.239* -0.206	-0.007 -0.008	0.055 0.049	-0.140 -0.132	-0.091 -0.086

Table 4 : Path analysis for seed traits of mustard

Traits	Direct effect on seed yield per plant	Indirect effect					
		Siliquae on main shoot	Seeds per siliquae	Siliquae length	Harvest index	1000 seed weight	Oil content
Siliquae on main shoot	0.224		-0.06471	0.09749	0.09238	0.00028	-0.00193
Seeds per siliquae	0.218	-0.06653		-0.1768	-0.14756	0.00034	-0.00006
Siliquae length	-0.215	-0.10139	0.17885		0.01141	0.00056	0.00045
Harvest index	0.904	-0.02287	-0.03554	-0.00272		0.00141	-0.00114
1000 seed weight	0.005	0.01326	0.01657	-0.02512	0.26532		-0.00073
Oil content	0.008	-0.05343	-0.00159	-0.0119	-0.12703	-0.00044	

Residual effect: 0.12912

Table 5 : Path analysis for agronomic traits of mustard

Traits	Direct effect On seed Yield plant	Indirect effect via					
		Days to flowering	Days to 50% flowering	Days to 100% flowering	Plant height	Number of primary branches of plant	Number of secondary branches of plant
Days to flowering	1.958		-2.46627	0.48869	0.13628	-0.02008	-0.00296
Days to 50% flowering	-2.458	1.96469		0.047058	0.11291	-0.0179	-0.00231
Days to 100% flowering	0.658	1.45474	-1.75847		-0.05465	0.0281	0.0126
Plant height	0.556	0.4801	-0.4993	-0.06468		0.02857	-0.02888
Number of primary branches of plant	0.075	-0.52208	0.5843	-0.24554	0.21086		-0.0337
Secondary branches	-0.047	0.1227	-0.12036	-0.17555	0.33995	0.05388	

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