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Characterization of *Brassica* Germplasm Collected from NEH Region of India

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Abstract

The Northeastern region of India is rich in biodiversity and various accessions of *Brassica* germplasm were collected from this region. The present study was carried out for 15 agro-morphological characters on seventy two diverse *Brassica* genotypes collected from different parts of Northeastern region of the country. High to medium variability was observed for all the traits in this report. The highest variability was observed for seed yield per plant (CV 46.6%) followed by 1000- seed weight (CV 34.3%), and the lowest variability observed for oil content (CV 2.8%). Seed yield per plant was positively and significantly correlated with main shoot length, siliqua on main shoot and 1000- seed weight. The promising genotypes were also identified for various traits.

Key words: Rapeseed- mustard, variation, correlation, North eastern hills

Introduction

The *Brassica* groups of oilseed crops, commonly known as rapeseed-mustard are the second largest oilseed crop next to groundnut in terms of area and production in India. Indian mustard is the predominant crop among the oilseed Brassicas, occupying nearly 90% of the total area among other six cultivated species of *Brassica* group (Kumar and Misra, 2007). The low productivity can be considerably increased by the use of diverse genotypes, which serve as potential donors for various quantitative and qualitative traits. It plays an important role in studying genetic and breeding behaviour of plants.

The Northeastern region of India is situated between 22-30^{o} north latitude and 80-97^{o} east longitude almost bottled up between Bhutan and Tibet in north, Burma in east and Bangladesh in south, has a total geographical area of little of 25.50 million hectare. This region is one of the hotspot of biodiversity for crop genetic resources and neighbouring to the centre of origin for *Brassica, i.e.* Indo- Chinese region. Therefore, an attempt was made to collect and characterize the diversity of rapeseed- mustard germplasm especially in parts of Nagaland, Meghalaya and Assam states. Further, an attempt was made to establish the relationship with yield-related traits and to identify the promising genotypes.

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Materials and methods

In the present study, the *Brassica* germplasm collected from parts of Nagaland, Meghalaya and Assam states were taken as experimental material. The seventy two diverse genotypes were grown during *rabi* season 2007-08 at the Directorate of Rapeseed–Mustard Research, Bharatpur (Rajasthan). These genotypes, along with three checks (BIO 902, PCR 7 and RH 30) were sown in an Augmented Complete Block Design. Each genotype was sown in paired rows of 3m length with 30 x 10 cm spacing. Recommended standard agronomic package of practices and plants protection measures were adopted. Randomly tagged five plants were selected at appropriate growth stages to record observations on morphological traits namely, initiation of flowering, 50% flowering, maturity, plant height, primary branches and secondary branches per plant, main shoot length, siliqua on main shoot, siliqua length, siliqua beak length and seeds per siliqua. Post harvest observations include seed yield per plant, 1000-seed weight, harvest index and quality traits (oil and protein content). The mean values for each character were considered for computation, except for days to flower initiation, 50 % flowering and days to maturity, which was recorded on a whole plot basis. One thousand seed were counted by electronic seed counter (Contador, Germany) and weighed by electronic balance. Oil and protein content were analyzed by Near Infrared Reflectance Spectroscopy (Dickey- John, Instalab

600). Mean data for each character were subjected to statistical analysis. Range, mean, coefficient of variations were computed using standard statistical methods by Gomez and Gomez (1984) and correlation coefficient were calculated according to the procedure of Singh and Chaudhary (1977).

Results and discussions

The collected germplasm belonging to *Brassica juncea* (Indian mustard), *B. rapa* var. *toria* and *B. rapa* var. *yellow sarson* and number are 50, 16 and 06, respectively. The collected germplasm are grouped as under:

Species	Accession name
Brassica juncea (Indian mustard)	IC 522312, IC 522313, IC 522314, IC 522315, IC 522316,IC 522317, IC 522318, IC 522320, IC 522321, IC 522322,IC 522323, IC 522324, IC 522325, IC 522326, IC 522327, IC 522329, IC 522330, IC 522335, IC 522338, IC 522340, IC 522342, IC 522343, IC 522344, IC 522346, IC 522347, IC 522348, IC 522349, IC 522354, IC 522355, IC 522356, IC 522357, IC 522358, IC 522359, IC 522360, IC 522361, IC 522362, IC 522363, IC 522365, IC 522367, IC 522368, IC 522369, IC 522370, IC 522371, IC 522372, IC 522373, IC 522374, IC 522375, IC 522376, IC 522378, IC 522379
B rapa var *toria* (rapeseed)	IC 522328, IC 522333, IC 522334, IC 522336, IC 522339, IC 522341, IC 522350, IC 522351, IC 522352, IC 522380, IC 522381, IC 522382 IC 522353, IC 522345, IC 522364, IC 522366
B rapa var *yellow sarson* (rapeseed)	IC 522311, IC 522319, IC 522331, IC 522332, IC 522337, IC 522377

These germplasm showed considerable variability for majority of the traits as indicated by coefficients of variation (CV) as presented in Table 1. The highest variability was observed for seed yield per plant (CV 46.6%) followed by 1000- seed weight (CV 34.3%) and harvest index (CV 32.7%) and the lowest variability observed for oil content (CV 2.8%) and protein content (CV 5.9%). On the basis of coefficient of variation the high variability (CV >30%) recorded for seed yield per plant (46.6%), 1000- seed weight (34.3 %), harvest index (32.7%), days to 50% flowering (30.9%) and primary branches per plant (30.0%) while, moderate variability (20-30%) were observed for plant height (25.2%), siliqua on main shoot (24.9%), secondary branches per plant (24.1%), main shoot length (23.5%) and siliqua beak length (22.4%). However, low coefficient of variation were recorded (<20 %) for seeds per siliqua (18.0%), siliqua length, maturity period (9.0%), protein content (5.9%), and oil content (2.8%). Similar finding were also reported by Ghosk *et al.* (2001), Singh *et al.* (2003), Misra *et al.* (2004, 2007). Promising donors were identified for various economically useful traits which can be used as donors in the cultivar development (Table 2).

In the plant breeding, study of correlation is essential because knowledge of relationship between yield and its components is essential as this may help in constructing suitable selection criteria for seed yield. In the present study, the seed yield per plant was positively and significantly correlated with main shoot length, siliqua on main shoot and 1000- seed weight (Table 3). Similar observations for correlations with seed yield were reported (Dubey *et al.*, 1996; Misra *et al.*, 2005; 2008). Siliqua on main shoot showed positive and significant correlation with days to 50% flowering, plant height, primary branches, secondary branches and main shoot length. Protein content has positively correlation with plant height, primary branches, secondary branches, main shoot length and siliqua on main shoot. Main shoot length was also directly and positively correlated with days to 50% flowering and plant height. The present study indicated the presence of wide range of variability for plant height, primary branches per plant, seeds per siliqua, harvest index and seed yield per plant. Similarly, Misra *et al.*, (2009) also observed this correlation in some of the indigenous Indian mustard germplasm. Therefore, selection should be based on these characters in order to achieve productivity in this crop.

The major traits for which germplasm characterization are carried in oilseed brassicas are high seed yield and oil content. The top ten genotypes selected on the basis high seed yield are namely IC522323,IC522329,IC522363,IC522316, IC522365, IC522357, IC522368, IC522342, IC522376 and IC522372, their characterization data are presented in Table 4. Similarly, germplasm having high oil content was also characterized (Table 5). The accessions having high oil yield are namely; IC522331, IC 22333, IC522332, IC522311, IC522352, IC522337, IC522319, IC522335, IC522379 and IC522376. Thus, for effective utilization of germplasm these may be characterized for various economic or

quality traits. It further suggested that these genotypes may be utilized in hybridization programme.

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Table 1: Range, Mean and Coefficients of Variation for different agro-morphological traits in *Brassica* germplasm

Characters	Range	Mean ± SEm	CV (%)	Mean values of checks		
				BIO 902	PCR 7	RH 30
50 % flowering (days)	30-85	55.8 ± 2.0	30.9	48	51	51
Maturity (days)	124-175	136.2 ± 1.4	9.0	135	136	136
Primary branches per plant	3.2-10.8	5.1 ± 0.2	30.0	5.2	5.4	6.0
Secondary branches per plant	2.4-8.0	4.6 ± 0.1	24.1	4.2	5.4	4.6
Siliquae on main shoot	16.0-49	26.3 ± 0.8	24.9	29.2	31.4	35.6
Seeds per siliqua	6.6-18.2	12.9 ± 0.3	18.0	12.9	12.6	13.8
Main shoot length (cm)	19.0-75.0	40.9 ± 1.1	23.5	44.4	49	53
Plant height (cm)	56.4-159.0	106.3 ± 3.1	25.2	130	135	137
Siliqua length (cm)	1.8-4.3	3.3± 0.1	14.5	4.1	3.8	4.0
Siliqua beak length (cm)	0.4-1.4	0.8± 0.0	22.4	1.0	1.1	0.8
Protein content (%)	17.0-24.1	20.1 ± 0.1	5.9	19.8	19.9	20.3
Oil content (%)	39.2-44.4	40.9 ± 0.1	2.8	40.5	40.1	39.8
Harvest index (%)	13.5-35.7	18.2 ± 0.9	32.7	27.4	23.8	25.1
1000-seed weight (g)	0.8-4.8	2.3 ± 0.1	34.3	3.9	4.15	4.02
Seed yield per plant (g)	1.4-12.6	5.4 ± 0.4	46.6	12.4	13.9	9.5

Table 2: Promising genotypes of *Brassica* germplasm for important traits

Characters	Promising Accessions
Plant height (cm)	**≤ 67.8:** IC 522341, IC 522336, IC 522339, IC 522328
Siliqua length (cm)	**≥4.1:** IC 522354, IC 522360, IC 522311, IC 522333
Secondary branches per plant	**≥ 6.3:** IC 522313, IC 522317, IC 522312, IC 522323
Main Shoot length	**≥ 54.0:** IC 522320, IC 522338, IC 522371, IC 522322
Siliqua on main shoot	**≥ 34.5:** IC 522320, IC 522316, IC 522330, IC 522329
Seeds per siliqua	**≥ 17.0:** IC 522342, IC 522337, IC 522333, IC 522378
Siliqua length	**≥ 4.1:** IC 522354, IC 522360, IC 522311, IC 522333
1000-seed weight (g)	**≥ 3.6:** IC 522371, IC 522375, IC 522370, IC 522357
Harvest index (%)	**≥ 30:** IC 522376, IC 522337, IC 522356, IC 522331
Seed yield per plant (g)	**≥11.0:** IC 522323, IC 522329, IC 522363, IC 522316
Oil content (%)	**≥ 43.05:** IC 522331, IC 522333, IC 522332, IC 522352
Protein content (%)	**≥ 22.5:** IC 522318, IC 522315, IC 522322, IC 522320

Table 3: Correlations among the different agro-morphological traits in *Brassica* germplasm

Trait	SYP	FF	PH	PB	SB	MSL	SMS	SL	SBL	SPS	1000SW	PC
50% flowering (FF)	0.13											
Plant Height (PH)	0.28*	0.42**										
Primary per branches (PB)	0.02	0.13	0.61**									
Secondary per branches (SB)	0.12	0.20	0.59**	0.79**								
Main shoot length (MSL)	0.47**	0.39**	0.64**	0.11	0.26							
Siliquae on main shoot (SMS)	0.40**	0.36**	0.70**	0.32**	0.40**	0.87**						
Siliqua Length (SL)	0.06	-0.17	0.05	-0.08	-0.08	0.03	0.04					
Siliqua beak Length (SBL)	-0.14	-0.23*	-0.30*	-0.29*	-0.25*	-0.06	-0.19	0.24*				
Seeds per siliqua (SPS)	-0.10	-0.05	-0.15	-0.23	-0.23	-0.08	-0.12	0.20	-0.09			
1000 seed weight (1000 SW)	0.32**	-0.19	-0.02	-0.19	-0.06	0.09	0.06	0.21	0.07	0.17		
Protein Content (PC)	0.00	0.09	0.59**	0.40**	0.34**	0.39**	0.40**	-0.12	-0.32**	-0.21	-0.31**	
Oil Content (OC)	0.00	0.01	-0.26*	-0.26*	-0.32**	-0.14	-0.18	0.13	0.03	0.36**	0.16	-0.38**

* and ** significant at 5% and 1% level, respectively

Table 4: Characterization of high yielding (based on *seed yield per plant) *Brassica* germplasm

Genotype	SYP*	FF	PH	PB	SB	MSL	SMS	SL	SPS	1000SW	HI	DM	PC	OC
IC522323	12.6	77	137	6.2	6.4	52	32.4	3.5	12.5	1.2	16.8	136	20.0	40.8
IC522329	12.0	66	133	4.4	4.4	51	34.6	2.4	11.8	2.6	17.2	131	21.8	40.1
IC522363	11.9	84	122	4.8	4.2	50	27.6	3.6	12.9	2.8	18.3	135	19.5	39.8
IC522316	11.0	57	150	7.6	6.2	49	39.6	2.7	12.1	3.3	24.5	147	21.2	39.4
IC522365	10.6	82	129	6.0	4.8	43	26.2	3.5	13.4	2.6	29.4	127	20.5	40.7
IC522357	9.9	67	110	5.6	5.0	50	34.2	2.6	6.6	3.6	22.1	139	20.2	40.1
IC522368	9.3	69	130	3.8	4.8	51	25.2	3.6	15.1	3.0	20.7	132	19.9	40.3
IC522342	9.3	79	108	4.6	4.6	53	32.0	3.4	18.2	2.4	26.5	139	19.8	41.4
IC522376	9.1	62	124	4.8	3.4	49	31.0	3.5	10.8	2.5	35.7	136	20.2	42.1
IC522372	9.1	41	141	5.8	5.6	50	30.8	2.7	11.4	3.5	28.5	133	20.8	41.3

Table 5: Characterization of high oil content *Brassica* germplasm

Genotype	OC	PC	SYP	FF	PH	PB	SB	MSL	SMS	SL	SS	1000SW	HI	DM
IC522331	44.4	19.2	4.8	52	95	3.8	3.0	36.6	22.4	2.7	13.5	2.5	24.0	134
IC 22333	44.4	20.3	3.0	54	84	3.6	3.2	32.0	19.0	4.0	17.5	2.0	15.2	172
IC522332	43.7	19.8	3.8	53	92	3.6	4.0	39.4	20.8	3.8	16.2	2.0	15.8	175
IC522311	43.5	20.0	4.1	57	92	4.6	3.8	34.0	20.4	4.0	15.5	2.1	15.8	172
IC522352	43.5	23.1	4.1	44	74	3.6	2.6	32.0	17.4	3.4	9.9	0.8	9.0	173
IC522337	43.2	21.2	11.0	84	78	3.4	2.4	32.0	17.8	3.4	17.7	3.3	24.5	147
IC522319	43.1	22.4	4.6	58	89	4.2	4.2	40.0	27.0	3.4	14.2	1.0	18.4	151
IC522335	42.7	24.1	2.7	64	85	5.4	4.0	40.0	26.4	2.7	16.5	1.4	8.4	166
IC522379	42.4	18.4	7.8	44	113	6.6	5.4	45.0	28.2	3.7	15.5	3.4	25.9	126
IC522376	42.1	22.5	7.6	62	124	4.8	3.4	49.0	31.0	3.5	10.8	0.9	11.8	136