SAARC J. Agric., 22(1): 139-152 (2024) *DOI: https://doi.org/10.3329/sja.v22i1.70189*

CHARACTERIZATION OF SOME *BRASSICA RAPA* AND THEIR F_1 GENOTYPES FOR MORPHOLOGICAL TRAITS

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ABSTRACT

The study was conducted in the research field of Sher-e Bangla Agricultural University, Dhaka, Bangladesh from November 2020 to February 2021 to characterize seven *Brassica rapa* and their 42 F_1 genotypes for morphological traits. Most of the F_1s showed intermediate characteristics between their parents for leaf, flower and pod characters. The parent, Brown Special matured within the shortest time (80.66 days) with moderate yield (5.88g plant^{-1}). All the F_1s had higher yield potential than their parents, except BARI Sharisha-15×BARI Sharisha -14 and BARI Sharisha-15×BARI Sharisha-17. The F_1 (Tori-7×Brown Special) matured within the shortest time (80.00 days) with yield of 13.24g plant^{-1}. The F_1s (Brown Special×BARI Sharisha-14), (Yellow Special×Brown Special), (BARI Sharisha-14×Tori-7), (Brown Special×BARI Sharisha-15) matured in 82.00, 83.00, 83.00 and 85.00 days, respectively with yield 11.59, 15.79, 13.27 and 26.02 g plant^{-1}, respectively. While the F_1s, (BARI Sharisha-15×Brown Special) and (Tori-7×Yellow Special) matured in late, 92.88 and 96.00 days, respectively, but had very high yield potential of 22.34 and 27.67 g plant^{-1}, respectively. Therefore, these genotypes possessed excellent potential for use in future trial.

Keywords: *Brassica rapa*, Duration, F_1 genotypes, Qualitative and quantitative traits, Yield.

INTRODUCTION

Brassica is a plant of mustard family (*Brassicaceae*). *B. rapa* L. is a diploid species of this family and is a major oilseed crop, but also used as vegetable, spice, and medicine (Huang *et al*., 2022). Its oil is cholesterol free, contains significant amount of ω-3 and ω-6 fatty acids, low levels of saturated fatty acids, 38-40% complete protein and a carrier of fat-soluble vitamins (Rashid, 2013). It also has high medicinal values due to the presence of some important anticancer, anti-inflammatory and antioxidant compounds including glucosinolates, carotenoids, flavonoids, ketones,

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Received:23.11.2023 *Accepted: 17.04.2024*

aldehydes, vitamin C, selenium, etc. (Jan *et al*., 2018). Its adventitious chemical composition and relatively low price makes it a valuable food additive. In Bangladesh rapeseed and mustard are cultivated in total 0.522 million hectares area which produces 0.683 million MT and *B. rapa* occupies the frist position in respect of area and production (AIS, 2022). Though *B. rapa* has high nutritional and medicinal values and occupied a biggest area, but its production is very low, indicates little attention for its improvement. Improvement usually obtained with lengthy breeding programs, which involves different gene pools, selection and utilization of selected individual for developing best genotypes. The yield, duration and quality of *Brassica* oils has extensively modified by using conventional breeding (Thakur *et al*., 2016) and the success of breeding program increases with increased variation within the present genotypes (Anjali *et al.,* 2022). Breeders can differentiate the extent of variability and similarity within the existing germplasm using morphological, biochemical and molecular approaches, which can be exploited in future breeding program (Avtar *et al.,* 2016, Carvalho *et al*., 2019 and Mishra *et al*., 2019). However, morphological characterization is the first approach in the description and classification of germplasms (Singh *et al*., 2018). Previously many researchers used phenotypic traits for assessing genetic diversity (Singh *et al.,* 2010). Thus, characterization is an important prerequisite to evaluate phenotypic diversity within the prevailing genotypes (Neeru *et al*., 2017). Therefore, the objectives of the present study was to explore the morphological features of some *B. rapa* and their F_1 genotypes.

MATERIALS AND METHODS

The study was conducted in the research field of SAU, Dhaka, Bangladesh from November 2020 to February 2021. Seven *B. rapa* genotypes viz., Brown Special and Yellow Special (from Sher-e-Bangla Agricultural University), Tori -7, BARI Sharisha-6, BARI Sharisha-14, BARI Sharisha-15 and BARI Sharisha-17 were collected from Bangladesh Agriculture Research Institute) were collected based on their high yield potential and short duration. Then 42 F_1s obtained from the full di-allel crosses among the collected genotypes grown with their parents in RCBD with three replications and studied the morphological characteristics. Characterization carried out based on different qualitative and quantitative traits. For mean performance, mean values of ten randomly selected plants for each traits under each population in each replication subjected to statistical analysis. Mean, range and co-efficient of variation were estimated using MSTAT-C and OPSTAT.

RESULTS AND DISCUSSION

B. rapa genotypes were characterized based on their qualitative and quantitative traits.

Leaf characteristics

For all genotypes, leaves were simple and alternate. Brown Special, Yellow Special, Tori -7 and BARI Sharisha-6 had an open (~ 65 º), BARI Sharisha-14 and BARI Sharisha-15 had semi prostrate (~ 45 º) and only BARI Sharisha-17 had prostrate (< 30 º) type leaf angle. Tori -7 and BARI Sharisha-15 had lyrated and the remaining genotypes had runcinated leaf blade. Leaf blade edge was lobed but crenated for BARI Sharisha-14, Yellow Special, Tori-7 and BARI Sharisha-6, semi crenated for Brown Special and serrated for BARI Sharisha-17 and BARI Sharisha-15. BARI Sharisha-14, BARI Sharisha-17 and BARI Sharisha-6 had acute while semi acute for Brown Special and Yellow Special but Tori-7 and BARI Sharisha-15 had rounded leaf apex (Plate 1). Brown Special, Tori -7, BARI Sharisha-17 and BARI Sharisha-15, had sparse leaf hair while in BARI Sharisha-14, Yellow Special and BARI Sharisha-6 had very sparse leaf hairs (Table 1). The basal leaf length and width ranged from 9.07 to 21.08 cm and 4.57 to 9.65 cm and measured highest in BARI Sharisha-6 (21.08 and 9.65 cm respectively). The petiole length and width ranged from 3.70 to 7.60 cm and 0.53 to 1.10 cm, respectively and measured highest in BARI Sharisha-6 (7.60 and 1.10 cm respectively). The leaf lobes number ranged from 6.00 to 9.00 (Table 2). These results matched with the findings of Young-Mathews (2012), PROTA (2018), Minnesota Wild Flowers (2021) and iNaturalist org. (2021).

Table 1. Characterization of *B. rapa* genotypes based on qualitative leaf characteristics

Genotypes	Leaf types	Leaf arrangement	Leaf angle	Leaf blade shape	Leaf apex shape	Leaf blade edges	Leaf hairiness
P_1 (BARI Sharisha-14)	Simple	Alternate	Semi prostrate (~ 45 º)	Runcinate	Acute	Lobed and crenated	Very sparse
P_2 (Brown Special)	Simple	Alternate	Open (~ 65 º)	Runcinate	Semi acute	Lobed and slightly crenated	Sparse
P_3 (Yellow Special)	Simple	Alternate	Open (~ 65 º)	Runcinate	Semi acute	Lobed and crenated	Very sparse
P_4 (Tori -7)	Simple	Alternate	Open (~ 65 º)	Lyrate	Round	Lobed and crenated	Sparse
P_5 (BARI Sharisha-17)	Simple	Alternate	Prostrate (< 30 º)	Runcinate	Acute	Lobed and serrated	Sparse
P_6 (BARI Sharisha-15)	Simple	Alternate	Semi prostrate (~ 45 º)	Lyrate	Round	Lobed and serrated	Sparse
P_7 (BARI Sharisha-6)	Simple	Alternate	Open (~ 65 º)	Runcinate	Acute	Lobed and crenated	Very sparse

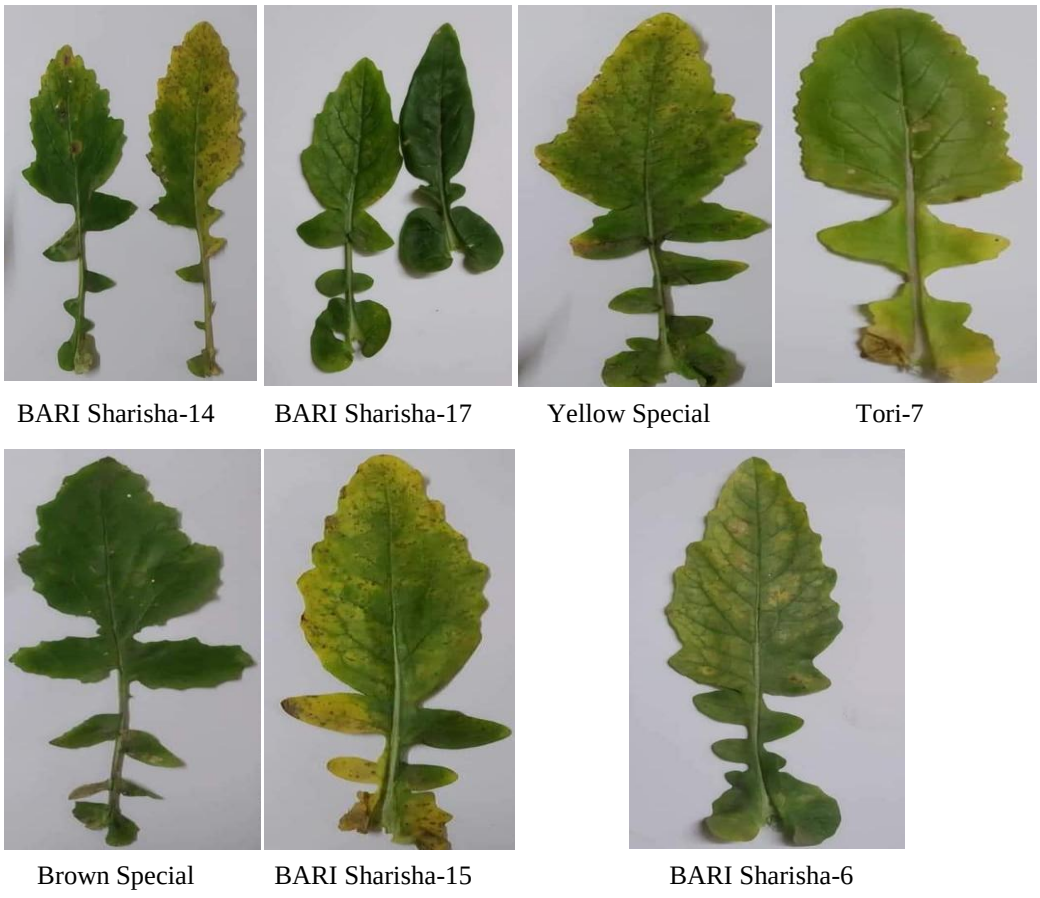
Table 2. Characterization of *B. rapa* genotypes based on quantitative leaf character

Genotypes	Basal leaf length (cm)	Basal leaf width (cm)	Number of leaf lobes	Petiole length (Basal leaf) (cm)	Petiole width (Basal leaf) (cm)
P_1 (BARI Sharisha-14)	9.07 g	4.57 f	9.13 a	3.70 e	0.59 f
P_2 (Brown Special)	18.41 b	7.87 b	8.66 ab	6.40 b	0.95 b
P_3 (Yellow Special)	14.73 e	6.35 d	6.53 b	4.50 d	0.71 d
P_4 (Tori -7)	17.78 c	7.08 c	6.06 b	5.25 c	0.80 c
P_5 (BARI Sharisha-17)	11.30 f	5.10 e	7.88 b	3.80 e	0.53 g
P_6 (BARI Sharisha-15)	15.89 d	6.60 cd	6.66 b	4.55 d	0.65 e
P_7 (BARI Sharisha-6)	21.08 a	9.65 a	8.33 ab	7.60 a	1.10 a
Minimum	9.07	4.57	6.06	3.70	0.53
Maximum	21.08	9.65	9.00	7.60	1.10
Mean	15.46	6.74	7.28	5.11	0.76
CV%	2.14	4.37	17.17	3.59	3.86
LSD	0.59	0.52	1.63	0.32	0.05

Flower and pod characteristics

The flowers were yellow and radially symmetrical for all genotypes (except BARI Sharisha-15, whitish yellow) (Plate 2 and Table 3). Flower length ranged from 0.70 to 1.10 cm and was highest in Tori-7 (1.10 cm). Petal length and width ranged from 0.58 to 0.94 cm and 0.28 to 0.45 cm respectively. The highest petal length measured in Tori-7 (0.94 cm) and petal width in BARI Sharisha-6 (0.45 cm) (Table 3). The pods were elongated, cylindrical, round slender and flattened in shape. A single prominent lengthwise vein distinguishes it from other *Brassica* species. Brown Special and Tori-7 had long, BARI Sharisha-6 and BARI Sharisha-15 had semi erect and rest of the genotypes had erect pod angle. The pod length and width and beak length ranged from 2.80 to 5.08 cm, 0.40 to 1.10 cm and 0.93 to 1.90 cm, respectively. The highest pod length measured in Brown Special (5.08 cm) and the pod width in BARI Sharisha-17 (1.10 cm). The beak length was the highest in BARI Sharisha-6 (1.90 cm) and the lowest in BARI Sharisha-15 (0.93 cm) (Plate 3 and Table 3). These results remained within the findings of Velez-Gavilan (2018), Vibrans (2018) and Hilty (2019).

Plate 1. Middle leaves of *B. rapa* parent genotypes at 50% flowering stage



BARI Sharisha-14 BARI Sharisha-17 Yellow Special Tori-7

Brown Special BARI Sharisha-15 BARI Sharisha-6

Table 3. Characterization of *B. rapa* genotypes based on qualitative and quantitative flower and pod characteristics

Genotypes	Qualitative characteristics			Quantitative characteristics					
	Flower colour	Siliqua/Pod shape	Siliqua/Pod angle	Flower length (cm)	Petal length (cm)	Petal width (cm)	Siliqua length (cm)	Siliqua width (cm)	Beak length (cm)
P_1 (BARI Sharisha-14)	Yellow	Cylindrical	Erect	0.70 g	0.58 g	0.28 f	2.80 e	0.96 b	1.20 c
P_2 (Brown Special)	Yellow	Rounded	Long	0.92 c	0.80 c	0.40 c	5.08 a	0.56 d	1.31 bc
P_3 (Yellow Special)	Yellow	Flattened	Erect	0.86 e	0.75 e	0.37 d	3.66 cd	0.78 c	1.45 b
P_4 (Tori -7)	Yellow	Round and slender	Long	1.10 a	0.94 a	0.42 b	3.98 c	0.40 e	1.16 c
P_5 (BARI Sharisha-17)	Yellow	Cylindrical	Erect	0.78 f	0.65 f	0.33 e	3.00 e	1.10 a	1.35 bc

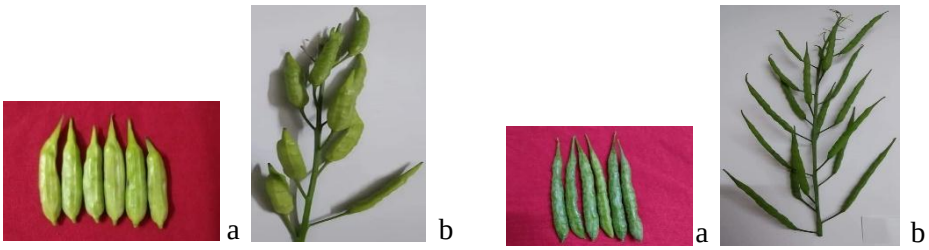
Genotypes	Qualitative characteristics			Quantitative characteristics					
	Flower colour	Siliqua/Pod shape	Siliqua/Pod angle	Flower length (cm)	Petal length (cm)	Petal width (cm)	Siliqua length (cm)	Siliqua width (cm)	Beak length (cm)
P_6 (BARI Sharisha-15)	Whitish yellow	Flattened	Semi-erect	0.90 d	0.78 d	0.40 c	3.41 d	0.63 d	0.93 d
P_7 (BARI Sharisha-6)	Yellow	Flattened	Semi-erect	0.98 b	0.86 b	0.45 a	4.46 b	0.75 c	1.68 a
Minimum	-	-	-	0.70	0.58	0.28	2.80	0.40	0.93
Maximum	-	-	-	1.40	0.94	0.45	5.08	1.10	1.68
Mean	-	-	-	0.93	0.76	0.38	3.84	0.74	1.33
CV%	-	-	-	0.78	0.64	1.00	5.31	6.50	8.48
LSD	-	-	-	0.05	0.06	0.07	0.36	0.08	0.20

Plate 2. Flowers of *B. rapa* parent genotypes

BARI Sharisha-14 Brown Special Yellow Special Tori-7

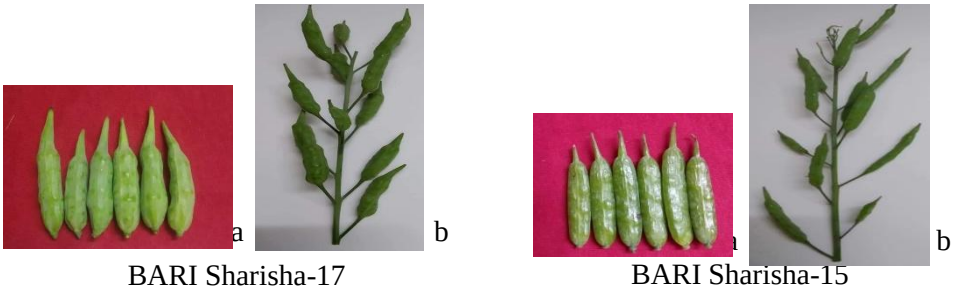
BARI Sharisha-17 BARI Sharisha-15 BARI Sharisha-6

Plate 3. Siliqua/pods of parent *B. rapa* genotypes



BARI Sharisha-14 Brown Special

Yellow Special Tori-7



BARI Sharisha-17 BARI Sharisha-15

BARI Sharisha-6

Morphological characterization of F_1s

The results of characterization and frequency distribution of each descriptor of the F_1s genotypes presented in Table 4.

Table 4. Characterization and frequency distribution of 42 F_1s for different qualitative and quantitative traits.

S. No.	Plant descriptors	State of expression	Number of F_1s belonging to each class	Frequency (%)
1.	Leaf length	Long	7	16.66
		Intermediate	31	73.81
		Short	4	9.52
2.	Leaf width	Large	5	11.90
		Intermediate	34	80.95
		Narrow	3	7.14
3.	Leaf angle	Open	32	76.19
		Semi-prostrate	6	14.29
		Prostrate	4	9.52
4.	Leaf blade shape	Lyrate	10	23.81
		Runcinate	32	76.19
5.	Leaf apex shape	Acute	22	52.38
		Semi acute	10	23.81
		Rounded	10	23.81
6.	Leaf blade edges	Lobed and crenated	30	71.43
		Lobed and Serrated	12	28.57
7.	Leaf hairiness	Very sparse	14	33.33
		Sparse	26	61.90
		Absent	2	4.76
8.	Number of leaf lobes	High	6	14.29
		Medium	30	71.43
		Low	6	14.29
9.	Petiole length	Long	6	14.29
		Intermediate	34	80.95
		Short	2	4.76
10.	Petiole width	Broad	12	28.57
		Intermediate	30	71.43
11.	Flower colour	Yellow	42	100.00
12.	Petal length	Long	6	14.29
		Medium	34	80.95
		Short	2	4.76
13.	Petal width	Broad	6	14.29
		Medium	34	80.95

S. No.	Plant descriptors	State of expression	Number of F_1s belonging to each class	Frequency (%)
		Narrow	2	4.76
14.	Siliqua/pod shape	Cylindrical	2	4.76
		Rounded	11	21.43
		Thin and Rounded	7	16.66
		Flattened	16	42.86
		Thin and Flattened	6	14.29
15.	Siliqua/pod length	Long	25	59.52
		Intermediate	15	35.71
		Short	2	4.76
16.	Siliqua/pod width	Broader	2	4.76
		Medium	27	64.29
		Narrow	13	30.95
17.	Siliqua/pod angle	Long	16	38.10
		Erect	10	23.81
		Semi-erect	16	38.10
18.	Beak length	Long	6	14.29
		Intermediate	32	76.19
		Short	4	9.52

Leaf characteristics

All the F_1s had simple and alternate leaves. 76.19% F_1s had open (~ 65 º), 14.29% had semi-prostrate (~ 45 º) and 9.52% had prostrate (< 30 º) leaf angle. 23.81% F_1s had lyrated and 76.19% had runcinated leaves. 52.38% F_1s had acute, 23.81% had semi-acute and remaining 23.81% had rounded apex shape. 71.43% had lobed and crenated and 28.57 % had lobed and serrated type. 33.33 % F_1s had very sparse, 61.90 % had sparse and in remaining 4.76 % had no leaf hair (Table 4).16.66 % F_1s had long (> 20 cm), 73.81% had intermediate (< 20 cm) and 9.52% had short (< 10 cm) leaf length. 11.90% F_1s had the larger (> 7 cm), 80.95% had intermediate (< 7 cm) and 7.14% had narrower (< 4 cm) leaf width. 14.29% F_1s had high (> 10), 71.43% had medium (> 5 but < 10) and 14.29% had low (< 5) leaf lobes. 14.29% F_1s had long (> 8 cm), 80.95% had intermediate (< 8 cm) and 4.76 % had short (< 4 cm) petioles length. While 28.57% F_1s had broad (> 1 cm) and 71.43% had intermediate (< 1 cm) petiole width (Table 4). Yadav (2013), iNaturalist org. (2021), Native Plant Trust (2021) and Minnesota Wild Flowers (2021) also found similar results in different *B. rapa* varieties.

Flower and pod characteristics

All the F_1s had bright yellow flower though one parent (BARI Sharisha-15) had whitish yellow flowers. 14.29% F_1s had long (> 1 cm) with broad (> 0.5 cm) petal, 80.95 % had medium length (< 1 cm) and width (< 0.5 cm) and 4.76 % had short (< 0.5 cm) and narrow (< 0.2 cm) petal. 4.76% F_1s had cylindrical, 26.19% had rounded, 16.66% had thin and rounded, 38.10 % had flattened and 14.29 % had thin and flattened pod (Table 4). 38.10% F_1s had long, 23.81% had erect and 38.10% had semi-erect pod angle (Table 4). 59.52% F_1s had long (> 3.5 cm), 35.71% had intermediate (< 3.5 cm) and 4.76 % had short pod length (< 2.0 cm) while 4.76 % had larger (> 1 cm), 64.29 % had medium (< 1 cm) and 30.95 % had narrower pod width (< 0.5 cm). 14.29 % F_1s had long (> 1.5 cm), 76.19 % had intermediate (< 1.5 cm) and 9.52 % had short (< 0.8 cm) beak (Table 4). Young-Mathews (2012), Velez-Gavilan (2018), Vibrans (2018) and Hilty (2019) also found similar results for these traits in different *B. rapa* genotypes.

Yield and yield related quantitative characters

Mean performance of different yield related traits of parents and their F_1s estimated and are presented in Table 5. Days to 80% maturity ranged from 80.66 to 110.00 days and 80.00 to 103.00 days in parents and F_1s, respectively. The parent, Brown Special and the F_1-(Tori-7×Brown Special) matured within the lowest time (80.66 days and 80.00 days, respectively). Plant height ranged from 73.46 to 148.56 cm in parents and 110.60 to 148.00 cm in F_1s. Tori-7 (73.46 cm) and the F_1-(BARI Sharisha-17×BARI Sharisha-14) (110.60 cm) showed the lowest plant height. The number of branches plant^{-1} ranged from 5.72 to 15.83 in parents and 6.03 to 35.75 in F_1s. The parent, Tori-7 (15.83) and the F_1-(Brown Special×BARI Sharisha-15) (35.75) showed the highest number of Siliqua plant^{-1} and ranged from 97.66 to 250.53 in parents and 101.00-1029.00 in F_1s. Tori-7 and the F_1-Brown Special×BARI Sharisha-15 produced the highest number of siliqua. Thousand seed weight in parents ranged from 2.82 to 4.78 g and 2.10 to 5.69g in F_1s. BARI Sharisha-6 (4.78 g) and the F_1-BARI Sharisha-6×BARI Sharisha-17 (5.69 g) produced the heaviest seeds. Seed yield plant^{-1} ranged from 4.25 to 8.41 g in parents and 4.21 to 27.67 g in F_1s. The highest seed yield recorded in BARI Sharisha-6 (8.41 g plant^{-1}) and in the reciprocal F_1-Tori-7×Yellow special had 27.67 g plant^{-1} (Table 5). These results remained within the findings of Naznin *et al.* (2015), Karmokar (2018), Ullah (2018) and Ferdous (2019) but exceeded in F_1s, which may be due to environmental factors.

Table 5. Mean performance of six yield and yield contributing traits of *B. rapa* genotypes

Sl. No.	Genotypes	Days to 80% Maturity	Plant height (cm)	Number of branches plant^{-1}	Number of siliqua plant^{-1}	1000 seed weight (g)	Seed yield plant^{-1} (g)
A.	Parents						
1.	P_1 (BARI Sharisha-14)	85.00	95.66	7.75	97.66	3.35	5.20
2.	P_2 (Brown Special)	80.66	109.38	10.88	210.63	3.62	5.88
3.	P_3 (Yellow Special)	88.00	112.26	5.72	137.73	4.62	5.36
4.	P_4 (Tori-7)	81.66	73.46	15.83	250.53	2.82	4.25
5.	P_5 (BARI Sharisha-17)	96.00	100.90	7.25	102.66	4.00	6.97
6.	P_6 (BARI Sharisha-15)	90.33	114.30	9.99	165.40	4.76	6.43
7.	P_7 (BARI Sharisha-6)	110.00	148.56	9.53	175.20	4.78	8.41
B.	Crosses						
1.	$P_1 \times P_2$	90.00	132.30	18.9	386.68	4.25	18.67
2.	$P_1 \times P_3$	89.00	124.80	8.03	190.24	3.92	12.09
3.	$P_1 \times P_4$	83.00	128.96	15.7	428.53	4.11	13.27
4.	$P_1 \times P_5$	88.00	111.63	6.03	101.00	3.47	10.20
5.	$P_1 \times P_6$	90.00	122.96	8.83	183.36	4.30	12.04
6.	$P_1 \times P_7$	92.00	125.53	9.99	232.73	4.39	14.11
7.	$P_2 \times P_3$	87.00	118.62	12.53	270.86	4.24	18.34
8.	$P_2 \times P_4$	86.00	112.86	21.00	305.13	2.98	15.75
9.	$P_2 \times P_5$	94.00	125.80	22.63	420.33	3.74	23.55
10.	$P_2 \times P_6$	85.00	148.00	35.75	1029.00	4.02	26.02
11.	$P_2 \times P_7$	84.33	122.13	14.06	276.26	5.04	12.44
12.	$P_3 \times P_4$	84.00	120.96	17.49	506.73	3.44	15.02
13.	$P_3 \times P_5$	88.00	116.46	10.33	160.13	4.72	15.80
14.	$P_3 \times P_6$	94.24	120.33	11.34	211.86	4.08	12.25
15.	$P_3 \times P_7$	96.66	128.60	10.00	230.73	3.20	13.70
16.	$P_4 \times P_5$	95.50	114.98	25.53	617.05	4.40	16.37
17.	$P_4 \times P_6$	96.00	133.73	29.52	620.26	2.81	15.54
18.	$P_4 \times P_7$	86.66	125.13	19.86	385.86	4.14	13.53
19.	$P_5 \times P_6$	91.33	126.60	9.13	180.13	3.19	10.55
20.	$P_5 \times P_7$	89.38	130.50	7.46	166.99	3.71	9.53
21.	$P_6 \times P_7$	93.00	134.00	13.58	341.23	5.41	12.66
C.	Reciprocals						
22.	$P_2 \times P_1$	82.00	128.51	14.06	312.93	3.08	11.59

Sl. No.	Genotypes	Days to 80% Maturity	Plant height (cm)	Number of branches plant^{-1}	Number of siliqua plant^{-1}	1000 seed weight (g)	Seed yield plant^{-1} (g)
23.	$P_3 \times P_1$	86.00	117.33	8.20	123.83	5.20	9.69
24.	$P_3 \times P_2$	83.00	129.26	15.19	350.00	4.15	15.79
25.	$P_4 \times P_1$	94.25	134.53	20.06	426.46	4.02	16.19
26.	$P_4 \times P_2$	80.00	116.46	21.06	401.73	4.37	13.24
27.	$P_4 \times P_3$	96.00	130.00	25.73	555.93	5.42	27.67
28.	$P_5 \times P_1$	91.00	110.60	13.07	120.53	4.37	11.82
29.	$P_5 \times P_2$	89.00	119.00	11.12	314.46	3.60	11.15
30.	$P_5 \times P_3$	93.00	121.90	8.70	168.70	3.00	9.66
31.	$P_5 \times P_4$	90.00	124.00	19.66	453.00	5.37	16.23
32.	$P_6 \times P_1$	88.00	118.66	17.32	171.30	3.53	8.37
33.	$P_6 \times P_2$	92.88	121.26	33.00	591.20	5.58	22.34
34.	$P_6 \times P_3$	89.00	129.40	7.92	164.93	3.10	9.52
35.	$P_6 \times P_4$	85.00	139.96	32.46	823.86	3.01	19.61
36.	$P_6 \times P_5$	95.00	120.96	12.92	169.36	2.81	7.80
37.	$P_7 \times P_1$	93.00	141.53	14.43	234.50	2.44	12.21
38.	$P_7 \times P_2$	87.00	130.16	12.37	258.62	4.42	14.04
39.	$P_7 \times P_3$	95.00	128.53	9.10	131.40	2.10	10.36
40.	$P_7 \times P_4$	90.00	137.86	18.53	463.40	3.10	16.60
41.	$P_7 \times P_5$	103.00	139.20	11.90	225.08	5.69	13.33
42.	$P_7 \times P_6$	99.00	136.66	8.93	240.06	3.27	9.32
	Minimum	80.00	73.46	5.72	97.66	2.10	4.21
	Maximum	110.00	148.56	35.75	1029.00	5.69	27.67
	Mean	44.38	124.01	14.91	306.58	3.93	90.02
	CV (%)	1.48	2.09	14.75	2.47	4.78	1.18
	LSD	1.06	4.20	1.63	12.32	0.30	1.73

CONCLUSION

Most of the F_1s showed intermediate type characteristics among their parents. The F_1s, BARI Sharisha-15×Brown Special, Tori-7×Yellow Special, Tori-7×Brown Special, Brown Special×BARI Sharisha-14, Yellow Special×Brown Special, BARI Sharisha-14×Tori-7 and Brown Special×BARI Sharisha-15 had both high yield potential and short duration. Therefore, these genotypes could be used for further evaluation.

ACKNOWLEDGEMENTS

Authors are thankful to the department of Genetics and Plant Breeding, Sher-e-Bangla Agricultural University for all sorts of support and Ministry of Science and Technology for providing financial support.

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