Indian J. Pl. Genet. Resources 13(2): 171-176, 2000

GENETIC VARIABILITY, CORRELATION AND PATH ANALYSIS IN GERMPLASM OF INDIAN-MUSTARD (*Brassica juncea* (L) Czern & Coss.)

S. S. MEENA, J. S. CHAUHAN AND J. S. YADAVA, National Research Centre on Rapeseed-Mustard, Sewar, Bharatpur 321 303 (Rajasthan)

Variability, correlation and path analyses were carried out for eleven agro-morphological characters of Indian-mustard [*Brassica juncea* (L) Czern & Coss]. The highest coefficient of variation (CV) was found for secondary branches/plant (67.0%) and seed yield/plant (47.0%) while, the least for days to maturity (2.0%). Rest of the characters had moderate variation (CV ranged from 6.6 to 19.3%). Seed yield had significant and positive correlation with all the characters except for days to maturity. Hioghest correlation was recorded with siliquae on main shoot (0.5) and secondary branches (0.5). Days to maturity had negative but non-significant correlation with all characters except plant height and seed yield. Siliquae on main shoot had the highest direct effect (0.344) on seed yield, followed by primary branches/plant (0.223), secondary branches/plant (0.189), 1000-seed weight (0.159) and siliqua length (0.147). Therefore, these characters are the main yield components and greater emphasis must be laid on them while, selecting plants in segregating generation.

Key words : Indian mustard, variability, interrelationship

Indian mustard is the predominant crop among the *Brassica* oil seeds occupying nearly 85 per cent of the total hectarage (7.0 m. ha). The productivity is low and there is further scope for improvement in productivity. Evaluation for available variability is prerequisite for planning the breeding programmes. The present study was undertaken to analyze the variability and interrelationship of components of productivity in Indian mustard germplasm.

MATERIAL AND METHODS

Three hundred and eleven germplasm accessions of Indian mustard was grown with standard checks in augmented design during *rabi* 1998-99 under irrigated conditions at National Research Centre on Rapeseed-mustard, Bharatpur. Each line was sown in paired row in plot size of 5.0m × 0.6 m with all recommended package of practices and the crop geometry (10 cm., plant to plant, 30 cm row to row space) was maintained by thinning at 25 days after sowing. Observations were recorded on a sample of 10 plants selected randomly from each plot for eleven agro-morphological traits viz., maturity, plant height (cm), primary and secondary branches per plant, main shoot length (cm), siliquae on main shoot, siliqua length (cm), seeds per siliqua, 1000- seed weight (g), seed yield (g) and oil content (%). The seeds were counted by an electronic seed counter and oil content was measured by NMR (Oxford, 5000). Correlation and direct and indirect effects were computed by using standard statistical methods (Dewey and Lu, 1959).

RESULTS AND DISCUSSIONS

The evaluated germplasm showed considerable variability for majority of traits as indicated by coefficients of variation (CV) presented in Table 1, which is prerequisite for further improvement. Secondary branches per plant and seed yield per plant had the highest variability (CV 67%) and (CV 47%) respectively. The seed yield per plant in the present collection ranged from 1.0 to 22.1 g. Most of the accessions (75.5%) ranged from 3.6 to 10.0 g. while, only seven accessions had more than 17.6 g. seed yield (Fig. 1). On the other hand, secondary branches per plant showed variability ranged from 3.0 to 29.0 branches which is also a good sign for yield improvement because it is one of the main yield contributing characters. Most of accessions (54.3%) had 5 . to 10 branches while, twelve accessions had more than fifteen branches (Fig. 2). Number of primary branches and 1000-seed weight showed moderate magnitude of variability (CV 19.3 and 19.2%, respectively). Selection of plants with more primary branches and bold seed are highly required for increasing the yield. The frequency distribution pattern for these characters showed that majority of accessions (90.3%) had 4 to 8 primary branches per plant (Fig. 3), and (79.1%) had 3 to 5g. 1000-seed weight nevertheless, 13.8 per cent of the accessions showed more than 5 g. seed weight (Fig. 4). Variability for main shoot length and siliquae on main shoot was also moderate (Table 1). Main shoot length ranged from 22.6-91.4 and 79.1 per cent accession had 60- 80 cm (Fig. 5) and for siliquae on main shoot 53.1 per cent accessions had 40-50 siliquae on main shoot (Fig. 6). Twenty eight accessions had both long main shoot (> 80 cm) and high number of siliquae (> 50 siliquae) respectively. The coefficients of variation for siliqua length and seeds per siliqua was 11.0 and 9.7 per cent respectively. Siliqua length varied from 2.9 to 5.5 cm and 76.8 per cent accessions had 3.5-4.5 cm (Fig. 7). Seeds per siliqua ranged from 3.8 to 17.1 seeds. Maximum accessions (91.3%) had 11 to 15 seeds per siliqua (Fig. 8). Plant height and maturity are the two important varietal characters determining its suitability in a production system. Varieties with shorter height, early maturity and high yield are being preferred. Plant height in the present investigation ranged from 123.6 to 224.4 cm with mean value of 176.8 cm. This character, however, showed low variability. Most of the accessions (7.14%) had 161 to 200 cm height (Fig. 9). The present collection showed least variability (1.9%) for maturity. Majority of accessions (72.7%) took 136 to 140 days to mature (Fig. 10) while, maturity varied from 131 to 149 days. Only four accessions were of early maturity type (< 130 days). Oil content showed low magnitude of variability (6.6%) with mean and range 38.6 per cent and 30.8 to 42.8 per cent. Six accessions had oil content more than 42 per cent while, 66.2 per cent ranged from 38 to 42 per cent (Fig. 11). Similar results were reported earlier by Yadav *et. al.* (1997). The present collection proved to be an important gene pool for different traits and many accessions (Table 4) could be utilized for national hybridization programmes to improve seed yield and oil content

Table 1. Mean, range and coefficient of variation (CV) for different characters in Indian mustard germplasm

Character	Mean	Range	S.D.	CV (%)
Days to maturity	139.1	131.0-149.0	2.8	2.0
Plant height (cm)	177.0	123.6-224.4	18.7	10.6
Primary branches/plant	5.2	2.8-11.8	1.0	19.3
Secondary branches/plant	8.0	3.0-29.0	5.3	67.0
Main shoot length (cm)	69.4	22.6-91.4	11.7	16.8
Siliquae on main shoot	42.2	23.4-63.0	6.7	15.9
Siliqua length (cm)	4.0	2.9-5.5	0.4	11.0
Seed/siliqua	12.6	3.8-17.1	1.2	9.7
1000-seed weight (g)	4.2	2.0-6.3	0.8	19.2
Oil content (%)	38.6	30.8-42.8	2.6	6.6
Seed yield/plant (g)	8.23	1.0-22.1	3.9	47.02

and suitable varieties could be developed for different production systems.

Correlation coefficients for eleven metric traits in mustard are presented in Table 2. Seed yield was positively and significantly correlated with all the characters except days to maturity (Khan and Gupta, 1998). However the positive correlations of seed yield were observed with siliquae on main shoot (0.465), secondary branches/plant (0.458), primary branches per plant (0.427), main shoot length (0.331) and plant height (0.271). Similar results have been reported by Reddy, (1991) and Kachroo *et al.* (1997). Therefore selection of high value for these characters will ultimately increase the seed yield. Tharsby, early maturing varieties are desired for escaping biotic and abiotic stresses. Siliqua length and seeds per siliqua have positive and significant correlation with yield and each other while, with rest of characters had non-significant correlation (Kachroo *et al.*, 1997). Seed weight and oil content have positive and significant association with seed yield and with each other. Whereas these have, negative but non-significant association with maturity, primary and secondary branches, main shoot length and siliqua length. Selection of plants with high oil content and bold seed will fetch higher price apart from high yield.

The contribution of these characters was further analyzed by computing their direct and indirect effects on seed yield and is presented in Table 3. Siliquae on main shoot, primary branches, and secondary branches had high direct positive effects whereas, 1000-seed weight, siliqua length and main shoot length had moderate direct effect on seed yield (Table 3). Similar results were reported by Rahman *et al.* (1982) and Khan *et al.* (1998). The direct effects of remaining characters were very low in magnitude. The characters showing high positive correlation with seed yield also had large positive direct effect and indirect effects via each other. The plant height had negative direct effect but correlation with seed yield is positive owing to high indirect effects through all other characters. Siliquae on main shoot showed the highest indirect effects on seed yield through plant height and main shoot length, whereas maturity showed negative indirect effects on seed yield through all the characters except plant height. The results of present investigation suggested in the selection programme the plant more with siliquae on main shoot, primary and

Table 2. Correlations among the different agro-morphological traits in Indian mustard germplasm

Character	Days to maturity	Plant height	Primary branches	Secondary branches	Main shoot length	Siliquae on main shoot	Siliqua length	Seeds/ siliqua	1000-seed weight	Oil content
Plant height (cm)	0.167**									
Primary branches/plant	–0.012	0.306**								
Secondary branches/plant	–0.006	0.171**	0.557**							
Main shoot length (cm)	–0.009	0.456**	0.134**	0.251**						
Siliquae on main shoot	0.081	0.523**	0.274**	0.306**	0.336**					
Siliqua length (cm)	–0.115	0.107	0.073	0.074	0.202**	–0.002				
Seeds/siliqua	0.049	0.029	0.121*	0.103	0.111	0.066	0.269**			
1000-seed weight (g)	–0.078	–0.031	–0.001	0.05	0.111	–0.039	0.161**	0.031		
Oil content (%)	–0.081	0.025	0.095	0.069	–0.001	0.116**	–0.015	0.122	0.347**	
Seed yield/plant (g)	0.046	0.271**	0.427**	00.458**	0.331**	0.465**	0.215**	0.134*	0.191**	0.124*

*Significant at 5 per cent level; **Significant at 1 per cent level

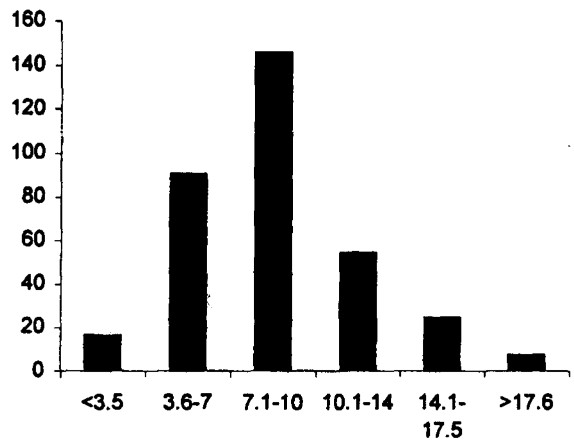

Fig. 1 Seed yield

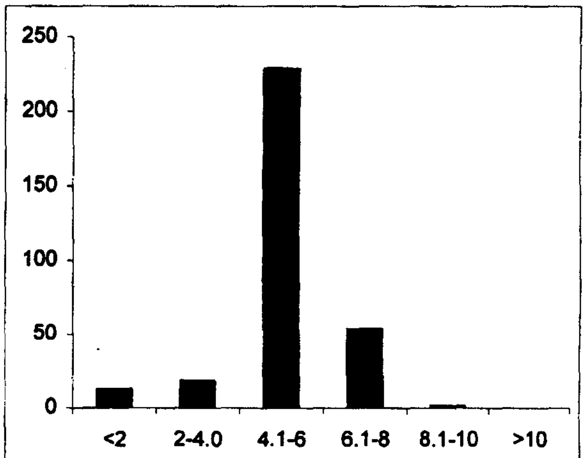

Fig. 3 Primary branches

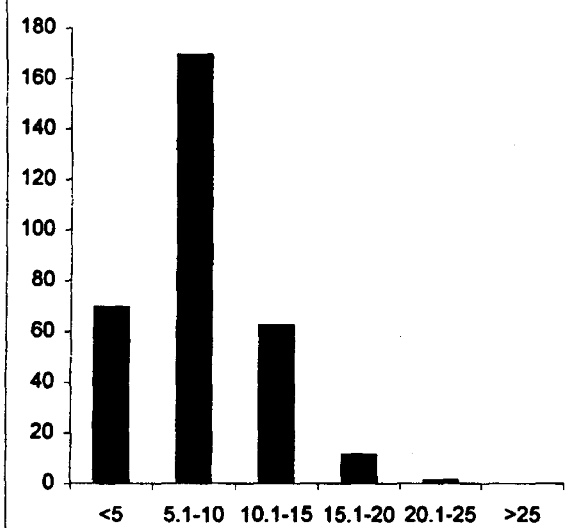

Fig. 2 Secondary branches

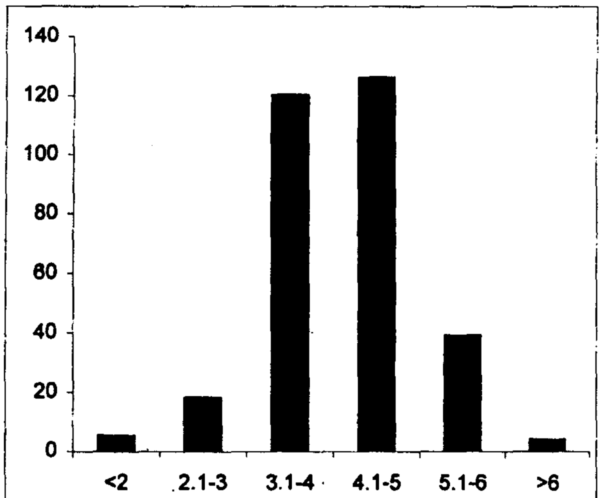

Fig. 4 Seed weight

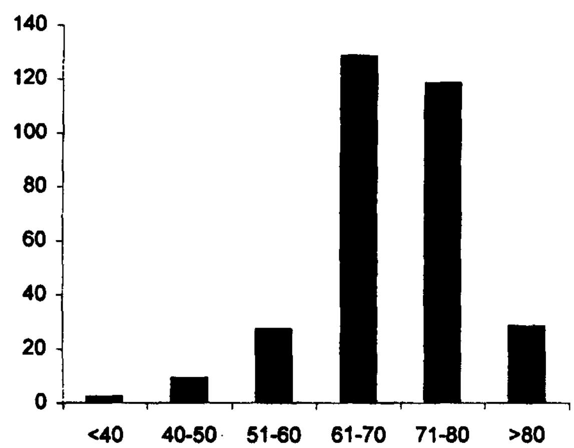

Fig. 5 Main shoot length

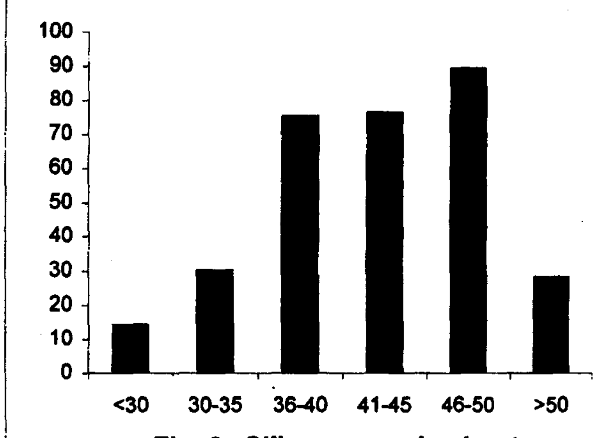

Fig. 6 Siliqua on main shoot

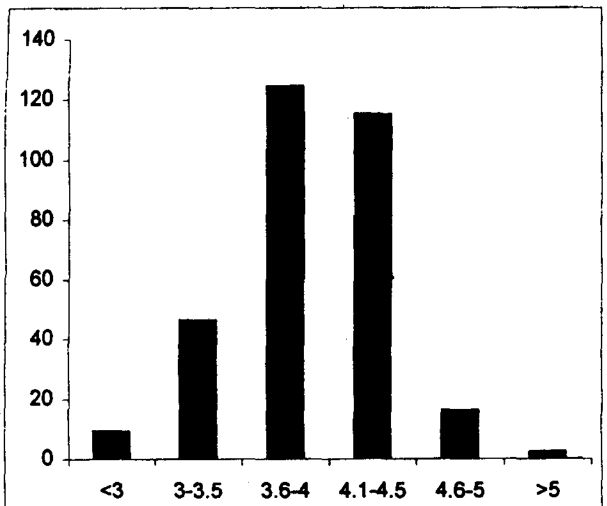

Fig. 7 Siliqua length

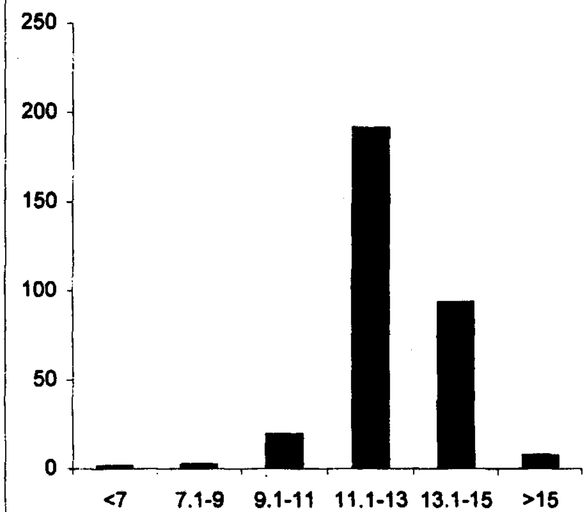

Fig. 8 Seeds per siliqua

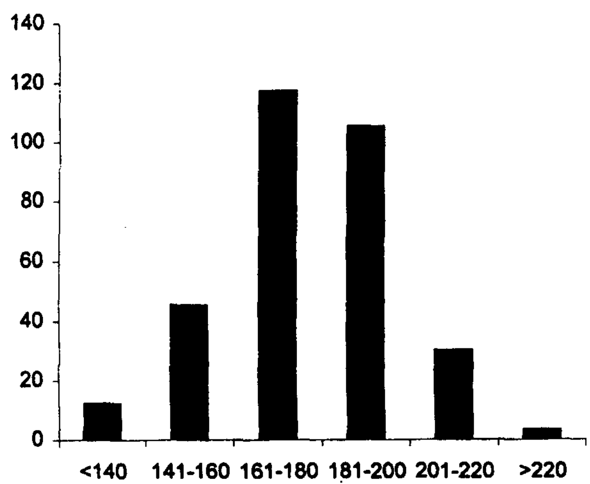

Fig. 9 Plant hight (cm)

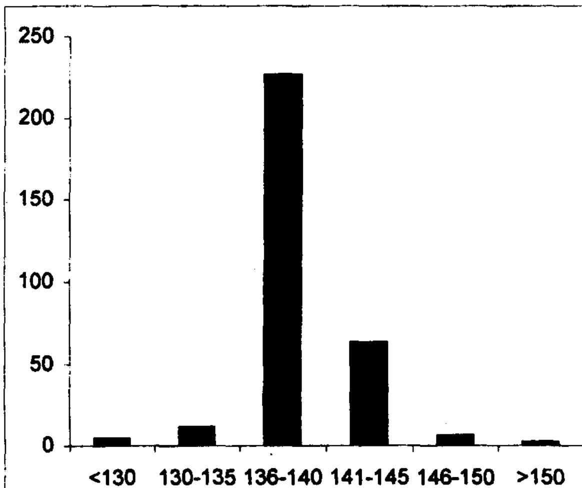

Fig. 10 Days to maturity

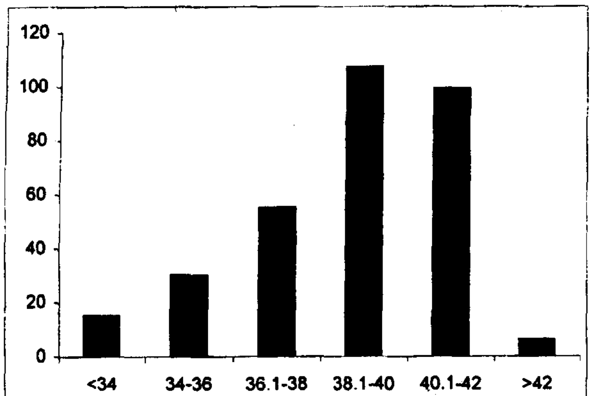

Fig. 11 Oil content

secondary branches, long main shoot length and siliqua length, medium plant height and bold seed should be selected for increasing the seed yield.

REFERENCES

Dewey, D.R. and K.H. Lu. 1959. A correlation and path coefficient analysis of component of crested Wheat grass seed production. *Agro Journal* 51: 515-518.

Kachroo, D., A. Kumar and S. V. Bali. 1997. Correlation and regression studies between different yield attributes and seed yield in mustard. *J. Oilseeds Res.* 14: 202-206.

Khan, M.N. and S.C. Gupta. 1998. Analysis of characters contributing to seed yield in Indian mustard. *J. Oilseeds Res.* 15: 54-59.

Table 3. Direct and indirect effects of different agro-morphological traits on seed yield in Indian mustard germplasm

Character	Days to maturity	Plant height	Primary branches	Secondary branches	Main shoot length	Siliquae on main shoot	Siliqua length	Seeds/ siliqua	1000-seed weight	Oil content	Correlati' on with yield
Days to maturity	**0.067**	0.014	–0.003	–0.001	–0.001	0.028	–0.017	–0.001	–0.012	–0.001	0.046
Plant height (cm)	0.011	**–0.082**	0.068	0.032	0.058	0.173	0.016	0.001	–0.005	0.001	0.271**
Primary branches	–0.001	-0.025	**0.223**	0.105	0.017	0.094	0.011	0.002	–0.001	0.001	0.427**
Secondary branches	–0.001	–0.014	0.125	**0.189**	0.032	0.106	0.011	0.001	0.008	0.001	0.458**
Main shoot length (cm)	–0.001	–0.038	0.029	0.048	**0.127**	0.116	0.029	0.002	0.018	0.001	0.331**
Siliquae on main shoot	0.005	–0.042	0.061	0.058	0.043	**0.344**	–0.001	0.001	–0.006	0.002	0.465**
Siliqua length (cm)	–0.008	–0.009	0.016	0.014	0.026	–0.001	**0.147**	0.004	0.026	–0.001	0.215**
Seeds/siliqua	–0.003	–0.003	0.027	0.019	0.014	0.023	0.039	**0.014**	0.005	0.003	0.136*
1000-seed weight (g0	–0.005	0.003	–0.001	0.009	0.014	–0.013	0.024	0.001	**0.159**	0.002	0.191**
Oil content (%)	–0.005	–0.002	0.021	0.013	0.001	0.041	–0.002	0.002	0.056	**0.003**	0.124*

Residual effects = 0.5707; Figures in diagonals indicate direct effects; *Significant at 5 per cent level; **Significant at 1 per cent level

Table 4. Donors identified based on present studies for different characters in Indian mustard germplasm

Character		Donor
Days to maturity	< 132	NC-58365, RC 1069, CSR 465, RC51, RC 165
Plant height (cm)	< 125	RH-112, IB-1907, B-374, RW 338
Primary branches/plant	> 9	RH-112, RC-81, JMG-387, T 6342, JMG-429
Secondary branches/plant	> 20	CSR-724, PRG-907, RC-52, T 6342, CSR 717
Main shoot length (cm)	> 80	PRG 943, CSR-626, RC 426, CSR 420
Siliquae on main shoot	> 50	JMG-429, PR 8973, PRG-911, CSR- 873, RC-53
Siliqua length (cm)	> 4.5	JMG-429, PRG-911, CSR 873, RC-121
Seeds/siliqua	> 4.0	RC-150, PRG 922, RC-160, RC-84, JMG-423
1000-seed weight (g)	> 15	MDOC-43, PRG-901, RC-389, CSR 420, JMG 195
Oil content (%)	> 42	B-420, MHC-10, CSR-698, NC-59778

Rahman, A., M.L. Das and H.R. Khan. 1982. Path analysis of yield components in *Brassica* species. *Indian J. Agril. Sci.* 53: 195-197.

Reddy, B.N. 1991. Correlation studies in *Indian mustard. J. Oilseed Res.* 8: 248-250

Yadav, S.K., A.K. Shukla, J.S. Chauhan, A.K. Singh and P.R. Kumar. 1997. Characterization of genetic resources of Indian mustard. *Indian J. Pl. Genetic Resources* **10**: 41-48.