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ASSESSMENT OF M_4 INDIAN MUSTARD MUTANTS FOR MORPHO-PHYSIOLOGICAL VARIABILITY AND YIELD ATTRIBUTES

Ashish P. Dhongade[1], R. D. Deotale[2], Beena Nair[3], N. D. Jadhav[4] and V. A. Guddhe[5]

ABSTRACT

An experiment was conducted to investigate morpho-physiological characters and yield attributes of M_4 Indian mustard mutants. The experiment was laid out in a Randomized Block Design with three replications. High yielding mutants ACM_{18}, ACM_{12}, ACM_6, ACM_8 and ACM_4 showed superiority in plant height, number of branches, dry matter production, leaf area, RGR, NAR. These mutants also produced higher number of siliqua plant-^{1}, number of seeds siliqua^{-1}, number of seeds 20^{-1} siliqua and test weight resulting higher seed yield. Among the mutants, ACM_{18} produced the highest seed yield due to superiority of morpho-physiological characters.All the morpho-physiological and yield contributing characters exhibited significant and highly positive correlation with seed yield.Hence, these five mutants are recommended for breeding programme and testing.

(Key words: Mustard mutants,morpho-physiological parameters, yield)

INTRODUCTION

Mustard (*Brassica juncea*) is a second important oil seed crop in India after groundnut in area and production. Indian mustard (*Brassica juncea*) is called as "rai" "raya" or "laha" is an important oilseed crop belonging to Brassica group. It belongs to family Crucifereae with chromosome number 2n= 36. Important species of Brassica that are extensively cultivated are *Brassica juncea*, *Brassica campestris* and *Brassica napus*. Out of these, *Brassica juncea* and *Brassica campestris* are largely grown in India.

An understanding of some morpho-physiological characters in mustard is necessary to make progress in genotypic improvement and for the management of the crop either to increase yield and quality or to reduce the cost of production (Mendham and Salisbury,1985).

Morphological mutations affecting different plant parts can be of enormous practical utility and many of them have been released directly as crop varieties.

This research work will help in finding out the characters which are strongly associated with yield in mustard. The cause of the association between yield and its components characters can also be released. This study will also help in knowing the potential of mutants and identifying superior mutants which can be recommended for cultivation in the farmer's field.

MATERIALS AND METHODS

Dry healthy seeds of *Brassica juncea* (L.) Pusa bold and Bio-902 treated with gamma rays and EMS. The gamma rays treatment of 900,1000,1100,1200 ,1300 Gy (Co^{60}) was done at BARC Trombay, Mumbai. Each of these treatments were treated with 0.5 per cent aqueous solution of EMS. The M_1 generation was raised during 2014-15 and individual plant in each treatment were harvested separately. The harvested seeds were used to raise M_2 generation.

During *rabi* 2015-16 mutants were identified from Pusa bold and Bio-902 (M_2 generation), these identified mutants along with 2 checks (Pusa bold Bio-902) were used in M_3 generation during *rabi* 2016-17.

The true breeding and stable mutants selected from M_3 generation were evaluated for morpho-physiological and yield and yield contributing traits in M_4 generation in RBD with 3 replications during *rabi* 2017-18.The field experiment was laid out in Randomized Block Design (RBD) with three replications consisting of twenty two mutants. Observations on plant height and number of branches were recorded at harvest. Observations on dry matter production and leaf area were recorded at 25, 45 and 65 DAS. RGR and NAR were calculated at 25-45 and 45-65 DAS. Observations on number of siliquaplant^{-1}, number of seeds siliqua^{-1}, number of seeds 20^{-1} siliqua and test weight were also recorded. Similarly seed yield ha^{-1} was also recorded.

1,4 and 5. P.G. Students, Botany Section, College of Agriculture, Nagpur
2. Professor, Botany Section, College of Agriculture, Nagpur
3. Linseed Breeder, AIRCP on Linseed, College of agriculture, Nagpur

Simple correlation of all morpho-physiological and yield contributing parameters with yield was calculated as per following formula.

$$r_g = \frac{gcov\ x\ y}{(\delta_g x)\ (\delta_g y)}$$

r_g= genotypic correlation coefficient

gcov x y = genotypic covariance between the character x and y

$\delta_g x$ = genotypic standard deviation of x

$\delta_g y$ = genotypic standard deviation of y

RESULTS AND DISCUSSION

Plant height

Significant variation in plant height was noticed at maturity stage. The data recorded about the plant height was subjected to statistically significant. The range of height was recorded 156.07-195.07 cm. The significantly maximum plant height was recorded in mutants ACM_{18}, ACM_{12}, ACM_6, ACM_8, ACM_4, ACM_7 and ACM_{10} respectively followed by mutant ACM_5. Similarly mutants ACM_3, ACM_{20} and ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14}, ACM_9 and ACM_{17} recorded moderate plant height in a descending manner over the checks Bio-902 and Pusa bold. Mutants ACM_{13}, ACM_{15} and ACM16 recorded minimum plant height at maturity stage.

Monica and Seetharaman (2016) showed that irradiated mutants showed a significant increase in all the quantitative characters when compared with control and concluded that the mutagenic effect of gamma rays and EMS were found to be beneficial in improving the plant height in garden bean. The present results are well comparable with them in general.

At maturity stage plant height was found positively and highly significant with seed yield (r = 0.676**).

Number of branches plant^{-1}

The data recorded about the number of branches plant $^{-1}$ were statistically significant. At the harvesting stage the range of number of branches plant^{-1} recorded was 4.27 – 6.4. Significantly highest number of branches plant $^{-1}$ was recorded in mutants ACM_{18}, ACM_{12}, ACM_6, ACM_8, ACM_4, ACM_7, ACM_{10} ACM_5, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11} and ACM_{14} in a descending manner, when compared with checks Bio-902 and Pusa bold. Mutants ACM_9, ACM_{17}, ACM_{13}, ACM_{15} and ACM_{16} were recorded minimum number of branches plant $^{-1}$ and were found at par with checks. Tall plants are supported to bear more number of branches and ultimately have more number of leaves and siliqua.

Positively and highly significant correlation was found between number of branches and seed yield (r = 0.658**).

Ramanjaneyulu and Giri (2007), Tuncturk and Ciftiv (2007), Uke *et at*. (2011) and Raut *et al*. (2012) had also reported significant and positive association of number primary branches with seed yield in mustard.

Dry matter production

Significant variation with gradual increase in dry matter production was noticed at all the stages of observations. The data recorded about dry matter production was subjected to statistically significant. At 25 DAS range of dry matter production recorded was 2.01 – 3.21 g. Significantly maximum dry matter production was recorded in mutants ACM_{18}, ACM_{12}, ACM_6 and ACM_8 followed by mutants ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14}, ACM_9 and check Bio-902.The rest of the mutants i e. ACM_{17}, ACM_{13}, ACM_{15} and ACM_{16} were found at par with check Pusa bold. These mutants produced minimum dry matter and found at par with check Bio-902.

The data recorded about the dry matter production were found statistically significant at 45 DAS. The range of dry matter production recorded was 3.58–8.73 g. Significantly highest dry matter production was recorded in mutants ACM_{18}, ACM_{12}, ACM_6 and ACM_8. Mutants ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11} and ACM_{14} recorded significantly moderate dry matter and these mutants were found superior over checks. Similarly mutants ACM_9, ACM_{17}, ACM_{13}, ACM_{15} and ACM_{16} recorded significantly minimum dry matter and were found at par with checks Pusa bold and Bio-902.

The data recorded about dry matter production were statistically significant at 65 DAS. The range of dry matter production recorded was 6.24 - 42.54 g. Significantly highest dry matter was recorded in mutant ACM_{18}. Next to these mutant, mutants ACM_{12}, ACM_6 , ACM_8, ACM_4 ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14}, $ACM_9$and Checks Bio-902 and Pusa bold showed significantly moderate dry matter production over mutants ACM_{13}, ACM_{15} and ACM_{16}.These three mutants exhibited least dry matter production at this stage of observation. The result is supported by the result of Uddin *et al*. (2012) in mustard, who reported that the high yielding mutants produced greater dry mass than low yielding ones.

Hassan *et al*. (2005) also recorded highest dry matter accumulation m^{-2} at the time of maturity in sunflower. Malek *et al.* (2012) also recorded maximum dry matter accumulation during pod development stage of mustard . Similar type of results were also recorded in the present investigation

At all stages dry matter was found highly significantly and positively correlated with seed yield (r = 0.774**, 0.853**, 0.869** at 25, 45, and 65 DAS respectively).

Uke *et al*. (2011) and Raut *et al*. (2012) found that seed yield had a strong positive correlation with dry matter production in mustard.

Leaf area

Leaf area depends upon the number and size of leaves. Leaf area plays an important role in the absorption of light radiation and using it in photosynthetic process. Leaf size is influenced by light, moisture and nutrients hence, yield is dependent on leaf area of crop.

At 25 DAS range of leaf area recorded was 2.37-3.91 dm^2. Significantly maximum leaf area was recorded in mutants ACM_{18}, ACM_{12}, ACM_8, ACM_7,ACM_{10} and ACM_5. Mutants ACM_3, ACM_4, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14}, ACM_9, ACM_{17}, ACM_{13}, ACM_{16} and check Bio-902 in a descending manner also registered significantly moderate leaf area as compared to remaining mutants. Mutant ACM_{15} and check Pusa bold showed least leaf area at this stage of observation.

At 45 DAS range of leaf area recorded was 4.52-9.72 dm^2. Significantly highest leaf area was recorded in mutants ACM_{18}, ACM_{12}, and ACM_6. Mutants ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14}, ACM_9 and ACM_{17} recorded significantly moderate leaf area in a descending manner and these mutants were found at par with checks Bio-902 and Pusa bold. Remaining mutants ACM_{13}, ACM_{15} and ACM_{16} exhibited lower leaf area over both the checks and above mentioned mutants also.

At 65 DAS significantly maximum leaf area was recorded in ACM_{18}, ACM_{12} and ACM_6. Similarly mutants ACM_8, ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3 and ACM_{20} showed significantly moderate leaf area. These mutants were found superior over checks Pusa bold and Bio-902. But mutants ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14}, ACM_9, ACM_{17}, ACM_{13} and ACM_{15} in a descending manner were found at par with checks Bio-902 and Pusa bold and noted lowest leaf area. The results obtained from the present study are consistent with results of Wei *et al.*(2007), who stated that the variation in leaf area could be attributed to change in the number of leaves and rate of leaf expansion and abscission.

At 25, 45, 65 DAS leaf area was found positively and significantly correlated with seed yield (r = 0.622**, 0.785**, 0.703** at 25, 45 and 65 DAS respectively).

Ilmulwar*et al.* (2003), Pagar (2005) and Uke *et al.* (2011) observed positive relationship between leaf area and seed yield of mustard.

Relative growth rate (RGR)

At first stage ie. 25-45 DAS range of RGR recorded was 0.0289-0.0500 mg g^{-1} day^{-1}. Significantly maximum RGR was observed in mutants ACM_{18}, ACM_{12}, ACM_6, ACM_8, ACM_4, ACM_7 and ACM_5. Similarly mutants ACM_{10}, ACM_3, ACM_{20}, ACM_{19} and ACM_1 also exhibited significantly moderate RGR over rest of the mutants and checks. But mutants ACM_2, ACM_{11}, ACM_{14}, ACM_9 and ACM_{17} were found at par with checks Bio-902 and Pusa bold and recorded minimum RGR at this stage.

At second stage i.e. 45- 65 DAS range of RGR recorded was 0.0278 - 0.0792 mg g^{-1} day^{-1}. Significantly maximum RGR was observed in mutants ACM_{18}, ACM_{12}, ACM_6, ACM_8, ACM_4 and ACM_7.Mutants ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14}, ACM_9, ACM_{17} and checks Bio-902 and Pusa Bold showed moderate RGR in descending manner. Rest mutants ACM_{13}, ACM_{15} and ACM_{16} showed least RGR as compared to the checks. The result of present study are in agreement with the results of Uddin (2012) in mustard, who stated that the maximum RGR was observed during vegetative stage and decline rapidly with the advancement of growth stages.

Correlation studies revealed highly significant and positive association of RGR with seed yield (r = 0.799**, 0.851**at 45 and 65 DAS respectively)

Bharud and Pawar (2005) also reported similar results in case of groundnut. Data revealed that the values of growth function upto the stage 60-90 DAS and declined between 90 DAS to harvesting. Positive significant correlation of RGR between 60-90 DAS was observed with the pod yield of groundnut.

Net assimilation rate (NAR)

At first stage i.e. 25-45 DAS range of NAR recorded was 0.019 - 0.0433 mg dm^2 day^{-1}. Significantly maximum NAR was observed in mutants ACM_{18}, ACM_{12}, ACM_6, ACM_8, ACM_4 and ACM_7. Mutants ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1 and ACM_2 showed significantly moderate NAR when compared with checks Pusa bold and Bio-902. Remaining mutants ACM_9, ACM_{16}, ACM_{13} and ACM_{17} exhibited least NAR when compared with two checks.

At second stage i.e. 45-65 DAS range of NAR recorded was 0.0235 - 0.1614 mg dm^2 day^{-1}. Significantly maximum NAR was observed in ACM_{18}, ACM_{12} and ACM_6. Similarly mutants ACM_8, ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14} and ACM_9 also recorded significantly moderate NAR over check Bio-902, but these mutants were at par with check Pusa bold. Similarly mutants ACM_{17}, ACM_{13}, ACM_{15} and ACM_{16} recorded significantly least NAR and remain at par with check Bio-902.

Increase in NAR during reproductive phase might be due to increased efficiency of leaves for photosynthesis as a response to photosynthetic apparatus to increase demand for assimilates by growing seed fraction and also due to photosynthetic contribution by pod and sink demand on photosynthetic rate of leaves.

Correlation studies revealed significant and highly positive association of NAR with seed yield (r = 0.884**at 45 and 65 DAS respectively)

Ilmulwar *et al.* (2003) reported positive correlation of post flowering NAR with seed yield in mustard.

Yield and yield contributing parameters

Number of siliqua plant^{-1}

Numbers of siliqua plant^{-1} in twenty mutants ranged from 148.27 – 270.73. Significantly maximum numbers of siliqua plant^{-1} were recorded by ACM_{18} and ACM_{12} followed by mutants ACM_6, ACM_8, ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_{20}, ACM_1 and ACM_2. Mutants

ACM_{11}, ACM_{14}, ACM_9, ACM_{17}, ACM_{13}, ACM_{15} and ACM_{16} were found at par with control Bio-902 and Pusa Bold and recorded significantly minimum siliqua plant^{-1}.

This result is consistent with the result of Uddin (2004), who studied mustard/rapeseed mutants and observed a wide range of variability in siliqua number plant^{-1} ranging from 40.1 to 55.4.

Correlation studies revealed a positive association of number of siliqua plant^{-1} with seed yield (r = 0.722**).

Uke *et al.* (2011) had also reported significant and positive association of siliqua plant^{-1} with seed yield in mustard.

Number of seeds siliqua^{-1}

The number of seeds siliqua^{-1} varied between 10.33 -19.33. The highest seeds siliqua^{-1} was recorded in ACM_{18},ACM_6, ACM_8, ACM_4, ACM_7 and $ACM_{10.}$ Next to these mutants ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_{20}, ACM_1, ACM_2, ACM_{11}, ACM_{14} and ACM_9 were recorded significantly moderate seeds siliqua^{-1} and were also found superior over checks. The remaining mutants ACM_{17}, ACM_{13}, ACM_{15} and ACM_{16} were found at par with checks Bio-902 and Pusa bold and produced significantly lowest seeds siliqua^{-1}.

Correlation studies revealed a positive association of number of seeds siliqua^{-1}with seed yield (r = 0.753**).

Number of seeds 20^{-1}siliqua

The number of seeds 20^{-1}siliqua in twenty mutants ranged from 189.33 – 373.67. Number of seeds 20^{-1}siliqua were significantly maximum in mutants ACM_{18} and ACM_{12}. Next to these mutants ACM_6, ACM_8, ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14} and ACM_9 were also found significantly moderate number of seeds 20^{-1}siliqua and also showed superiority over checks. Mutants ACM_{17}, ACM_{13}, ACM_{15} and ACM_{16} were found at par with checks Bio-902 and Pusa bold but recorded significantly minimum number of of seeds 20^{-1}siliqua.

Correlation studies revealed a significantly and positive association of number seeds 20^{-1} siliqua with seed yield (r = 0.783**).

Test weight

Data showed significant variation. The maximum test weight was recorded by mutant ACM_{18}. The mutants ACM_{12}, ACM_6, ACM_8, ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14}, ACM_9 and ACM_{17} in a descending manner gave significantly moderate 1000 seed weight when compared with check Bio-902 and Pusa bold. While the mutants ACM_{13}, ACM_{15} and ACM_{16} showed significantly lowest 1000 seed weight. This result is consistent with the result of Uddin (2012), who studied mustard/rapeseed mutants and observed a wide range of variability in test weight ranging from 4.0 g to 4.08g.

Test weight was found to have positive correlation with seed yield (r = 0.849**).

Gunasekaran and Pavadai (2015) reported that mutant lines showing higher yield plant^{-1} than the respective parents and checks were isolated in M_2 and subsequent generations were significantly more siliqua yield and yield components than the checks.

Seed yield ha^{-1}(q)

Data recorded for seed yield ha^{-1} were showed significant variation. Mutants ACM_{18}, ACM_{12}, ACM_6, ACM_8, ACM_4, ACM_7 and ACM_{10} recorded significantly maximum seed yield over checks Bio-902 and Pusa bold and remaining mutants also. Similarly ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11}, ACM_{14} and ACM_9 were showed significantly moderate seed yield when compared with checks Bio-902 and Pusa bold, while significantly minimum seed yield was recorded by mutants ACM_{17}, ACM_{13}, ACM_{15} and ACM_{16} when compared with two checks and remaining mutants under study.

Gobinath and Pavadai (2015) showed that in M_2, M_3 and M_4 populations significantly increase morphology and yield components in soybean were noted. The yield parameters like plant height, number of clusters plant^{-1}, number of seeds plant^{-1} and seed yield plant^{-1} were recorded the moderated and high mean value in treated mutants.

Harvest Index

The highest harvest index was recorded in mutants ACM_{18}, ACM_{12}, ACM_6 and ACM_8 over checks Bio-902 and Pusa bold and remaining mutants under study. Similarly mutants ACM_4, ACM_7, ACM_{10}, ACM_5, ACM_3, ACM_{20}, ACM_{19}, ACM_1, ACM_2, ACM_{11} and ACM_{14} also exhibited moderate harvest index in descending manner but were found at par with check Pusa bold. Rest of mutants i.e. ACM_9, ACM_{17} ACM_{13}, ACM_{15} and ACM_{16} registered significantly lowest harvest index and were found at par with check Bio-902.

Harvest index was found significantly and positively correlated with seed yield (r = 0.846**).

Bharud and Pawar (2005) reported that the harvest index showed significant and positive association with the seed yield of groundnut.

Table 1. Morpho-physiological attributes and correlation in twenty mustard mutants

Sr. No.	Mutants	Plant height (cm)	No. of branches $plant^{-1}$	Total dry matter $plant^{-1}$ (g)			Leaf area (dm^2)			RGR ($g\ g^{-1}\ day^{-1}$)		NAR ($g\ dm^{-2}\ day^{-1}$)	
				25 DAS	45 DAS	65 DAS	25 DAS	45 DAS	65 DAS	45-25 DAS	65-45 DAS	45-25 DAS	65-45 DAS
1	ACM_1	172.4	5.67	2.65	5.88	19.32	3.32	7.13	8.23	0.0398	0.0595	0.0324	0.0877
2	ACM_2	170.8	5.60	2.57	5.14	16.36	3.29	7.12	8.21	0.0347	0.0579	0.0259	0.0733
3	ACM_3	174.6	5.80	2.78	6.53	23.11	3.41	7.35	8.70	0.0427	0.0632	0.0365	0.1035
4	ACM_4	183.4	5.93	2.91	7.23	30.21	3.38	8.22	9.06	0.0455	0.0715	0.0397	0.1331
5	ACM_5	175.0	5.80	2.84	6.81	25.22	3.48	8.04	8.76	0.0437	0.0655	0.0365	0.1097
6	ACM_6	188.8	6.07	3.15	7.90	34.12	3.79	8.59	10.12	0.0460	0.0732	0.0405	0.1405
7	ACM_7	178.2	5.87	2.88	7.04	28.29	3.61	8.08	8.93	0.0447	0.0695	0.0375	0.1250
8	ACM_8	185.9	6.00	3.12	7.70	32.12	3.70	8.43	9.26	0.0452	0.0714	0.0399	0.1381
9	ACM_9	168.0	5.20	2.31	4.34	11.13	3.17	6.65	7.65	0.0315	0.0471	0.0216	0.0476
10	ACM_{10}	177.3	5.87	2.84	6.91	27.51	3.54	8.06	8.93	0.0445	0.0691	0.0370	0.1214
11	ACM_{11}	169.2	5.53	2.48	4.90	14.21	3.24	7.12	8.18	0.0340	0.0532	0.0246	0.0609
12	ACM_{12}	192.6	6.13	3.18	8.11	37.61	3.79	9.11	10.55	0.0467	0.0768	0.0406	0.1503
13	ACM_{13}	161.1	4.73	2.02	3.61	7.21	3.11	4.82	7.05	0.0290	0.0346	0.0204	0.0307
14	ACM_{14}	169.0	5.47	2.41	4.73	13.12	3.19	6.82	7.75	0.0337	0.0510	0.0243	0.0577
15	ACM_{15}	157.7	4.67	2.02	3.60	6.81	2.68	4.71	6.96	0.0289	0.0319	0.0219	0.0279
16	ACM_{16}	156.0	4.27	2.01	3.58	6.24	2.91	4.52	6.95	0.0289	0.0278	0.0215	0.0235
17	ACM_{17}	164.1	5.07	2.11	3.91	9.24	3.15	6.20	7.30	0.0308	0.0430	0.0200	0.0396
18	ACM_{18}	195.0	6.40	3.21	8.73	42.54	3.91	9.72	11.26	0.0500	0.0792	0.0433	0.1614
19	ACM_{19}	173.4	5.80	2.68	6.2	21.17	3.37	7.17	8.43	0.0419	0.0614	0.0350	0.0962
20	ACM_{20}	174.4	5.80	2.74	6.41	22.18	3.39	7.27	8.48	0.0425	0.0621	0.0361	0.1003
21	Bio 902	162.6	5.07	2.08	3.77	8.17	3.07	6.20	7.29	0.0297	0.0387	0.0190	0.0327
22	Pusa Bold	165.7	5.07	2.27	4.23	10.51	2.37	6.22	7.49	0.0311	0.0455	0.0217	0.0459
	Correlation	0.676**	0.658**	0.774**	0.853**	0.869**	0.622**	0.785**	0.703**	0.799**	0.851**	0.833**	0.884**
	SE (m) ±	6.60	0.35	0.16	0.38	1.47	0.16	0.45	0.55	0.0025	0.0038	0.0020	0.0062
	CD at 5%	18.84	1.0	0.22	1.10	4.21	0.45	1.20	1.50	0.0071	0.010	0.0058	0.0177

Table 2. Yield and yield contributing attributes in twenty mustard mutants

Sr. No.	Mutants	No. of siliqua plant^{-1}	No. of seeds siliqua^{-1}	No. of seeds 20^{-1} siliqua	Test Weight (g)
1	ACM_1	185.27	14.67	278.00	4.03
2	ACM_2	183.33	14.33	266.67	3.90
3	ACM_3	189.47	15.00	298.00	4.43
4	ACM_4	215.00	16.33	313.67	4.90
5	ACM_5	191.33	15.33	299.67	4.57
6	ACM_6	233.6	16.67	316.00	5.03
7	ACM_7	196.73	16.00	302.33	4.87
8	ACM_8	218.67	16.33	314.67	4.97
9	ACM_9	172.93	13.33	241.33	3.07
10	ACM_{10}	194.07	16.00	302.00	4.60
11	ACM_{11}	180.87	13.33	254.67	3.50
12	ACM_{12}	250.27	17.33	330.33	5.23
13	ACM_{13}	158.53	12.00	210.33	2.60
14	ACM_{14}	175.47	13.33	253.67	3.17
15	ACM_{15}	148.97	11.33	193.67	2.33
16	ACM_{16}	148.27	10.33	189.33	2.07
17	ACM_{17}	169.4	12.33	233.00	3.07
18	ACM_{18}	270.73	19.33	373.67	6.03
19	ACM_{19}	185.40	14.67	283.00	4.33
20	ACM_{20}	188.07	14.67	283.67	4.40
21	Bio 902	161.67	12.33	231.33	2.93
22	Pusa Bold	171.4	12.67	233.67	3.07
	Correlation	**0.722	**0.533	**0.783	**0.849
	SE (m) ±	11.95	0.91	17.28	0.25
	CD at 5%	34.11	2.60	49.34	0.72

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